United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Anchorage Fish and Wildlife Field Office
4700 BLM Road, Anchorage, Alaska 99507

In Reply Refer To:
FWS/AFES/AFWFO

Mark L. Everett
U.S. Coast Guard District 17
P.O. Box 25517
Juneau, Alaska 99802

Marcia Combes
U.S. Environmental Protection Agency
222 West 7th Avenue, #19
Anchorage, Alaska 99513

Re: Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges (Consultation #2011-0036)

Dear Mr. Everett and Ms. Combes:

The U.S. Fish and Wildlife Service (Service) wishes to acknowledge the U.S. Coast Guard's (USCG) and Environmental Protection Agency's (EPA) commitment to a meaningful consultation pursuant to section 7(a)2 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq., as amended, ESA) regarding Alaska's Federal and State Preparedness Plan for Response to Oil and Hazardous Substance Discharges and Releases (Unified Plan). The enclosed document transmits the Service's Biological Opinion (BO), which is based upon the best scientific and commercial data available to inform the analyses of potential effects of the implementation of the Unified Plan on listed or candidate species and designated critical habitat.

The Service's BO assesses listed species under our management authority including: the southwest Distinct Population Segment (DPS) of northern sea otter (*Enhydra lutris kenyoni*, listed as threatened in 2005); short-tailed albatross (*Phoebastria albatrus*, listed as endangered in 2000); the spectacled eider (*Somateria fischeri,* listed as threatened in 1993); Alaska breeding population of Steller's eider (*Polysticta stelleri*, listed as threatened in 1997); Pacific walrus (*Odobenus rosmarus divergens*, a candidate as of 2011); and the polar bear (*Ursus maritimus*, listed as threatened in 2008). We also assess adverse effects to critical habitat federally designated for Steller's and spectacled eiders, and sea otters.

Section 7 Consultation History

03/03/2011 – Service received a letter from EPA and USCG expressing intent to consult on the Unified Plan
05/16/2011 – Service received a request from EPA and USCG for a species list
06/16/2011 – Service issued species list to EPA and USCG
02/14/2012 – EPA and USCG requested formal consultation on the Unified Plan
09/04/2013 – Service receive Draft BA
09/05/2013 – Service received Draft Dispersant Use Plan
09/20/2013 – Service provided comments to EPA and USCG on the Draft Dispersant Use Plan
02/10/2014 – Service received a Final BA and request for initiation of formal consultation
04/08/2014 – Service received final draft of dispersant policy
04/11/2014 – Service requested additional information
07/02/2014 – Service received additional information, but some information needs were still outstanding
10/06/2014 – Service received final installment of requested information
10/07/2014 – Service issued notice to EPA and USCG that information was adequate and formal consultation was initiated
02/10/2015 – Service requested and received approval for a 10 day extension for completion of the BO

Using EPA's risk assessment framework, the Service evaluated potential exposure to stressors, assessed the ecological impacts to the exposure, and finally characterized risk. Under this approach, the Service found that proposed activities implemented under the Unified Plan would not jeopardize listed species under the jurisdiction of the Service or result in adverse modification of critical habitat. Take of individuals, however, is likely to occur during a spill response event, but will be enumerated during emergency consultation. This BO fully documents our rational for reaching these conclusions.

Thank you for your cooperation in meeting our joint responsibilities under section 7 of the ESA. If you have questions, please contact Ecological Services Branch Chief, Ellen Lance, Ellen_Lance@fws.gov (907-271-1467), or me at Socheata_Lor@fws.gov (907-271-2787).

Sincerely,

Socheata Lor, PhD.
Anchorage Field Supervisor

Enclosure: Biological Opinion

cc: Sadie Wright, NOAA; Capt. Dan Travers, USCG

BIOLOGICAL OPINION

For the

Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases

Consultation with U.S. Coast Guard and Environmental Protection Agency

Prepared by:
Anchorage Fish and Wildlife Field Office
U. S. Fish and Wildlife Service
4700 BLM Rd
Anchorage, AK 99507
February 27, 2015

Cover Photo. Spectacled eiders (*Somateria fischeri*)

Table of Contents

Acronyms & Abbreviations viii
1.0 INTRODUCTION 10
1.1 Species Not Further Considered in this Opinion 11
2.0 PROPOSED ACTION 12
2.1 Mechanical Countermeasures 13
Deflection and Containment 13
2.2 Non-mechanical Countermeasures and Monitoring 19
Application of Approved Chemical Dispersants by Vessels or Aircraft 19
In Situ Burning 23
Other Non-mechanical Countermeasures and Monitoring 24
2.3 Tracking and Surveillance 25
Use of Aircraft, Vessels, All-terrain Vehicles, or Heavy Machinery 25
Installation of Buoys 25
Sample Collection 26
2.4 Waste Management 26
Waste Handling and Storage 26
Waste Transport 26
Waste Treatment and/or Disposal 27
Decontamination 27
2.5 Wildlife Protection/Mitigation Measures 27
Recovery of Contaminated Carcasses to Prevent Contamination of Other Wildlife 27
Deterrence 28
Pre-emptive Capture and Relocation of Uncontaminated Wildlife & 28
Capture, Treatment, and Release of Contaminated Wildlife 28
Strategic Avoidance 28
2.6 Decision-Making Processes 28
Response Planning 29
During an Incident 30
2.7 Interrelated and Interdependent Actions 34
2.8 Assumptions 34
2.9 Action Area and Life of the Project 35
3.0 STATUS OF THE SPECIES 36
4.0 ENVIRONMENTAL BASELINE 36
4.1 Sea otter 36
Status in the Action Area 36
Critical Habitat Designation and Use 37
Threats and Possible Stressors in the Action Area 38
Recovery 40
4.2 Short-Tailed Albatross 41
Status in the Action Area 41
Threats and Possible Stressors in the Action Area 41
Recovery 43
4.3 Polar Bear 43
Status in the Action Area 43
Threats and Possible Stressors in the Action Area 45
Recovery 49
4.4 Walrus 50
Status in the Action Area 50
Threats and Possible Stressors in the Action Area 50
Recovery 55
4.5 Spectacled Eider 55
Status in the Action Area 55
Critical Habitat Designation and Use 57

Threats and Possible Stressors in the Action Area ... 57
Recovery ... 61
4.6 Steller's Eider ... 61
Status in the Action Area ... 61
Critical Habitat Use and Designation ... 62
Threats and Possible Stressors in the Action Area ... 62
Recovery ... 66
4.7 Summary ... 66
5.0 EFFECTS OF THE ACTION ... 67
5.1 Exposure Analysis ... 68
Methods ... 68
Assumptions ... 69
Species-Specific Analyses ... 70
Exposure Analysis Conclusions ... 81
5.2 Response Analysis ... 82
Method and Assumptions ... 82
Natural Attenuation ... 83
Mechanical Countermeasures ... 83
Non-mechanical Countermeasures ... 84
Disturbance ... 91
Tracking and Surveillance ... 95
Waste Management ... 95
Wildlife Protection Measures ... 96
Interdependent and Interrelated Actions ... 97
Response Analysis Conclusions and Synthesis ... 98
5.3 Risk Characterization Analysis ... 99
Methods ... 99
Factors Affecting Risks ... 101
Species-specific Synthesis ... 104
Risk Characterization Conclusions ... 112
5.4 Effects Analysis Conclusions ... 114
6.0 CUMULATIVE EFFECTS ... 115
6.1 Further Oil and Gas Development ... 115
6.2 Community Growth ... 115
6.3 Commercial Fishing ... 115
6.4 Increased Marine Traffic ... 115
6.5 Increased Scientific Research ... 116
6.6 Subsistence Harvest ... 116
7.0 CONCLUSIONS ... 116
7.1 Sea otter ... 117
7.2 Short-tailed Albatross ... 118
7.3 Spectacled Eider ... 118
7.4 Steller's eider ... 119
7.5 Pacific Walrus ... 120
7.6 Polar Bear ... 120
8.0 CONSERVATION RECOMMENDATIONS ... 121
9.0 INCIDENTAL TAKE ... 123
10.0 REINITIATION STATEMENT ... 124
11.0 LITERATURE CITED ... 124
APPENDIX A. STATUS OF THE SPECIES ... A-1
Northern sea otter ... A-1
Species Description ... A-1
Status and Distribution ... A-1
Life History ... A-4

Threats A-5
Short-Tailed Albatross A-8
Species Description A-8
Status and Distribution A-8
Life History A-10
Threats A-12
Polar Bear A-16
Species Description A-16
Status and Distribution A-16
Life History A-17
Threats A-20
Walrus A-21
Species Description A-22
Status and Distribution A-22
Life History A-24
Threats A-25
Spectacled Eider A-27
Species Description A-28
Status and Distribution A-28
Life History A-28
Threats A-33
Steller's eider A-34
Species Description A-34
Status and Distribution A-34
Life History A-42
Threats A-43
Effects of Climate Change A-46
Loss of Sea-Ice A-46
Storm Surges A-47
Acidification of northern waters A-48
Reduced Availability of Benthic Prey A-48
Contribution of the Action A-49
LITERATURE CITED A-49
Northern Sea Otter A-49
Short-tailed albatross A-53
Polar Bear A-58
Walrus A-62
Spectacled Eider A-63
Steller's eider A-66
Climate Change A-71
APPENDIX B. Definitions B-1
APPENDIX C. Boat Operation Guidance to Avoid Disturbing Sea Otters C-1
APPENDIX D: Avoidance Areas D-1
APPENDIX E: Discussion Paper On Atypical Dispersant Use F-1
APPENDIX F: Effects of Natural Attenuation of Spills on Listed Species F-1
Birds – Spectacled Eider, Steller's Eider, and Short- tailed Albatross F-1
Effects of feather fouling F-1
Effects of ingested oil F-3
Effects on embryos (eggs) F-3
Sea Otter F-5
Polar Bears F-5
Pacific Walrus F-6
Indirect Effects on Invertebrate Prey of Listed Species F-7

FIGURES

Figure 1. The boundaries of the Preauthorization Area of the Dispersant Use Plan under the Unified Plan. 22
Figure 2. Map of Alaska showing the delineations for the 10 subareas designated under the Unified Plan.....30
Figure 3. Diagram showing the notification of the Service and initiation of an emergency consultation 32
Figure 4. Diagram showing the incident-specific decision-making process for the use of dispersants and in situ burning as oil spill response tools.....33
Figure 5. Geographic distribution of accident frequency in the Aleutian Islands..... 40
Figure 6. Number of spills by subarea and product (left) and gallons spilled by subarea and product (right) from ADEC (2007).....45
Figure 8. Oil and gas exploration and development areas in Northern Alaska 47
Figure 9. Ocean currents near Alaska from (Pearson 2004 - 2015).....53
Figure 10. Hanna Shoal Walrus Use Area based on Jay et al. (2012). Image from 78 FR 1942.....53
Figure 11. Distribution of spectacled eiders. 57
Figure 12. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders.....58
Figure 13. Hazardous materials spills reported in Alaska marine waters.....60
Figure 14. Distribution of Alaska-breeding Steller's eiders during the non-breeding season,.....64
Figure 15. The standard steps of an ecological risk assessment.....68
Figure 16. Exxon Valdez spill area (EVOS 1993) superimposed on the range of the listed sea otter. 70
Figure 17.Short-tailed albatross range in the U.S. Exclusive Economic Zone.....73
Figure 18. Polar bear range and subpopulations, with hypothetical worst-case scenario spill superimposed. 75
Figure 19. Map of Alaska and Russia showing critical habitat for spectacled eiders with the spatial extent of the Exxon Valdez oil spill superimposed over critical habitat designated for winter use.....79
Figure A-20. Northern sea otter stocks in Alaska.....A-2
Figure A-21. Short-tailed albatross breeding locations in the North Pacific. A-10
Figure A-22. Locations of 99 short-tailed albatrosses tracked between 2002 - 2012, showing adult and juvenile distributions in the North Pacific.....A-11
Figure A-23. Distribution of polar bear stocks throughout the circumpolar basin.....A-17
Figure A-25. Utilization distribution estimates (UDs) of walrus foraging A-24
Figure A-25. Density distribution of spectacled eiders observed on aerial transects.....A-29
Figure A-26. Spectacled eider satellite telemetry locations 2008 – 2011.....A-32
Figure A-27. Steller's eider distribution in the Bering, Beaufort, and Chukchi seas.....A-35
Figure A-28. Steller's eider nest locations (1991 - 2010) and breeding pair observations near Barrow A-39
Figure A-29. Average September arctic sea-ice extent from 1979 through 2012.....A-47

TABLES

Table 1. Effects determinations from USEPA and USCG for listed species under jurisdiction of the Service.....10
Table 2. Spill Response Action described in the Unified Plan 12
Table 3. Corexit® 9500 and Corexit® 9527 dispersant formulations..... 19
Table 4. Population estimates for the Southwest Alaska stock of northern sea otters (USFWS 2014).....37
Table 5. Summary of importance of threats to recovery of the southwest Alaska DPS of the northern sea otter by management unit (from USFWS 2010)..... 40
Table 6. Status of polar bear stocks in the Action Area..... 44
Table 7. Incidental (i.e., unintentional), lethal take permitted by the Service for Steller's eiders under §10 of the ESA. 65
Table 8. Incidental take of Steller's eiders permitted by section 7 of the ESA from 1997 to present. 65
Table 9. Density of northern sea otters by management unit (USFWS and USGS 2015).....71
Table 10. Risk summary table. This table highlights potential situations of concern for listed species and critical habitat..... 113
Table 11. Effects Analysis Conclusions Table. 114
Table A-12. Known short-tailed albatross mortalities associated with North Pacific and west coast fishing activities since 1983. Data from USFWS unpublished data and Kiyoaki Ozaki, Yamashina institute, pers. comm. in USFWS 2014)..... 13
Table A-13. Mean estimated annual harvest (standard error) of Pacific walruses, 2006 - 2010. Russian harvest information was provided by Chukot TINRO and the Russian Agricultural Department. United States

harvest information was collected by USFWS, and adjusted for unreported walruses using a mark-recapture method. Total harvest includes a struck and lost factor of 42% (Fay et al. 1994).....26
Table A-14. Important staging and molting areas for female and male spectacled eiders from each breeding population..... 31
Table A-15. Aerial population estimates for Steller's eiders, from the North Slope.....37
Table A-16. Steller's eider males, nests, and pair densities recorded during ground-based and aerial surveys conducted near Barrow, Alaska 1999–2010 (modified from Safine 2011).....37
Table F-17. Estimates of acute bird mortality rates from oil spills.....4

Acronyms & Abbreviations

A-C:	Alaska-Chukotka
ACP:	Arctic Coastal Plain
ADEC:	Alaska Department of Environmental Conservation
ARRT:	Alaska Regional Response Team
BA:	Biological Assessment. The Biological Assessment of the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases (Unified Plan)
BCFO:	Bunker C fuel oil
BIOS:	Baffin Island Oil Spill
BLM:	The Bureau of Land Management
BMPs:	Best Management Practices
BO:	Biological Opinion
BOEM:	Bureau of Ocean Energy Management
BSEE:	Bureau of Safety and Environmental Enforcement
CDC:	Centers for Disease Control and Prevention
CFR:	Code of Federal Regulations
CHU:	Critical Habitat Unit
CI:	Confidence Interval
CITES:	Convention on International Trade in Endangered Species of Wildlife Fauna and Flora
DHS:	Deepwater Horizon Spill
DMA:	Division of Management Authority
DOC:	Department of Commerce
DOI:	Department of the Interior
DPS:	Distinct Population Segment
DWG:	Dispersant Working Group
EEZ:	Exclusive Economic Zone
EPA:	U.S. Environmental Protection Agency
ESA:	Endangered Species Act of 1973, as amended
EU:	Environmental Unit
EVOS:	Exxon Valdez oil spill
FOSC:	Federal On-Scene Coordinator
GHG:	Greenhouse gas
GRS:	Geographic Response Strategy
IAP:	Incident Action Plan
ICS:	Incident Command System
I-I:	Inuvialuit-Inupiat
IPCC:	Intergovernmental Panel on Climate Change
IUCN:	International Union for Conservation of Nature
KSCHU:	Kuskokwim Shoals Critical Habitat Unit
LBCHU:	Ledyard Bay Critical Habitat Unit
MMPA:	Marine Mammal Protection Act
MMS:	Minerals Management Service

MOA: Memorandum of Agreement
NCP: National Contingency Plan
NMFS: National Marine Fisheries Service
NMML: National Marine Mammal Laboratory
NOAA: National Oceanic and Atmospheric Administration
NOBE: Newfoundland Offshore Burn Experiment
NSE: North Slope Eider
OCs: Organochlorine compounds
OSAs Oil-suspended particulate matter aggregates
PAHs: Polycyclic aromatic hydrocarbons
PBSG: Polar Bear Specialist Group
PCEs Primary Constituent Elements of Critical Habitat
POPs: Persistent organic pollutants
PVA Population viability analysis
PWS: Prince William Sound
RP: Responsible Party
SBS: Southern Beaufort Sea
SCP: Subarea Contingency Plan
SMART: Special Monitoring of Applied Response Technologies
SRC: Spill Response Coordinator
UME: Unusual Mortality Event
US, U.S.: United States
USCG: U.S. Coast Guard
USEPA: U.S. Environmental Protection Agency
USFWS: United States Fish U.S. Fish and Wildlife Service (Service)
USGS: U.S. Geological Survey
UV: Light Ultra-violet
WAF Water Accommodated Fraction
Y-K: Yukon-Kuskokwim

Units of Measure

µl: microliter
bbl: oil barrel, 42 US gal (159 liters)
cm: centimeter
dwt: deadweight tonnage
ft: feet
g: gram
gal: gallon
h: hour
km: kilometer
km^2: square kilometer
L: liter
lb: pound
m: meter
M: million
mi: mile
ml: milliliter
mos: months
ppm: parts per million
yr(s): year(s)

1.0 INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) in accordance with section 7(a)2 of the Endangered Species Act of 1973, as amended (ESA), on effects of *Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance* Discharges (ARRT 2010; hereafter referred to as the Unified Plan, or "the Action"; see http://www.akrrt.org/UnifiedPlan/) on: the southwest Distinct Population Segment (DPS) of northern sea otter (*Enhydra lutris kenyoni*, listed as threatened in 2005); short-tailed albatross (*Phoebastria albatrus*, listed as endangered in 2000); the spectacled eider (*Somateria fischeri,* listed as threatened in 1993); Alaska breeding population of Steller's eider (*Polysticta stelleri*, listed as threatened in 1997); Pacific walrus (*Odobenus rosmarus divergens*, a candidate as of 2011); the polar bear (*Ursus maritimus*, listed as threatened in 2008); and designated critical habitat for these species. The U.S. Coast Guard (USCG) and the U.S. Environmental Protection Agency (EPA) are the lead Federal agencies, or "Action Agencies" implementing the Unified Plan, and have made the following determinations of effects (Table 1).

Table 1. Effects determinations from USEPA and USCG for listed species under jurisdiction of the Service.

Species	Status[a]	CH[b]	Determination[c]	Rationale
Northern sea otter – southwest Alaska DPS	T	Yes	LAA, LAA (CH)	Dispersed oil can foul fur, resulting in hypothermia. Ingestion of dispersed oil while grooming could result in sublethal effects. Impacts to eyes, mucus membranes, or lungs may occur from exposure to dispersants or dispersed oil. Removal of kelp in CH that provides protection from marine predators may occur.
Short-tailed albatross	E	No	LAA	This species does not breed or nest in Alaska. Species congregates in open ocean and at the edge of the continental shelf.
Spectacled eider	T	Yes	LAA, LAA (CH)	Response activities during the breeding season could cause nest abandonment or destruction. Response activities may displace eiders from feeding and sheltering habitat. Exposure to dispersants or dispersed oil may result in hypothermia. Exposure to particulates generated by *in situ* burning could result in adverse effects. Removal of soil and vegetation in critical habitat and nesting areas could reduce the available nesting and feeding area. Flushing of marine shorelines could damage benthic organisms, reducing prey base. Exposure of prey (e.g., larval bivalves) to dispersed oil may affect eiders.
Steller's eider-Alaska Breeding Population	T	Yes	LAA, LAA (CH)	Response activities during the breeding season could cause nest abandonment or destruction. Response activities may displace eiders from feeding and sheltering habitat. Exposure to dispersants or dispersed oil may result in hypothermia. Exposure to particulates generated by *in situ* burning could result in adverse effects. Removal of soil and vegetation in critical habitat and nesting areas could reduce the available nesting and feeding area. Flushing of marine shorelines could damage benthic organisms, reducing prey base. Exposure of prey (e.g., larval bivalves) to dispersed oil may affect eiders.
Pacific walrus	C	No	LAA	Response activities may cause a stampede, resulting in injury, mortality, or abandonment of calves. Effects may occur from inhaling *in situ* burn particulates or exposure to dispersants or dispersed oil. Prey (e.g., bivalves) may be affected by dispersants.
Polar bear	T	No[d]	LAA	Injury or mortality may result from encounters with security personnel (i.e., bear guards). Ingestion of contaminants may occur during grooming or consumption of contaminated prey (e.g., seals exposed to dispersed oil). Disturbances near den sites could cause a female to abandon the den, resulting in cub mortality from hypothermia or predation.
Eskimo curlew	E	No	NLAA	Current population status is unknown and this species is considered potentially extinct.
Aleutian shield fern	E	No	NE	Aleutian shield fern is found only in an location where oil spill response would not occur.

[a] T=Threatened, E= Endangered, C=Candidate
[b] CH=Critical Habitat
[c] LAA=Likely to Adversely Affect, NLAA=Not Likely to Adversely Affect, LAA; NE=No Effect
[d] Critical habitat for polar bears was designating on December 7, 2010 (75 FR 76086). On January 11, 2013, the final rule was vacated and remanded to the Service by the U.S. District Court for the District of Alaska in Alaska Oil and Gas Association et al. v. Salazar et al (D. Alaska)(3:11-cv-00025-RRB). Service decisions regarding the District Court's order are currently pending, and the scope and description of a final critical habitat designation for polar bears are unresolved at this time.
[d] Yellow-billed loons were as a candidate from 2009 - 2014, but found not warranted for listing on October 1, 2014 (79 FR 59195).

[Top]

This programmatic consultation assesses potential impacts of the program as a whole, considering activities conducted under the Unified Plan both individually and cumulatively to ensure they are not likely to jeopardize the continued existence of listed entities or result in the destruction or adverse modification of designated critical habitat. Regulations adopted pursuant to section 7(a)(2) further clarify that "jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This BO is based on information from a variety of sources including the Biological Assessment (BA) produced for this consultation (Windward 2014), published literature, agency and consultant biological surveys and reports, and personal communications with species experts. The assessment approach is explained in detail in Chapter 4 of the BO. The BO does not include an incidental take exemption because information on the location, timing, design, and other aspects of these actions are not available at this time. We will review the effects of those actions, and through emergency section 7(a)(2) consultation, issue incidental take statements in the future, if appropriate, when formal consultation is requested on specific discretionary actions.

The USCG and EPA requested evaluation of the Pacific walrus by submitting a determination of effects for this species. Although the ESA provides no legal protection for candidate species, they are evaluated at the request of the lead Federal agencies, thus Pacific walrus is included in this analysis. Under the ESA, listed entities include threatened and endangered species or populations, but for brevity in this BO, the term "listed species" refers to threatened, endangered, and candidate species and populations.

1.1 Species Not Further Considered in this Opinion

Several species including the Aleutian shield fern (*Polystichum aleuticum*, listed as endangered in 1988), Eskimo curlew (*Numenius borealis*, listed as endangered in 1967), yellow-billed loon (*Gavia adamsii*, a candidate from 2009 to 2014); and Kittlitz's murrelet (*Brachyramphus brevirostris*; a candidate from 2004 - 2013) are not further considered in the BO because either: 1) we concurred with the Action Agency's determinations of No Effect or Not Likely to Adversely Affect (e.g., Aleutian shield fern and Eskimo curlew), or 2) they were candidates found not warranted for listing under the ESA (e.g., yellow-billed loon and Kittlitz's murrelet). Explanations and justifications follow.

The Aleutian shield fern is known to occur only atop Mt. Reed on Adak Island. Mt. Reed receives few human visitors and has no paved roads or other transportation routes by which vessels or automobiles carry hazardous substances. No development is planned for Mt. Reed. There is little if any potential for the Aleutian shield fern to be exposed to spill response actions implemented as part of the Unified Plan. EPA and USCG determined that there would be no effect to the Aleutian shield fern.

The Eskimo curlew is likely extinct. The last record confirmed by physical evidence is a specimen collected in Barbados in 1963. Since that time, 39 potential sightings have occurred in 22 different years, most recently in Nova Scotia in 2006 (Hoffman 2007). The reliability of

these sightings is variable and none have been confirmed by physical evidence. Surveys of the Eskimo curlew's historic and potential breeding areas over recent decades have not detected the species (USFWS 2011). Due to the very low probability of encountering this species during a spill response action, we concur with the determination of the EPA and USCG that implementation of the Unified Plan is not likely to adversely affect Eskimo curlews.

Yellow-billed loon and Kittlitz's murrelet were candidates at the time the BA was prepared by USCG/EPA. However, in both instances, the species were found not warranted for listing under the ESA (79 FR 59195 and 78 FR 61764, respectively). Therefore, the effects of the Unified Plan on yellow-billed loon and Kittlitz's murrelet will not be analyzed further in this BO.

[Top]

2.0 PROPOSED ACTION

The proposed action considered in this BO includes the oil and hazardous substance discharge responses authorized and conducted under the Unified Plan (ARRT 2010) and the proposed *Dispersant Use Plan for Alaska,* as provided in Final Draft form (ARRT 2014). The Unified Plan establishes the decision-making processes that direct oil spill response in Alaska. Major components of the activities that may be authorized or conducted to respond to oil spills in Alaska are shown on Table 2.

Table 2. Spill Response Action described in the Unified Plan

Potential Response Action		Description of Response Action
Mechanical counter-measures	Deflection/ containment phase:	Booming Constructing barriers, dams, pits, and trenches Culvert blocking
	Recovery phase:	Skimming/Vacuuming Sorption
	Removal/ cleanup phase:	Flushing and flooding Steam cleaning and sandblasting Removing contaminated soil, sediment, vegetation, or natural debris
Non-mechanical countermeasures and monitoring		Application of approved chemical dispersants by vessel or aircraft *In situ* burning Required real-time efficacy monitoring with specialized equipment
Tracking and surveillance		The use of aircraft, vessels, all-terrain vehicles, or heavy machinery Installation of buoys Sample collection
Waste management		Waste handling and storage Waste transport Waste treatment and/or disposal Decontamination
Wildlife protection		Recovery of contaminated carcasses to prevent contamination of other wildlife Wildlife deterrence (i.e., hazing) Pre-emptive capture and relocation of uncontaminated wildlife Capture, treatment, and release of contaminated wildlife Strategic avoidance
Natural attenuation		No action; allow affected habitat to recover naturally and monitor results

[Top]

2.1 Mechanical Countermeasures

Mechanical countermeasures are primary response actions that are intended to deflect, exclude, or contain oil or other spilled material before it can further impact ecological resources.

Deflection and Containment

Deflection or containment actions may involve deploying booms or constructing structures, such as earthen berms, on land to contain and collect a spilled material. In upland environments, the placement and configuration of controls is often based on detailed drainage patterns and topography. In coastal environments, the mapping or modeling of winds, currents, and tidal patterns, in conjunction with real-time observations, supports the placement and configuration of booms and sorbents.

Booming

A boom is typically a flexible floating barrier used to divert (either into or away from an area) or contain buoyant spilled materials in aquatic environments (i.e., open water, nearshore, rivers, and lakes). Fire booms are used to concentrate spilled oil during an *in situ* burn. Oil spill containment booms generally have five operating components—flotation chamber, freeboard, skirt, tension member, and ballast. The overall height of the boom is divided between the freeboard (the portion above the surface of the water) and the skirt (the portion below the water surface). Boom heights range from approximately six inches to over 90 inches depending on environmental conditions. Flotation attached to the freeboard, and ballast (e.g., chain, weights) attached to the skirt, enable the boom to float upright in the water. Boom is typically made up of 50-foot sections and can be connected to form longer booms. Configurations vary according to the site-specific conditions and purpose (e.g., containment versus deflection). Deployment typically involves the use of one or more large vessels and/or small work boats with associated crew(s). Shoreside workers and heavy machinery on barges or piers may also be used if boom ends are anchored onshore. In open water, booms are typically deployed between two vessels in order to concentrate the spilled substance or oil slick for recovery actions (e.g., skimming).

The use of defensive or containment booms is one of the first response actions called for in Geographic Response Strategies (GRS) under the Unified Plan. Boom designs are specific to the environment in which they will be used, however, they are less effective in rough water, high winds, fast currents, or broken ice (Stevens and Aurand 2008; NOAA 2010). Booms require frequent tending and adjustment to stay in position over the course of their use and thus require the periodic or continuous presence of a work vessel (or other equipment) and crew to be effective.

Constructing Barriers, Dams, Pits, and Trenches

Filter fences, berms, dams, pits, and trenches are used to divert or contain spilled materials in upland, riparian, or sea-ice environments. These physical barriers are typically used in conjunction with skimming or other recovery techniques (e.g., sorbents, vacuuming).
The construction of these physical structures typically require the use of heavy machinery to install man-made materials (e.g., filter fences, sand bags, air- or water-filled seal booms) or place natural substrates (e.g., soil, snow, ice rubble), although hand construction may be possible. If water flow from a bermed area is necessary, an underflow culvert or overflow weir may be

included in the construction of a berm or dam. Activity is associated with construction as equipment and personnel are mobilized to and from the site (air, boat, or land transportation to the site).

Culvert Blocking

Open culverts present a potential route for spilled material to enter otherwise unaffected areas. In order to eliminate this threat, culverts may be blocked with a temporary or permanent fixture (e.g., plywood, plug, plastic sheeting, and sand bags). Culvert blocking may also be achieved through the use of deflection booming near the culvert.

Recovery

The recovery of spilled oil is often an important component of an oil spill response action and is typically carried out in conjunction with containment, diversion, deflection, and/or removal actions. In the case of uncontaminated petroleum products, recovered material is reprocessed and refined for commercial use. Several technologies or processes, including skimmers, vacuums, sorbent materials, and manual or mechanical removal, may be used in recovery, depending on the environment in which the spill occurred, the nature and amount of the material spilled, and the behavior of the material following release. Highly refined petroleum products such as gasoline, diesel, and kerosene tend to evaporate from the water very quickly, even during winter months. Crude oil becomes difficult to recover, burn, or chemically disperse after the first 24 - 48 hours because evaporation accelerates as the oil spreads and thins, viscosity and density may increase, emulsification tends to occur, and slick thickness rapidly decreases (NOAA 2010). In sub-freezing temperatures, when ice pack is present, spilled oil will evaporate more slowly than oil spilled in open water (Payne et al. 1991). Overall, recovery efforts in open water tend to have limited effectiveness; recovery rates can range from 1 - 30% (MMS 2010).

Skimming/Vacuuming

Skimmers are mechanical devices that collect oil or other floating contaminants at the water's surface through suction or sorption. They are designed to minimize the intake of water and maximize the uptake of spilled material but often generate wastewater that requires additional space (on land or shipboard) for storage and treatment. The efficiency of skimmers is limited if the water is rough; if aquatic vegetation, floating debris, or ice is present; or if the floating material is too viscous.

The objective of this response activity is to recover floating oil from the water surface. There are numerous types or categories of skimming devices, including weir, centrifugal, submersion plane, and oleophilic. Weir skimmers use gravity to drain oil from the water surface into a submerged holding tank. Once in the holding tank, oil may be pumped away to larger storage facilities. Centrifugal (also vortex) skimmers create a water/oil whirlpool in which the heavier water forces oil to the center of the vortex. Once in the center, oil may be pumped away from the chamber within the skimmer. Submersion plane skimmers use a belt or inclined plane to push the oil beneath the water surface and toward a collection well in the hull of the vessel. Oil is scraped from the surface or removed by gravity into a collection well where it is subsequently removed with a pump. Oleophilic (i.e., having an affinity for oil) skimmers may take on several forms (e.g., disc, drum, belt, rope, brush), but the general principle of oil collection remains the

same; oil on the surface of the water adheres to a rotating oleophilic surface. Once oil adheres to the surface it may be scraped off into containers or pumped directly into large storage tanks.

Skimmers are placed at the oil/water interface to recover, or skim, oil from the water surface. Skimmers may be operated independently from shore, be mounted on vessels, or be completely self-propelled. To minimize the amount of water collected incidental to skimming oil, booming may be used in conjunction with skimming to concentrate the floating oil in a wedge at the back of the boom, which directs a thick layer of oil to the skimmer head.

In shallow water, hoses attached to vacuum pumps may be used instead of other skimming devices. Oil may be removed from the water surface using circular hose heads (four to six inches in diameter); however, this is likely to result in the intake of a large water-to-oil ratio and inefficient oil removal. Instead, flat head nozzles, sometimes known as "duckbills" are often attached to the suction end of the hose in order to maximize the contact between the oil and vacuum, minimizing the amount of water that is removed from the environment. Duckbills (very much like an attachment to a vacuum cleaner) are typically 18 inches or less in width and less than two inches in height. In other words, duckbills are relatively small and designed for maximizing the amount of oil removed from the water surface relative to the volume of water removed. Vacuum hoses may also be attached to small, portable skimmer heads to recover oil they have collected. Adequate storage for recovered oil/water mixtures, as well as suitable transfer capability, must be available. Recovery systems that use skimmers are often placed where oil naturally accumulates: in pockets, pools, or eddies. Vacuums may be small, portable units or truck/vessel-mounted units used to remove pooled or stranded material (typically oil), regardless of the viscosity. Large amounts of water may be entrained during the vacuuming of floating material and require storage, treatment, and disposal.

Sorption

Sorbents collect spilled materials, particularly petroleum or similar products, through either adsorption (adherence to the sorbent surface) or absorption (penetration of the pores of the sorbent). Natural and mineral sorbents include peat moss, straw, snow, and clay. Synthetic sorbents are inert and insoluble materials generally manufactured in particulate form and designed to be spread over an oil slick or deployed as sheets, rolls, pillows, or booms. They are typically deployed by hand or machine to the spilled material (either floating or on land) and removed and replaced once coated or saturated. In the case of oil spills, the sorbent material is recovered from the coated/saturated sorbents to the degree practicable. Used sorbents require collection, handling, and offsite hazardous waste disposal.

The objective of this response is to remove floating oil by allowing it to adhere to pads or rolls made of oleophilic material. The dimensions of sorbent pads are typically 2 x 2 ft. Sorbent rolls are approximately the same width as pad and may be 100 feet long. The use of sorbents to remove floating oil is different from the use of skimmers in two ways: (1) the use of sorbents is a passive oil collection technique that requires no mechanized equipment, whereas skimmers may be attached to active vessels for oil collection; and (2) sorbents are left temporarily in the affected environment to adsorb oil in a specific locale, whereas skimmers may transit in order to collect oil in a broader area.

Sorbents are most likely to be used to remove floating oil in nearshore environments that contain shallow water. They are often used as a secondary method of oil removal following gross oil removal, such as skimming. Sorbents may be used for all types of oil; lighter oils absorb into the material and heavier oils adsorb onto the surface of sorbent material, requiring sorbents with greater surface area. Retrieval of sorbent material is mandatory, as is at least daily monitoring to check that sorbents are not harming wildlife or breaking apart after lengthy deployments. However, sorbent materials generally do not remain in the environment for longer than one day.

Passive collection with sorbents can also be used in conjunction with other techniques (e.g., flushing, booming) to collect floating oil for recovery. This variation of the removal of surface oil allows for oil adsorption onto oleophilic material placed in the intertidal zone or along the riverbank. Sorbent material is placed on the surface of the shoreline substrate, allowing it to adsorb oil as it is released by tidal or wave action. The sorbents most typically used for medium to heavy oils are snares made of oleophilic material; snares are attached at 18-inch intervals along a rope that can be tied, anchored, or staked along the intertidal shoreline. As the snares are moved about by tidal or wave action, they also help remobilize oil by rubbing across rock surfaces. Snare lines are monitored on a regular basis for their effectiveness at picking up oil, and to collect and replace oiled sorbents with new material. This method is often used as a secondary treatment method after gross oil removal, and along sensitive shorelines where access is restricted.

Removal/Cleanup

A response action may include the manual or mechanical removal of spilled material, contaminated soil, sediment, vegetation, or debris in upland (including shorelines) and nearshore environments. Shorelines or streams that are in the path of a spill may be subject to the pre-emptive removal of debris (e.g., large logs or root balls) to minimize the retention of a spilled material and its subsequent release over time. Removal may also be augmented by flushing or otherwise washing surfaces (including large vegetation) to which spilled materials have adhered. Flushing or related responses are used in conjunction with containment and recovery actions. Chemicals may also be used to assist in the removal or release of spilled materials (particularly oil) from surfaces; however, no chemicals are currently approved by the ARRT for use in this manner.

Flushing and Flooding

Flushing and flooding are response actions that rely on hydraulic action to remove spilled material from a solid or semi-solid surface (e.g., rocks, bulkhead, and cobble beaches) where it can be contained and collected. Water can be heated to enhance the removal process. These actions are typically applied in shoreline habitats. Flushing involves forcing large quantities of ambient or supplied water at pressure (ranging from < 50 - 1,000 pounds per square inch) through sediment or across surfaces to move hydrophobic contaminants into a containment area. Flooding involves the use of very large quantities of water to flush a spilled product from the sediment to the surface and into a containment area.

The objective of ambient water flushing is to remobilize oil stranded on surface substrate, and in crevices and rock interstices to water's edge for collection. Water is pumped from hoses onto an oiled beach, beginning above the highest level where the oil is stranded, and slowly working down to the water level. The flow of water remobilizes oil stranded on the surface sediments and flushes it down to water's edge. The remobilized oil is contained by boom and recovered for disposal. Increased water pressure may be needed to assist in the remobilization as the oil weathers and begins to harden on the substrate. Because of the potential for higher pressures to cause siltation and physical disruption of the softer substrates, flushing with higher pressures is restricted to rock or hard man-made substrates. Intake and outflow hoses may range from 2 – 4 inches in diameter and, depending on the pump used, pump between 200 -400 gallons of water per minute. Intake hoses are fitted with screens to minimize the extraction of debris, flora and fauna. Screen holes generally range from 0.25 - 1.0 inch in diameter, depending on the environment from which the water is being pumped. Intake hoses are propped off bottom using rebar in about three feet of water to further minimize the amount of sediment, debris, and organisms taken into the hose and pump.

Flooding is used to mobilize stranded oil from rock crevices and interstices. Ambient water is pumped through a header pipe at low pressure above and inshore from the fouled area of shoreline. A pipe creates a sheet of water simulating tidal washing over the affected area. Removing stranded oil may be particularly important when a more sensitive habitat is nearby and in danger of becoming fouled with oil remobilized in tidal cycles. The effects of flooding may also be desired when a spring tide has deposited oil above the normal high water mark or when the wave energy of the adjacent water is not great enough to sufficiently wash the affected area over the following tidal cycle. After oil has been loosened from the substrate it is collected and removed using a variety of mechanical, manual and passive methods.

Low pressure washing with ambient water is used to mobilize liquid oil that has adhered to the substrate or man-made structures, pooled on the surface, or become trapped in vegetation to the water's edge for collection. Low-pressure washing (<50 pounds per square inch) with ambient seawater sprayed through hoses is used to flush oil to the water's edge for pickup. Oil is trapped by booms and picked up with skimmers or sorbents. This variation may also be used in concert with ambient water flooding, which helps move the oil without the potential effects associated with higher water pressures.

High pressure washing with ambient water is used to mobilize oil that has adhered to hard substrates or man-made structures to the water's edge for collection. It is similar to low-pressure washing except the water pressure may reach 100+ pounds per square inch, and it can be used to flush floating oil or loose oil out of tide pools and between crevices on riprap. Compared to the lower pressure spray, high-pressure spray will more effectively remove oil that has adhered to rocks. Because water volumes are typically low, this response method may require the placement of sorbents directly below the treatment area or the use of a deluge to carry oil to the water's edge for collection.

Warm water, moderate-pressure washing is used to mobilize thick and weathered oil that has adhered to rock surfaces, prior to flushing it to the water's edge for collection. Seawater is heated

(typically between the ambient temperature and 90°F) and applied at moderate pressure to mobilize weathered oil that has adhered to rocks. If the warm water is not sufficient to flush the oil down the beach, flooding or additional low- or high-pressure washing may be used to float the oil to the water's edge for pickup. Oil is then trapped by boom and may be picked up with skimmers or sorbents.

Hot water, moderate-pressure washing is used to dislodge and mobilize trapped and weathered oil from inaccessible locations and surfaces not amenable to mechanical removal, prior to flushing oil to water's edge for collection. Water heaters are mounted on offshore barges or on small land-based units. The water is heated to temperatures from 90°F-170°F, which is usually sprayed in small volumes, by hand, using moderate-pressure wands. Used without water flooding, this procedure requires immediate use of vacuums (vacuum trucks or super suckers) to remove the oil/water runoff. With a flood system, the oil is flushed to the water's edge for collection with skimmers or sorbents. This response is generally used when the oil has weathered to the point that even warm water at high pressure is ineffective for the removal of adhered oil, which must be removed due to the threat of continued release of oil or for aesthetic reasons.

Steam Cleaning and Sandblasting
When constructed or low-value shoreline habitat is contaminated by a floating product, steam cleaning or sandblasting may be used to remove the product from rocky substrates. This process is very limited in scope but nonetheless effective for oil recovery. Biota living in areas treated in this manner will likely be destroyed by the high heat, pressure, and/or abrasion.

Removing Contaminated Soil, Sediment, Vegetation, or Natural Debris
Manual removal is conducted using hand tools (e.g., rakes, shovels, scrapers). Material is collected in containers typically transported by vehicle to a storage area for later disposal. Mechanical removal relies on heavy equipment (e.g., bulldozers, backhoes) and is usually implemented when the spill area/debris size exceeds the capacity of manual removal.
Oiled sediment is removed by either use of hand tools or by use of various kinds of motorized equipment. Oiled sediment removal is restricted to the supratidal and upper intertidal areas to minimize disturbance of biological communities in the lower intertidal and subtidal. After removal, oiled sediments are transported and disposed of offsite.

Aquatic, shoreline, or riparian vegetation heavily contaminated by a spilled product may be a continuing threat to organisms that forage on the vegetation or otherwise use the habitat. Vegetation can be removed either manually or mechanically. The heavier the machinery used, the greater the soil or sediment compaction and noise produced, although foot traffic by workers will also cause some compaction. Debris (e.g., seaweed, trash, and logs) is removed from the shoreline when it becomes heavily contaminated and when it is a potential source of chronic oil release, an aesthetic problem, or a source of contamination for organisms on the shoreline.

2.2 Non-mechanical Countermeasures and Monitoring

Non-mechanical countermeasures alter the physical or chemical properties of spilled material (i.e., petroleum or oil-like materials), such that the options for recovery are improved or the overall impacts of spilled material that cannot be recovered are reduced.

Application of Approved Chemical Dispersants by Vessels or Aircraft

Two dispersant formulations from EPA's product schedule are currently available for use in Alaska: Corexit® EC9500A and Corexit® EC9527A (hereafter referred to as Corexit® 9500 and Corexit® 9527). See Table 3 for Corexit® 9500 and Corexit® 9527 dispersant formulations. In certain instances, use of these dispersants requires authorization from ARRT. Use of Corexit® 9527 is restricted to existing stocks and will be phased out as these stocks are depleted. Other chemical formulas currently available for use during an oil spill (i.e., those listed on the National Contingency Plan [NCP] product schedule; EPA 1994; 59 FR 47384) would require ARRT approval for use in Alaska.

Chemical dispersants are mixtures of surfactants, hydrocarbon-based solvents, and other compounds altering the spatial distribution, chemical fate, and physical transport of spilled oil in aquatic environments. Dispersants are specifically designed to enhance dispersion of oil into the water column by generating smaller droplets of oil that are subject to natural processes, such as dissolution, volatilization from the water surface, biodegradation, and sedimentation from interactions with suspended particulate material. The application of chemical dispersants in marine environments is restricted to a response to spilled petroleum or other oil-carried or oil-like contaminants. Dispersants do not reduce the total amount of oil in the environment, but instead, change the characteristics of the oil, thereby changing the transport, fate, and potential effects of the oil.

Table 3. Corexit® 9500 and Corexit® 9527 dispersant formulations

Chemical Constituent	Chemical Type	CAS[b] No.
Propylene glycol	solvent	57-55-6
2-Butoxy ethanol[a]	solvent	111-76-2
Sodium dioctyl-sulfosuccinate	surfactant	577-11-7
Sorbitan monooleate	surfactant	1338-43-8
Polysorbate 80	detergent/surfactant	9005-65-6
Polysorbate 85	surfactant	9005-70-3
1-(2-Butoxy-1-methylethoxy)-2-propanol	solvent	29911-28-2
Petroleum distillates, hydro-treated, light	solvent	64742-47-8

[a] This chemical is not included in the formulation of Corexit® 9500

[b] CAS: Chemical Abstracts service

[Top]

The use of chemical dispersant as a response option is reserved for occasions when resources are at risk and other response actions are either not feasible or not adequate to contain or control the spill because of field conditions (e.g., remote location, lack of access). Dispersed oil is less likely to wash ashore in sensitive coastal areas or to form a slick capable of oiling wildlife at the

sea surface (NRC 2005). However, the tradeoff of using dispersants is pelagic species may be more exposed to oil after chemical dispersion (Windward 2014).

Dispersant use generally requires ARRT approval on a case-by-case basis, except in the case of immediate risk of the ignition or inhalation of volatile and poisonous constituents of oil[1]. The exception to this general approach is the Preauthorization Zone, shown in Figure 1. Within this zone, use of dispersants would not require prior approval by the ARRT.

Dispersants are applied to the oil's surface via either vessel-mounted equipment or aerial spraying (at concentrations of 2 - 5% by volume of the oil). Subsurface application, was performed for the 2010 Deepwater Horizon Spill (DHS) in the Gulf of Mexico, but based on the description of the action provided by USCG/EPA (EPA and USCG 2015), is not included as an action in this consultation. The effectiveness of dispersants is dependent upon the amount of time that has elapsed since the spill (oil weathering), surface oil thickness, oil viscosity, water depth, salinity, temperature, and sea conditions (NRC 2005). Dispersants require physical mixing for optimum effect. The mixing can be intentionally induced (e.g., use of propeller wash in broken ice conditions).

Efficacy of applied dispersant can be assessed in a variety of ways. An interagency monitoring program has been designed for monitoring use of *in situ* burning and dispersants. This program, termed the Special Monitoring of Applied Response Technologies (SMART) program, involves personnel from USCG, National Oceanic and Atmospheric Administration (NOAA), USEPA, Centers for Disease Control and Prevention, and Bureau of Safety and Environmental Enforcement (BSEE; part of the agency formerly known as the Minerals Management Service, MMS). SMART protocols identify three levels of monitoring:

- **Tier I**—A trained observer, flying over the oil slick and using photographic job aids or advanced remote sensing instruments, assesses dispersant efficacy and reports results to the incident command post. This is the minimum level of monitoring required for dispersant use nationally.
- **Tier II**—Real-time empirical data is gathered from the treated slick. A sampling team on a boat uses a monitoring instrument to continuously monitor for dispersed oil one m under the dispersant-treated slick and reports the results to the incident command post. Water samples are taken for later analysis at the laboratory.
- **Tier III**—Expanded real-time empirical data is gathered from the treated slick to determine where the dispersed oil goes and what happens to it. Similar to Tier II, a sampling team(s) uses at least two monitoring instruments to monitor the water at several depths, often from the center of the slick. A portable water laboratory provides data for water temperature, pH, conductivity, dissolved oxygen, and turbidity. Results are reported to the incident command post.

[1] Spilled oil products may contain poisonous and flammable volatile organic compounds, and oil dispersal is a possible option to reduce the immediate risk of ignition or inhalation. The FOSC may use dispersants without obtaining outside consent or consultation under circumstances presenting a hazard to human life (40 CFR 300.910(d)).

Conditions/stipulations of the Dispersant Use Plan include:

- All dispersant application field tests will be conducted on a representative portion of the oil slick.
- The Federal On-Scene Coordinator (FOSC) immediately notifies the Department of the Interior (DOI) ARRT representative of the decision to authorize dispersant use.
- If the FOSC determines that dispersant use may affect listed species under the Service's jurisdiction, the FOSC initiates a spill-specific emergency ESA section 7 consultation during which the Service Spill Response Coordinator (SRC) and/or section 7 biologist will provide mitigation measures to lessen potential impacts to ESA-listed species.
- The Service's SRC and Environmental Unit (EU) (which the SRC and/or a section 7 biologist is a part of), provides the FOSC any necessary supporting information, including weather and other environmental characteristics, and a description and prioritization of Resources at Risk.
- Following review of the dispersant field test, the EU provides the FOSC with a recommendation on whether full-scale dispersant application should commence.
- Dispersant application effectiveness and potential trade-offs associated with its use will be evaluated on a daily basis, informing the FOSC's decision to continue, postpone, modify, or cease dispersant application based on that day's monitoring information.
- Dispersant applications will only be carried out in daylight conditions.
- Use of dispersants will not exceed 96 hours following the dispersant application field test (unless an extension is approved as a "atypical dispersant use" using the Process for Case-by-Case Dispersant Use Authorization, which includes consultation with DOI) and will be guided by the "Environmental Monitoring for Atypical Dispersant Operations."
- Dispersants will only be applied in areas where the water depth is 10 fathoms (60 feet) or greater, and at sufficient distances from shore to ensure that sensitive nearshore and benthic habitats are not affected by dispersants and/or dispersed oil.
- Dispersant applications will maintain a minimum 500 meters (1,640 feet) horizontal separation from swarming fish, rafting flocks of birds, marine mammals in the water, and/or marine mammal haulouts.
- Any monitoring required by the Service and/or National Marine Fisheries Service (NMFS) for ESA section 7 compliance will be conducted.
- DOI and/or Department of Commerce (DOC) will provide a specialist in aerial surveying of marine mammals and pelagic birds to accompany a SMART Tier 1 monitoring team to help ensure compliance with the above requirements. If DOI and/or DOC cannot provide the appropriate specialist(s), a third party acceptable to the DOI and/or DOC will be identified to accompany the monitoring team.
- Information on the location of all dispersant application(s) will be provided to the public, including posting on the ARRT website.
- A checklist verifying that all conditions/stipulations have been met will be completed prior to approval of dispersant use.
- Other incident-specific conditions/stipulations may be developed on a case-by-case basis.

The *Dispersant Use Plan for Alaska* as described in Final Draft form (April 2014; ARRT 2014) in Appendix A of the BA (Windward Environmental LLC and ERM 2014) is incorporated into the Unified Plan, with the exception of subsea application. The Preauthorization Area identified

in the Dispersant Use Plan extends from the Western Aleutians to the east side of Prince William Sound, starting 24 nautical miles from the coast and extending south out to the 200 mile Exclusive Economic Zone (EEZ), and north 100 nautical miles offshore (Figure 1).

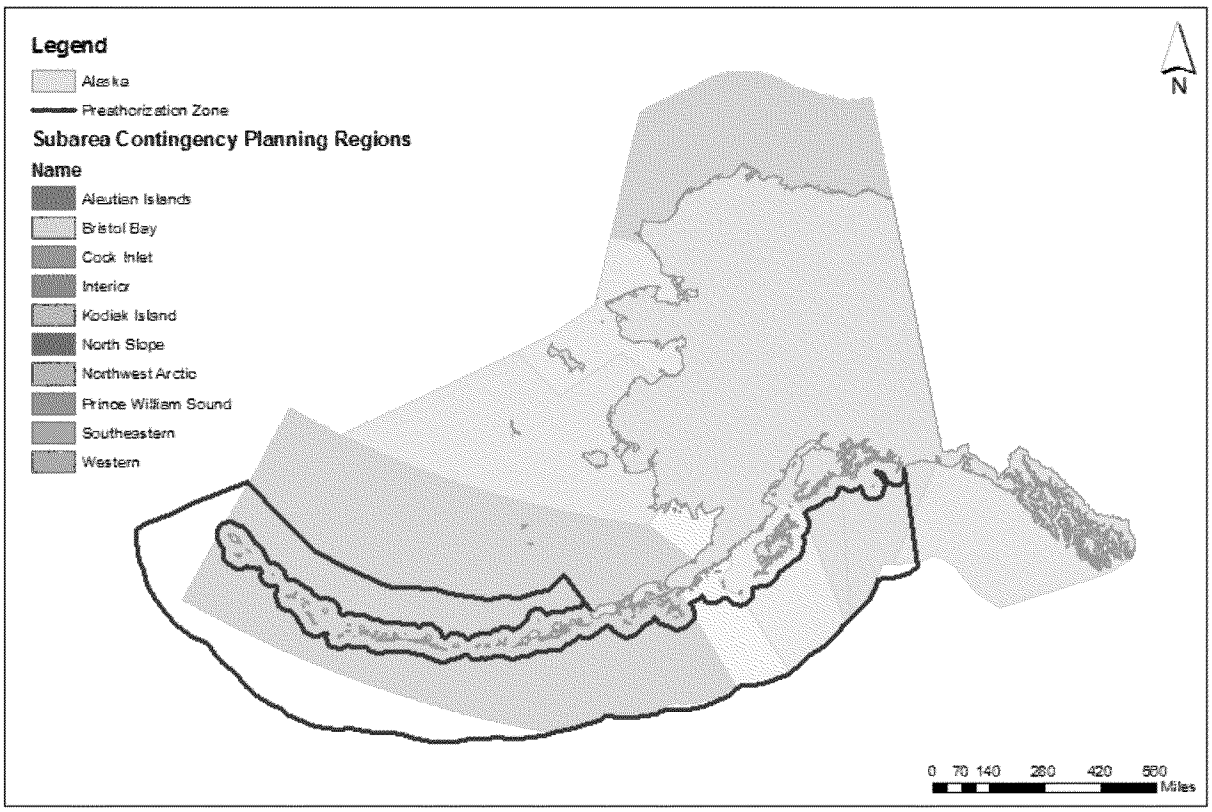


Figure 1. The boundaries of the Preauthorization Area of the Dispersant Use Plan under the Unified Plan. The boundaries of the Subarea Contingency Plans (SCPs) are shown where they overlap with the Preauthorization Area.

[Top]

The Preauthorization Area enables the USCG to require certain vessel and facility response plan holders in Alaska to maintain a minimum dispersant use capability in accordance with the USCG August 31, 2009 rulemaking (33 CFR Parts 154 and 155; "Vessel and facility response plans for oil: 2003 removal equipment requirements and alternative technology revisions; Final Rule").

The NCP Subpart J Section 300.910(d) affords the FOSC the authority to authorize the use of dispersant without obtaining concurrence from the ARRT when the FOSC has judged that the use of dispersant is necessary to prevent or substantially reduce a hazard to human life. Once the threat to human life has subsided, the continued use of dispersant must follow the approval process in the NCP Section 300.910(b), which includes review and approval by DOI.

Conditions/stipulations that apply within the Preauthorization Area include:

- The preauthorization of dispersant use only applies to incidents involving tank vessels carrying crude oil to/from a U.S. port.
- The Preauthorization Area excludes any avoidance areas to be identified in certain Subarea Contingency Plans (SCPs). State and federal natural resource trustees, including the Service, will assist in the identification of these avoidance areas.
- Avoidance areas for protection of the short-tailed albatross have been approved by the ARRT Dispersant Working Group (DWG) in accordance with Section 1.4 of the Dispersant Use Plan (See Appendix D for correspondence regarding avoidance areas). These avoidance areas will be incorporated into the Unified Plan via inclusion in SCPs. Use of dispersants within these areas will be considered in the same manner as for areas outside of the Preauthorization Area.

In Situ Burning

In situ burning is a response action used to address spilled oil in either aquatic or terrestrial habitats. According to the "*In Situ* Burning Guidelines for Alaska, Revision 1" (ADEC et al. 2008; included in the Unified Plan as Appendix II to Annex F), burning can be conducted if, "mechanical containment and recovery by themselves are incapable of controlling the oil spill, burning is feasible, and the burn will lie a safe distance from populated areas." The FOSC has the authority to authorize *in situ* burning on a case-by-case basis after obtaining concurrence from the EPA and Alaska Department of Environmental Conservation (ADEC) representatives to the ARRT[2]. A review checklist is included in the *in situ* burning guidelines to facilitate the decision process. The checklist includes the following steps:

1. Review the completed Application to Burn Plan (Appendix A to the *In Situ* Burn Guidelines for Alaska, Revision 1; ADEC et al. 2008)
2. Determine the feasibility of burning
3. Determine whether burn may be conducted at a safe distance from population areas
4. Determine whether environmental and other considerations will be adequately addressed
5. Review consultations and requests for authorization
6. Make a decision on whether to authorize burn

The objective of *in situ* burning is to remove oil from the water surface or habitat by burning it in place, or *in situ*. Oil floating on the water surface is collected into slicks a minimum of two to three mm thick and ignited. The oil is typically collected in fire-resistant boom that is towed through the spill zone by watercraft, or collected by natural barriers such as the shore. Although *in situ* burning may be used in any open water environment, the environment dictates the specific procedure employed in a given burn. For example, in offshore and nearshore marine environments, bays and estuaries, large lakes and large rivers a boom may be towed at one knot or less during the burning process in order to maintain the proper oil concentration or thickness. Wind or mechanically generated currents (known as herding) may be used to collect and concentrate oil along the shoreline or in a stationary boom attached to the shoreline.

[2] Concurrence from DOI and DOC natural resource trustees will be obtained when practicable.

Once an oil slick is sufficiently thick, an external igniter is used to heat the oil, generating enough vapors above the surface of the oil to sustain a burn. It is these vapors, rather than the liquid oil on the water surface, that actually burn. When the oil burns enough so the remaining layer is less that one to two mm thick, the fire goes out. The fire is extinguished at this thickness because the oil slick is no longer sufficiently thick to provide insulation from the cool water. This insulation is necessary to sustain the heat that produces the vapors, which are subsequently burned. The small quantity of burn residue remaining in the boom is then manually recovered for disposal.

The use of *in situ* burning as a response action is a valuable tool to quickly remove oil from open water or upland areas and prevent it from reaching sensitive habitats or populations. For spills in uplands or wetlands where there is a layer of water underneath the oil slick, the oil is often naturally contained by being trapped in the vegetation or concentrated in open water areas. For spills on land that do not have any natural containment, temporary dikes can be constructed to contain and isolate the oil for burning. For spills on snow, two burning approaches can be used. Oiled snow can be plowed into piles and burned right on the ground or on the ice. Alternately, oiled snow can be removed with front-end loaders, loaded into dump trucks, and hauled to a burn pit (ACS 1999).

The burning of weathered or emulsified oil is typically infeasible because it is not likely to continue burning once ignited. This is due to the emulsion of oil with water, as well as the evaporation of flammable, volatile oil components. Sea and wind conditions also affect the feasibility of *in situ* burning. Concentrated oil is better able to remain ignited, and oil trapped between sea-ice floes is often sufficiently concentrated so that further containment measures may not be necessary prior to an *in situ* burn.

For *in situ* burning operations, SMART protocols include deploying one or more air quality monitoring teams with specialized portable equipment downwind of the burn at sensitive locations, such as population centers. Teams begin sampling before the burn to collect background baseline air quality data. After the burn starts, the teams continue sampling for particulate concentration trends, recording them both manually at fixed intervals and automatically, and report results to the incident command post.

Other Non-mechanical Countermeasures and Monitoring

Examples of other non-mechanical countermeasures include application of other chemical agents (e.g., solidifiers and fire foam), and application of biodegrading organisms or nutrient stimulants used to enhance biodegradation of oil. Such countermeasures, including subsea dispersant application, while not previously approved by the ARRT, are available to FOSCs provided they are approved by the ARRT – which includes review by DOI – prior to application in accordance with National Contingency Plan (NCP) Section 300.910(b). Other non-mechanical countermeasures and oil spill response monitoring methods have not been previously approved by the ARRT, therefore, are not part of the proposed action, and are not considered in this consultation.

2.3 Tracking and Surveillance

Tracking and surveillance (e.g., aerial reconnaissance) is performed for almost all spill events for which a response is planned. These activities are conducted to visually and electronically assess the field conditions and extent of a spill and to project, through computational modeling, the future movements of the spill. Information is also gathered on the location and movement of sensitive wildlife.

Nuka Research (2006) identifies two tracking tactics: plume delineation on land and discharge tracking on the water. Each is used to determine the size, shape, and trajectory of a spill, as well as the resources required to appropriately control the spilled material, and reduce ecological and economic impacts. On land, it is easier to map a plume of spilled material and predict its trajectory than in water. Actions may involve land transport or aerial surveillance. The location of a plume can be validated through the use of monitoring equipment (e.g., photo ionization detection). To monitor deep soil, excavation equipment may be required.

For spills on the water, aerial surveillance is typically used to visually inspect a spill. In addition, infrared remote sensing and other non-invasive imaging technologies can be used during aerial surveillance to facilitate location, trajectory, and density mapping, including under ice. In some instances, buoy-based systems moving through a spill on the water and electronically tracking the position and direction of the material's movement may be deployed. Additional in-water tracking may be conducted by means of vessels, and vessel operators may sample materials that can be analyzed for current spill conditions (i.e., extent of oil weathering). The trajectory of a plume and wildlife movement is tracked over time. Information gathered during tracking and surveillance helps support the development of an Incident Action Plan (IAP), wildlife protection measures, and other BMPs.

Use of Aircraft, Vessels, All-terrain Vehicles, or Heavy Machinery

Fixed and rotary wing (i.e., helicopters) aircraft, small craft, ships, all-terrain vehicles, and/or heavy machinery may be routinely employed during tracking and surveillance activities and do not require special approval by the ARRT for deployment. Based on capabilities (e.g., operating limits, range, onboard equipment, personnel), such purpose-built or general purpose assets may be staged in forward staging areas adjacent to but outside the operating area to minimize mobilization/demobilization intervals and maximize asset time available to perform response activities. Personnel using these assets may perform aerial, water surface, subsurface, ground, or subterranean reconnaissance visually or electronically, transport tracking and surveillance personnel to remote areas, move/deploy/recover equipment or supplies used in tracking and surveillance, sample collection, and/or communication. Most of these assets are pre-identified in industry or government response plans, and in most cases, are continuously maintained and ready for use.

Installation of Buoys

In certain cases, buoys may be deployed from aircraft, small craft, ships, or shore for tracking and surveillance of spilled product, or for marking the boundaries of environmentally sensitive areas or specially designated on-water zones potentially in the path of spilled product. The buoys used in these applications are of two main types: drift buoys and static buoys. Drift (i.e.,

unanchored) buoys may be deployed into spilled product or near the spill's leading edge. Drift buoys have highly visible colors to help track product movement in the water visually, and/or radar-reflective material/features for aerial/surface radar tracking, and/or more sophisticated technology for longer-range monitoring (e.g., radio telemetry) from satellite, aerial, surface, or shore-based tracking. Static (i.e., anchored) buoys of similar configuration may be set-up to mark outer boundaries of protected or environmentally sensitive areas (e.g., rookeries, hatcheries, haulouts) or specially designated on-water special use zones (e.g., safety/security zones, channels).

Sample Collection

Water, tissue, soil, and product samples are often collected as part of tracking and surveillance activities. Collection of water and soil samples, both from baseline (i.e., unaffected) and affected areas is vital to assess and document size, volume, toxicity, and other impacts on the environment before and during the event. Collection of product samples from spill sources and in the spill environment are essential for determining characteristics of the product and the nature and course of the interaction between the pollutant and the environment. This critical information informs response strategies developed and tactics used to combat the spill.

2.4 Waste Management

Waste handling and associated activities are common to all response actions apart from natural attenuation. Response actions produce large volumes of waste (e.g., contaminated soils, used sorbents, personal protection equipment) that must be handled, stored, decontaminated, transported, and/or disposed of properly. Protocols that comply with state and federal regulations are in place to minimize the reintroduction of wastes into the environment and protect habitats, endangered species, and response workers.

Waste Handling and Storage

Waste handling and storage are required throughout a spill response. Materials (e.g., soil, sediment, and snow) used to construct diversion and exclusion or containment structures may be contaminated by the spilled material due to leaching or other processes, generating additional wastes to be handled and disposed of properly. Some spilled materials may be pumped or suctioned directly into storage tanks or drums for the purpose of either recovery or treatment and disposal. Pumping and suctioning usually entrain large volumes of water that must also be stored and treated. In the case of viscous oils, reheating might be required prior to pumping.

Waste Transport

The handling, transport, and disposal of wastes require the use of heavy machinery and vessel or overland transport. It is possible that the volume of waste produced by the response operations will exceed the capacity of local waste receivers. In this event, disposal at multiple sites will be required. There are also some wastes (e.g., oil emulsions, oily water, and hazardous wastes) that cannot be treated in Alaska and must be transported to the contiguous U.S. In these cases, longer transport distances could increase the possibility of subsequent or secondary spills or accidents.

Waste Treatment and/or Disposal
Under ideal conditions, spilled products can be recovered and reused, reducing the wastes generated by a response action. For example, recovered oil can be refined into low-grade fuel or other petroleum products. Some chemical agents can separate oil from water or other materials, allowing the volume of wastewater that requires treatment or disposal to be reduced. Although no chemical agents are currently pre-approved for such use in Alaska, they may be proposed on a case-by-case basis. Oil collected from aquatic habitats will be mixed with water and require separation and decanting prior to disposal; such decanting may take place on board a work vessel or be conducted at an upland location or facility. Decanted water may contain small amounts of dissolved oil constituents or consist of an oil-water emulsion but must meet water quality standards prior to discharge. Waste disposal involves either direct disposal (i.e., without treatment) or treatment and then disposal. Wastes can be incinerated (onsite or offsite), but any incineration of waste in Alaska is subject to ADEC regulations.

Decontamination
During an oil spill response action, all personnel, hand tools, equipment, vehicles, and vessels must be decontaminated in a manner that does not reintroduce oily wastes into the natural environment. The decontamination process involves a multi-stage flushing procedure that removes and collects such wastes. The wastes are then stored and treated in accordance with state and federal regulations. Of primary concern is the reintroduction of oily waste and contaminated materials into the natural environment during the decontamination procedure. The use of engineered controls (e.g., berms, booms, plastic sheeting, and tarps) reduces the risk of the accidental release of contaminated materials.

2.5 Wildlife Protection/Mitigation Measures
Wildlife protection responses are actions that could be implemented should listed species be threatened by exposure to a spilled material. Wildlife protection for listed species is conducted by trained personnel under a USFWS permit.

The Unified Plan describes that wildlife might be deterred from entering an area impacted by a spill in order to prevent them from becoming contaminated, or captured and treated after they have been exposed or injured. Animals might also be captured and temporarily held or relocated (i.e., preemptively captured) to prevent them from being exposed to spilled material. Although returning captured animals to the wild is the ultimate goal, not all captured animals may be able to be released following holding or treatment due to injuries received from exposure to spilled products. Guidelines that address procedures and decision criteria have been developed by the ARRT Wildlife Protection Working Group in accordance with the NCP and approved by the ARRT (see Annex G of the Unified Plan).

Recovery of Contaminated Carcasses to Prevent Contamination of Other Wildlife
Recovery of contaminated carcasses from affected areas is an important primary response strategy to prevent further contamination of other wildlife in water and on land. Contaminated carcasses can cause further direct or indirect environmental harm through mechanisms such as secondary pollution (i.e., pollution reentering the environment from a contaminated source) or by ingestion by other creatures using the carcass as a food source. The Unified Plan contains

detailed guidelines (Appendix 11 of Annex G) on carcass collection including procedures for searching, documentation of collection *in situ*, chain of custody, inventory, storage, use as evidence, and disposal. Natural resource trustees, including Service personnel, use these basic guidelines to develop incident-specific guidelines tailored to each event. Oil spills are assigned a Responsible Party (RP) through the Natural Resource Damage Assessment (NRDA) process. Carcass recovery is a useful tool for assessing the amount of lethal take during NRDA.

Deterrence

Deterrence (i.e., hazing) of wildlife is the act of causing animals to move away from the spill area to prevent them from being exposed to the spilled material. However, deterrence of wildlife under the Service's authority requires prior approval in order to be conducted lawfully. Take may occur during hazing of wildlife for the protection of the species, but the amount or degree of take may increase due to spill exposure if hazing is not conducted. The decision whether to haze animals away from a spill will be evaluated on case-by case basis during incident-specific consultation. Spill responders are required to monitor, tabulate, and report take (including disturbance) of any listed species encountered during response activities to ensure that this information is available for NRDA and law enforcement actions.

Pre-emptive Capture and Relocation of Uncontaminated Wildlife & Capture, Treatment, and Release of Contaminated Wildlife

Similar to deterrence (above), this activity requires prior authorization to be conducted legally. Capture and handling of wildlife under the Service's authority requires training and incident-specific approval and coordination. As with deterrence, if these actions are conducted for the protection of the species, take may occur, but level of take may be lower than if no pre-emptive capture or treatment efforts are conducted. The decision to capture animals will be made on a case-by-case basis.

Strategic Avoidance

Strategic avoidance as a means of wildlife protection occurs during response strategy formulation and as part of tactical practice in the field. At the strategic level, environmentally sensitive areas are identified within the EU of the Incident Command System (ICS). Areas threatened by the spill are prioritized for protection as a primary response strategy. Such areas are also disqualified for use as forward operating locations (e.g., bases, heliports, staging areas, decontamination sites) in the response. At the field tactical level, environmentally sensitive areas are avoided in the development of plans and procedures (e.g., shoreline cleaning, berming) which may result in wildlife exposures to cleaning agents and mechanisms. Methods which may cause irritation, injury, or death receive consultation with natural resource trustees, including the Service, during deployment planning.

2.6 Decision-Making Processes

As described in the Effects of the Action section below, oil spill response activities have the potential to negatively impact listed species under the Service's authority if not properly managed and mitigated. Therefore, it is important to understand when and how various response activities are taken during an incident. Although it is not possible to predict where, when, and how big a spill may occur, it is possible to understand the direction the response would take

based on the existing planning documents, the revision process for those planning documents, and the decision-making process that occurs during each incident.

Response Planning

Spill response planning in Alaska is accomplished through the development of a series of inter-related plans, for which the NCP provides the overarching framework and establishes procedures designed to minimize the imminent threat to human health or the environment from an uncontrolled release of oil or other hazardous substances. The Unified Plan applies the NCP framework in a regional context containing both administrative and technical statewide guidance for all members of the response community to follow during emergency response to a spill in Alaska. This guidance is organized as a series of annexes (A through Z), each with supporting appendices. Administrative guidance in the Unified Plan establishes how the spill response will be organized, managed, and funded; technical guidance addresses countermeasures that have been approved for use as part of the response.

Mechanical countermeasures are the main focus of emergency spill response under the Unified Plan; however, most of the details regarding the selection and implementation of a response are provided in supplemental documents (e.g., Nuka Research 2006; NOAA 2010) prepared in response to or in support of the Unified Plan[3]. Because of their greater potential for adverse effects, the Unified Plan incorporates guidance on the use of non-mechanical countermeasures (i.e., the application of dispersants or other chemical agents and *in situ* burning) and other response measures (i.e., wildlife protection). The Unified Plan further describes the decision process leading to the selection of a non-mechanical countermeasure in order to support the evaluation of tradeoffs associated with implementation (i.e., magnitude of environmental harm versus benefit). No other non-mechanical countermeasures have been approved for use in Alaska; any proposal would require approval by ARRT, of which DOI is a member.

The Unified Plan is supplemented by ten SCPs, which provide greater detail for local response planning in large inland and coastal areas of Alaska (Figure 1, Figure 2). The SCPs set resource protection priorities and incorporate key provisions of local government emergency response plans and applicable information from RP spill response plans. These SCPs are updated regularly, and the updates are reviewed and approved by ARRT to maintain consistency with the Unified Plan.

In 2001, the USCG, EPA, DOI Office of Environmental Policy and Compliance, the Service, NMFS, and National Ocean Service signed *Inter-agency Memorandum of Agreement (MOA) Regarding Oil Spill Planning and Response Activities Under the Federal Water Pollution Control Act's National Oil and Hazardous Substances Contingency Plan and the Endangered Species Act* , an agreement which provides a general framework for cooperation and participation in the exercise of their oil spill planning and response responsibilities. The MOA outlines procedures to streamline ESA compliance before, after, and during an incident (USCG et al. 2001).

[3] A more complete list of documents describing mechanical countermeasures and their uses can be found in Annex N of the Unified Plan

Pre-spill Activities

Spill drills, exercises, training events, equipment and facility testing, and field deployments may affect listed species. These activities do not constitute emergencies, and are not eligible for emergency consultation. Separate consultation is required for pre-spill activities that may affect listed species or critical habitat. This may include approval of GRSs by the EPA or USCG.

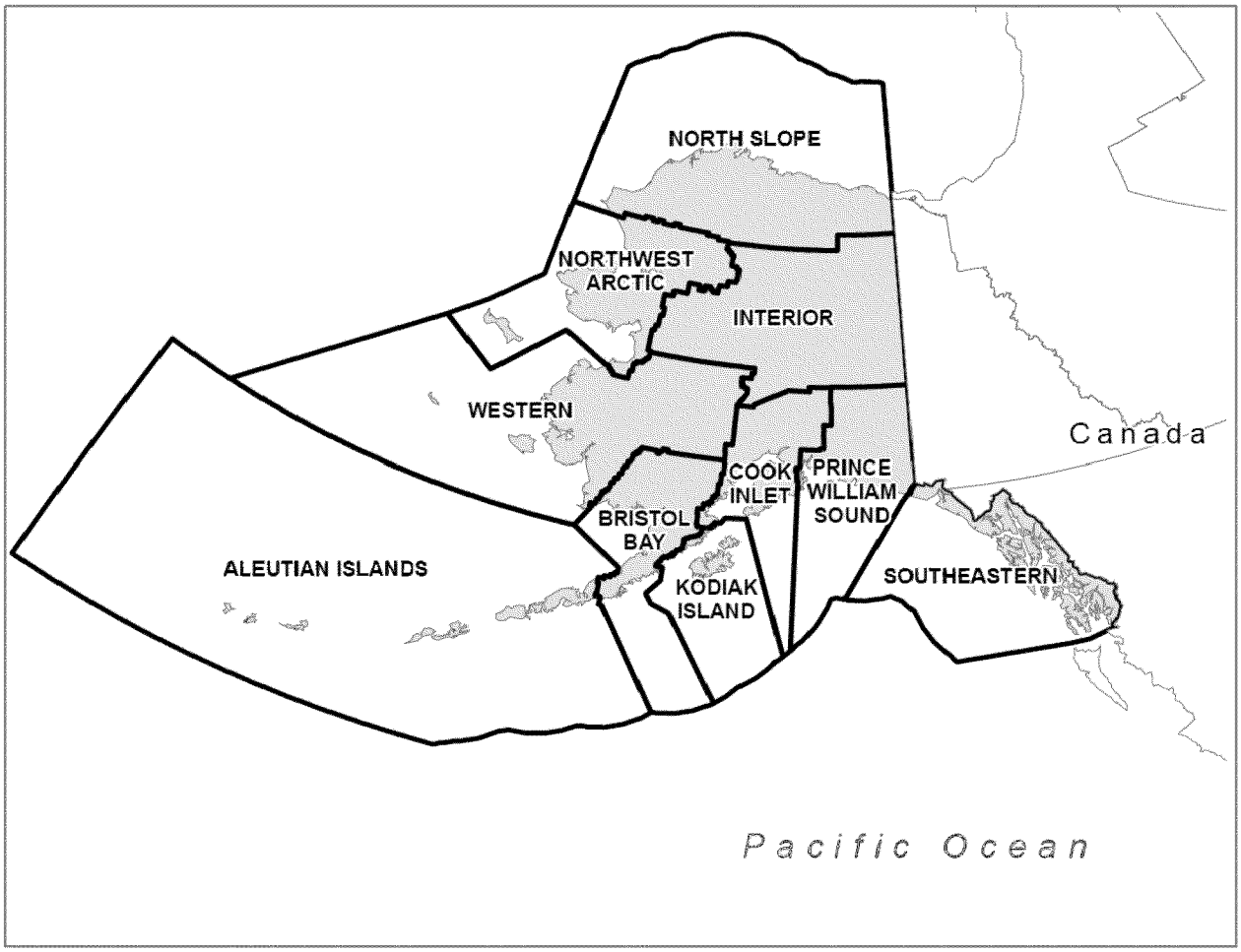


Figure 2. Map of Alaska showing the delineations for the 10 subareas designated under the Unified Plan. Each subarea has a separate Subarea Contingency Plan for oil spill response (from Windward 2014). [Top]

During an Incident

The selection and implementation of incident-specific response strategies are ultimately at the discretion of the Unified Command (i.e., the team of on-scene coordinators representing the RP and federal, state, and local agencies), following the guidance in the Unified Plan and in consultation with other members of the response community. The Service's section 7 biologists are involved in selection of site-specific strategies either through involvement in the EU or through coordination with the Service's SRC and the DOI representatives on the ARRT.

The Unified Command is responsible for selecting, prioritizing, and implementing the actions meeting these goals. The selection of the response action (or actions) for a given spill is dependent on a number of factors, including the nature and magnitude of the spill, weather, timing, location, accessibility, resources at risk, and likely fate and effects of the material released. Every response strategy has uncertainties, along with potential environmental tradeoffs that are evaluated as part of the action selection process. Response decisions are made using the best information available, with the knowledge that the initial understanding of the event may be incomplete. During a spill, responses are modified as environmental conditions change or additional information becomes available. The spill response community relies on training and exercises to make the uncertainties manageable. This emergency spill response training, a requirement of the Unified Plan, is expected to assist decision-making in the face of uncertainty and to ensure that at-risk environmental resources, such as listed species and their habitats are properly protected.

During each incident, the FOSC (USCG or EPA) will determine if the response may affect listed species. If the response overlaps in time and space with listed species under the Service's authority, the FOSC will initiate emergency consultation pursuant to section 7 of the ESA (Figure 3). The Service provides recommendations to the FOSC to minimize impacts on listed species and documents any incidental take resulting from spill response actions.

The use of dispersants and *in situ* burning as countermeasures for oil spills requires an additional decision-making process under the Unified Plan (Annex F). Decisions regarding the use of dispersants must take into account the resources at risk, the size of the spill, the physico-chemical properties of the type of oil spilled, the feasibility of the response actions, and site-specific conditions (e.g., weather, sea state, the presence of ice). The overarching criterion for decision-making is that dispersed oil will be less harmful to listed species and critical habitat than non-dispersed oil.

In marine waters outside of the pre-authorization zone, the USCG FOSC must formally request the use of dispersants anywhere in Alaska's waters (Figure 4). The FOSC works with the RP, the Service's SRC, the EU of the ICS, and other resource agencies to complete a comprehensive, detailed checklist and application, and submit them to the incident-specific ARRT for expedited approval. This request documents the conditions under which the dispersant would be applied and the environmental tradeoffs associated with the decision. The ARRT considers each request on a case-by-case basis. The EPA representative to the ARRT must concur, modify, or reject the request. If Alaskan waters or interests are involved or threatened by the spill, the state's representative to the ARRT must also concur, modify, or reject the request. EPA and State of Alaska representatives must be in agreement as to the disposition of the FOSC's dispersant use request.

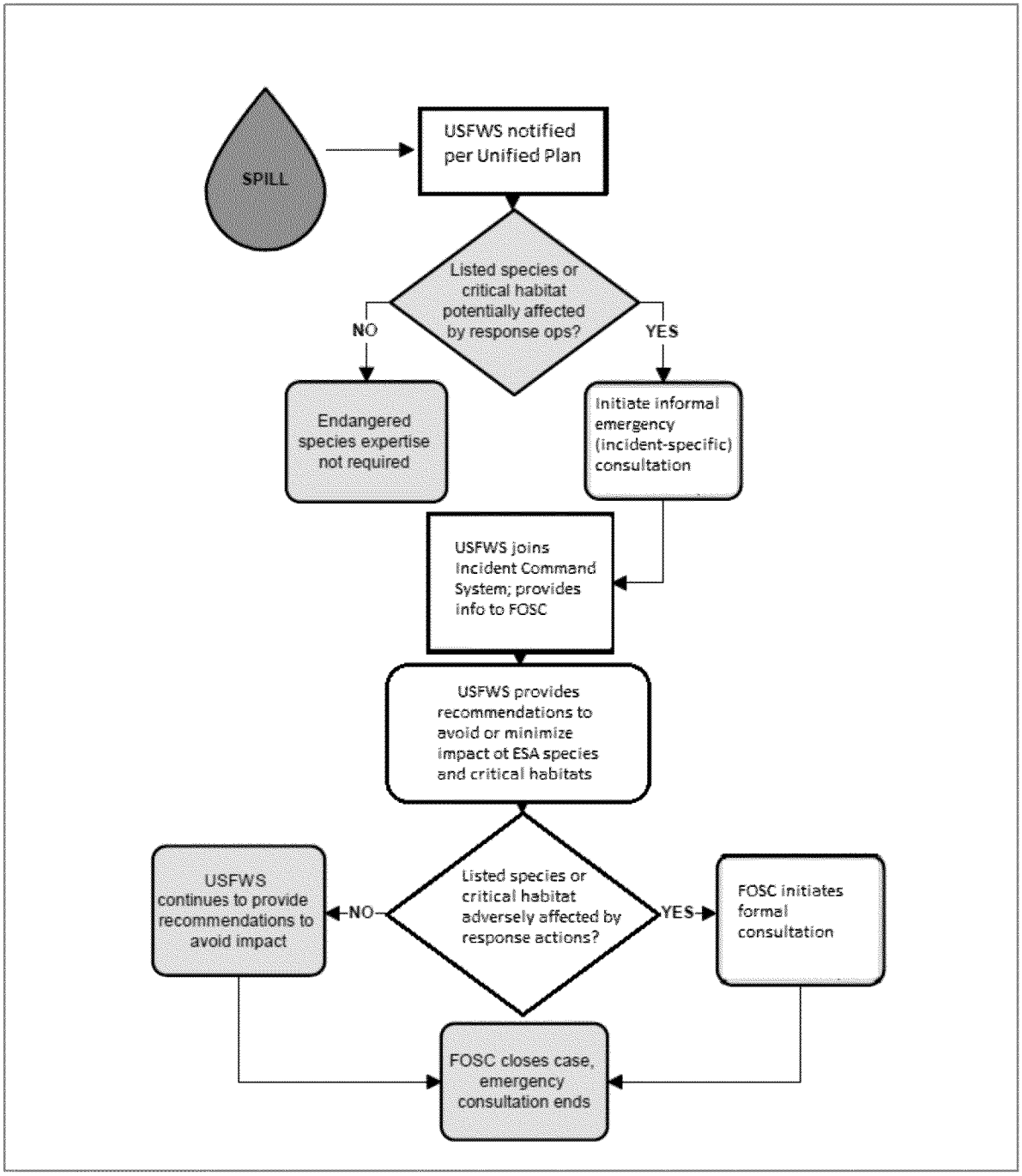


Figure 3. Diagram showing the notification of the Service and initiation of an emergency consultation pursuant to section 7 of the ESA as per the 2001 MOA. [Top]

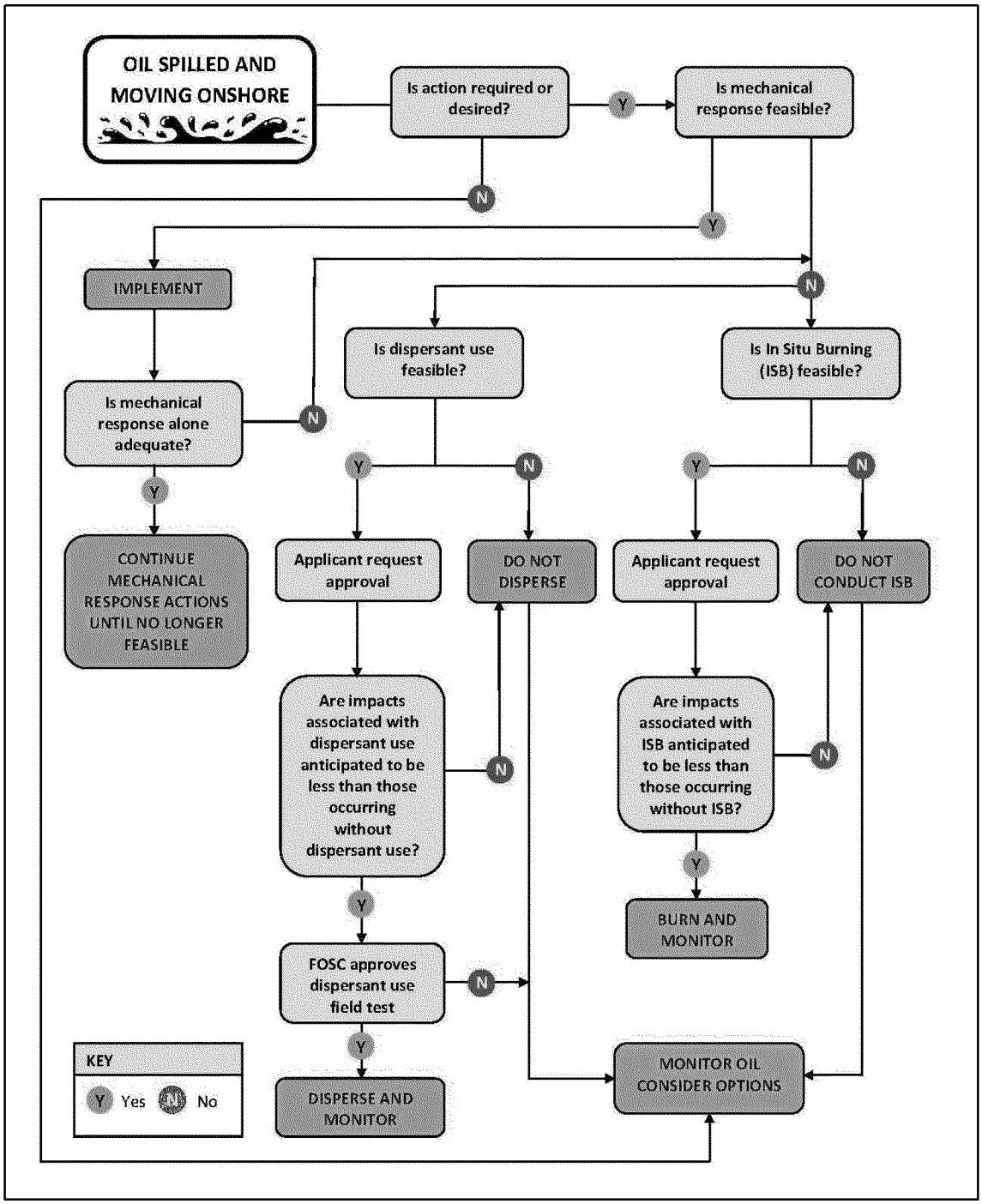


Figure 4. Diagram showing the incident-specific decision-making process for the use of dispersants and in situ burning as oil spill response tools. [Top]

Decision-making regarding *in situ* burning should take into account the same information as considered for dispersant use (described above and also described in Revision 1 to the *In Situ* Burning Guidelines for Alaska, included in Annex F to the Unified Plan; ADEC et al. 2008).

Burning may be considered if mechanical countermeasures are ineffective, burning is feasible, and can be conducted at a safe distance from populated areas or sensitive resources. *In situ* burning is included as part of the emergency consultation process with the Service, who provides recommendations regarding how to avoid or minimize impacts to listed species or critical habitats from burning oil or burning activities.

2.7 Interrelated and Interdependent Actions

For purposes of the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). To concur that an action may affect, but is not likely to adversely affect, listed species, the Service must find that all of the effects of the proposed action or interrelated or interdependent actions are expected to be insignificant, discountable, or entirely beneficial. Insignificant effects relate to the size of the impact and should never reach the scale where a take will occur. Discountable effects are those that are extremely unlikely to occur. Based on best judgment, one would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur. Wholly beneficial effects are contemporaneous positive effects with no adverse effects to listed species.

Interrelated and interdependent actions are those which have no independent utility apart from the proposed action. They depend on the larger action for their justification (50 CFR §402.02). Interrelated and interdependent actions related to oil spill response activities include actions not directed by the Unified Plan, but resulting from decisions made under the Unified Plan. This includes the influx of people and supplies into the response area during an event. Depending on the size of a spill, this associated movement of people and supplies can be the equivalent of a small community. The establishment of a small community for the purposes of spill response would include increased flights or marine vessel traffic to the area to transport people and supplies, increased water and energy consumption, increased waste management, and increased human activity in the vicinity of the community (which could have a marine coastal component). Increased recreational human activity from oil spill responders during their time off may increase baseline stressors on the environment (e.g., potentially increased coastal disturbance, noise, additional oil spills) in marine or coastal areas.

2.8 Assumptions

We conducted this consultation using a number of assumptions:

1. We assumed that the Unified Plan will be followed during a response as it is written (including its associated documents described above), and that the recommendations provided by the Service during an incident in order to minimize effects to ESA-listed species will be followed.
2. We also assumed that per the *2001 Inter-agency MOA (USCG 2001)* the FOSC and Area Committees will solicit and involve the Service's SRC and section 7 personnel as described here and in the Unified Plan.
3. When a response planning document (supplemental to the Unified Plan) provides contradictory information (e.g., related to a decision-making process or action

description) to the Unified Plan, we assumed responders will defer to and operate under the Unified Plan, except regarding the use of dispersants.

4. We assumed responders would operate under the most recent draft of the Dispersant Use Plan (ARRT 2014). Regarding subsea (i.e., below the water surface) use of dispersants, we assumed responders would follow guidance provided by the USEPA and USCG documented in *Discussion Paper Clarifying Inclusion Of Atypical Dispersant Use In Formal Consultation On The Alaska Unified Plan* (EPA and USCG 2015). This document specifies that subsea dispersant uses are not part of this consultation and are therefore not considered in this BO (See EPA and USCG 2015; Appendix E).
5. In areas identified as avoidance areas for the short-tailed albatross, we assumed that dispersant use would be considered in the same manner as for areas not within an approved Preauthorization Area. See Appendix D for correspondence regarding avoidance areas.
6. For the purpose of assessing potential exposure risk in our effects analyses, we assumed that an incident has occurred to trigger the use of the Unified Plan. The Unified Plan is designed for use during a spill, or potential spill, therefore we assumed that the actions under consideration may occur during future spill events.
7. The conclusions regarding the maximum possible exposure of listed species to spill response assume the hypothetical worst-case scenarios developed for analysis do not underestimate the level of take that could actually occur.
8. We assume Best Management Practices (BMPs) and impact avoidance and minimization measures specified within the Unified Plan will be fully implemented

2.9 Action Area and Life of the Project

The "Action Area" is defined in the implementing regulations for section 7 at 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action". It includes the spatial distribution of all negative stressors and positive subsidies on the environment likely to be directly or indirectly caused by an action. Under this approach, those stressors and subsidies on the environment are analyzed outward from their source until they can no longer be meaningfully detected. Individuals of a listed species affected by a proposed action might leave an action area after being exposed and their responses might occur outside of an action area. In these instances, the action area does not expand to include the area where the responses occur.

For this BO, the action area includes the State of Alaska and its coasts and its contiguous waters bounded by the U.S. exclusive economic zone (EEZ). Generally, the USCG has jurisdiction over the "coastal zone" and the EPA has jurisdiction inland of the coastal zone, as defined in the NCP (40 CFR 300.5). Our assessment of baseline conditions in the Action Area focuses on those areas occupied by species designated as threatened or endangered under the ESA or designated as a candidate for listing that are under the jurisdiction of the Service.

The Unified Plan is intended to be reviewed and revised by the ARRT every five years. Updates to the Unified Plan are provided to the Service for review per the 2001 Inter-agency MOA. The Service evaluates the changes to determine if additional consultation under ESA section 7 is necessary. Consultation is considered to be necessary if the addition of new (i.e., technologies or species) have the potential to affect listed species. The most recent comprehensive update,

"Change 3" of the Unified Plan was finalized in 2010; this review incorporates all changes to date, as described under Section 2.8 Assumptions. Therefore, the anticipated life of the Unified Plan is from 2015 - 2020. Because the end of the five-year update schedule does not invalidate the Unified Plan, we did not limit our evaluation of effect to listed species to this time period.

[Top]

3.0 STATUS OF THE SPECIES

See APPENDIX A.

4.0 ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for the Unified Plan provides information specific to the status of listed species within the U.S. EEZ.

4.1 Sea otter

Status in the Action Area

The range of the listed population of sea otters is entirely within the action area; see the Status of the Species Section for the current condition of and factors affecting this species. Our most recent estimate of the size of the southwest Alaska DPS of the northern sea otter, based on surveys in 2000 - 2011, is 54,771 animals (USFWS 2014c; Table 4). Populations are stable or increasing in the Kodiak, Katmai, Kamishak and Cook Inlet Areas and stable or decreasing in the Aleutians and the Alaska Peninsula. The population size in southwest Alaska has declined by more than 50% since the mid-1980s. While the overall population trend for the Southwest Alaska stock is believed to have stabilized, current numbers are well below historical levels, and there is no evidence of recovery.

Sea otters are carnivores that forage in nearshore marine and intertidal habitat. They eat a wide variety of benthic (living in or on the sea floor) invertebrates, including sea urchins, clams, mussels, crabs, and octopus. Clams were the most frequently identified sea otter prey item (57 - 67% of the diet) in the northern Kodiak Archipelago. Mussels, crabs, and green sea urchins contributed ≤25% to the total prey (Doroff and DeGange 1994). Sea otters mainly forage in depths less than 20 m (Bodkin et al. 2004). In some parts of Alaska, sea otters also eat epibenthic (living upon the sea floor) fishes (Estes et al. 1982; Estes 1990). They have a high metabolic rate compared to land mammals of similar size (Costa 1978; Costa and Kooyman 1984). To maintain the level of heat production required to sustain them, sea otters eat large amounts of food; estimated at 23– 33% of their body weight per day (Riedman and Estes 1990).

The sea otter is considered a keystone species that strongly influences the species composition and diversity of the nearshore marine environment it inhabits (Estes et al. 1978). For example, studies of subtidal communities in Alaska have demonstrated that when sea otters are abundant, epibenthic herbivores such as sea urchins will be present at low densities whereas kelp, which is consumed by sea urchins, will flourish. Conversely, when sea otters are absent, grazing by abundant sea urchin populations creates areas of low kelp abundance, known as urchin barrens (Estes and Harrold 1988).

Table 4. Population estimates for the Southwest Alaska stock of northern sea otters (USFWS 2014).

Survey Area	Year	Unadjusted Estimate	Adjusted Estimate	CV	N_{min}	Reference
Aleutian Islands	2000	2,442	8,742	0.22	7,309	Doroff *et al.* (2003)
North Alaska Peninsula	2000	4,728	11,253	0.34	8,535	Burn and Doroff (2005)
South Alaska Peninsula - Offshore	2001	1,005	2,392	0.82	1,311	Burn and Doroff (2005)
South Alaska Peninsula - Shoreline	2001	2,651	6,309	0.09	5,865	Burn and Doroff (2005)
South Alaska Peninsula - Islands	2001	402	957	0.09	889	Burn and Doroff (2005)
Unimak Island	2001	42	100	0.09	93	USFWS unpublished data
Kodiak Archipelago	2004		11,005	0.19	9,361	USFWS unpublished data
Katmai	2008		7,095	0.13	6,362	Coletti *et al.* (2009)
Kamishak Bay	2002		6,918	0.32	5,340	Bodkin *et al.* (2003)
Current Total			**54,771**		**45,064**	
Previous SAR Total			47,676		38,703	

[Top]

Critical Habitat Designation and Use

On October 8, 2009, the Service finalized designation of 15,164 km^2 (5,855 mi^2) of critical habitat for the threatened northern sea otter in southwest Alaska. The Primary Constituent Elements (PCEs) are the physical and biological features essential to conservation of the species and may require special management considerations. The PCEs for the designated critical habitat of the sea otter are: 1) shallow, rocky areas less than two m (6.6 ft) in depth where marine predators are less likely to forage or 2) nearshore waters within 100 m (328.1 ft) from the mean

high tide line that may provide protection or escape from marine predators; and 3) kelp forests, which occur in waters less than 20 m (65.6 ft) in depth, that provide protection from marine predators or 4) prey resources within the areas identified by PCEs 1, 2, and 3 that are present in sufficient quantity and quality to support the energetic requirements of the species.

Threats and Possible Stressors in the Action Area

Sea otters are susceptible to the acute and chronic effects of spills in the marine environment, as was demonstrated by the effects of the 1989 Exxon Valdez Oil Spill (EVOS) in Prince William Sound (PWS). An estimated 3,905 (1,904 - 11,257) sea otters died during EVOS (Degange et al. 1994), and the PWS population has only recently shown signs of full recovery (Harwell and Gentile 2014). Risk of spills in the Aleutians is considered relatively high compared to other places in Alaska. This risk was realized in 2004 with the wreck of the M/V *Selendang Ayu* (Unalaska Island, 2004) when >300,000 gal of heavy bulk fuel oil spilled into the sea (ADEC 2014). The acute impacts to sea otters from this spill were minimal, but this spill was considered by many to be a "shot across the bow" warning of the existing risks in the region (Ritchie and Gill 2008).

Spills generally involve waste products, hazardous materials, or petroleum products. Waste products are substances that can be accidently introduced into the environment by industry activities. Examples include ethyl glycol, drilling muds, or treated water. Hazardous materials include any substance that can pose a health or environmental risk, including products such as ammonia and urea. Releases of oil or other petroleum products are generally referred to here as oil spills. Examples include oil, gas, or hydraulic fluid spills from mechanized equipment or spills from pipelines or facilities. Oil spills as considered either small (< 1,000 bbls) or large (≥ 1,000 bbls). A volume of oil of 1,000 bbls equals 42,000 U.S. gallons (gal), or 158,987 liters. Large spills are associated with oil platforms, such as drill rigs or pads and pipelines.

Spill data for events occurring both in marine waters and on land was compiled from 1995 - 2005 (ADEC 2007). These data show that most spills were caused by structural or mechanical failures or inadequacies or human factors. Accidents caused 3% of spills, but resulted in 13% of total volume spilled. Major sources of spills from regulated industries included oil exploration and production (60% of spills and 38% of total volume), non-crude terminals (11% of spills), pipelines (9% of spills and 32% of volume), and rail transport (3% of spills, but 15% of volume). Lesser sources within regulated industry included crude terminals and refineries. Major sources in unregulated industries included mining, vessel transport, and storage.

Spill risks in the range of the listed sea otter are primarily associated with shipping and local industry. The shipping industry transports various types of petroleum products both as fuel and cargo within southwest Alaska. Shipping routes in the area include the North Pacific Great Circle Route, which is the shortest transportation distance for vessels travelling between Northwest North America and East Asia. From August 1, 2008 - July 31, 2009, nearly 16,000 vessel tracks were recorded from over 2,200 vessels in the Aleutians (DNV and ERM 2010a). Nearly 75% of vessels were deep draft vessels transiting the North Pacific Great Circle Route; most of the ships were bulk carriers and container ships (DNV and ERM 2010a). Important shipping passes through the Aleutian Islands, especially Unimak Pass, Akutan Pass, and the

approach to Dutch Harbor, coincide with habitats used by sea otters, short-tailed albatross, and wintering Steller's eiders. In 2012, 1,961 ships made 4,615 transits through Unimak Pass, 3% of which were tankers (Nuka 2014). (Nuka 2014).

Information on oil spills throughout the range of the listed sea otter from 2006 - 2010 indicates that an average of four spills of crude oil occurred each year in the marine environment (ADEC 2014). Crude oil spills ranged in size from less than four to 760 liters (1 - 200 gal), with a mean size of about 41.8 liters (11 gal). Spills of non-crude oil averaged 62 per year, ranging in size from less than four to 24,320 liters (1 - 6,400 gal). The majority of the non-crude oil spills were small, with a mean size of about 380 liters (100 gallons) and a median size of four liters (1 gal). Dispersants have been used in an extremely limited capacity in Alaska to date, primarily during field trials during EVOS.

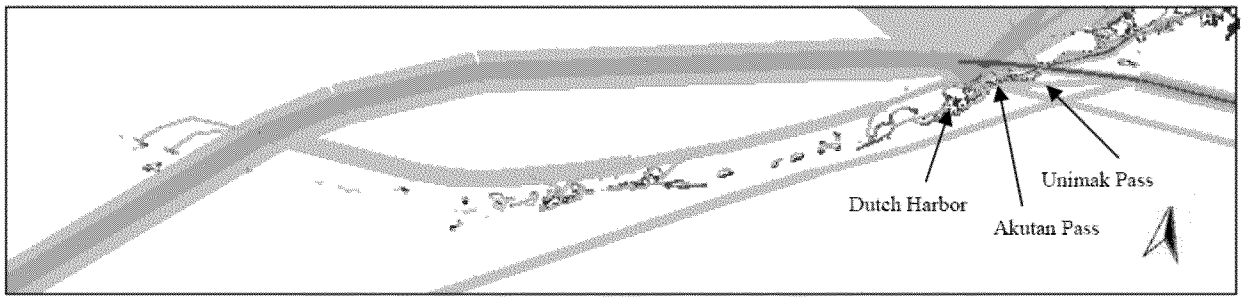
Spills occurring near shore in southwest Alaska would generally spread toward the southwest with the Alaska Coastal Currents or through the Aleutian Passes into eddies in the Bering Sea. Spread of spills would depend on location, surface wind, tides, and freshwater discharges (Figure 9; Chen and Firing 2006).

DNV and ERM (2010b) modeled existing accident frequency in the Aleutians for 2008 - 2009. Model parameters included shipping lane data (i.e., hazards), environmental data (wind, currents, etc.), internal operation data (normal vessel speed, onboard equipment that minimizes accident frequency and consequences), and external operations data (presence of vessel traffic managements systems, emergency tugs, etc.). The total predicted frequency of accidents was 8.67 per year, but the authors note that this is likely to be too high due to model sensitivity to environmental data. They found that the greatest accident frequencies are associated with fishing vessels (72%), tugs (10%), and tank barges (4%). The accident rate was very low in terms of vessel miles (8.67/5.36E+06 = 1.62 accidents per million vessel miles; Figure 5). The vast majority of accidents do not result in spills (DNV and ERM 2010b). DNV and ERM also evaluated the potential consequences of spills and found that scenarios associated with large spills (≥400,000 bbl) of persistent oil at high-release rates have significant potential for ecological impacts (DNV and ERM 2011).

There is no oil or gas production within the range of the listed otter, but exploration efforts are planned for lower Cook Inlet. Potential impacts of oil spills on sea otters could range from negligible to high, depending on the location, extent, and type of material spilled. If areas within the range of the listed otter were to be opened for oil and gas exploration and development in the future, potential impacts to sea otters should be given thorough consideration.

Threats and impacts of past and present impacts of Federal, State, or private actions and activities are described in the Status of the Species section. A review of the threats to sea otter recovery was completed in 2013(USFWS 2013). Most threats were assessed to be of low importance to recovery of the sea otter; threats judged to be most important are predation (moderate to high importance) and oil spills (low to moderate importance). The Recovery Plan concludes that due to the large spatial extent of the DPS, even a large spill from a crude oil

tanker would be unlikely to affect a substantial proportion of the overall sea otter population (USFWS 2013). Table 5 summarizes that analysis.



Color	Accident Frequency (accidents per year within each calculation location)
	1.0 E-08 - 1.0 E-06
	1.0 E-06 - 1.0 E-05
	1.0 E-05 - 1.0 E-04
	1.0 E-04 - 1.0 E-03
	1.0 E-03 - 1.0 E-02
	> 1.0 E-02

*e.g. 1.0E-08 = 0.00000001 accident per year or once in a hundred million years; 1.0 E-02 = 0.01 accidents per year or once in a hundred years

Figure 5. Geographic distribution of accident frequency in the Aleutian Islands. Increased risk along the Great circle route is shown in blue (from DNV and ERM 2010b). [Top]

Table 5. Summary of importance of threats to recovery of the southwest Alaska DPS of the northern sea otter by management unit (from USFWS 2010).

Management Unit		Western Aleutians	Eastern Aleutian	Bristol Bay	South Alaska Peninsula	Kodiak, Kamishak, Alaska Peninsula
Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range from Oil spills	Potential Impact	High	High	High	High	High
	Geographic Scope	Local to Widespread	Local to Widespread	Local to Widespread	Local to Widespread	Local to Widespread
	Likelihood	Very to Not Likely	Very to Somewhat Likely	Very to Not Likely	Very to Not Likely	Very to Somewhat Likely
	Level of Confidence	High	High	High	High	High
	Importance to Recovery	Low	Moderate	Low	Low	Moderate
	Management potential	High	Moderate	Moderate	Moderate	Moderate

[Top]

Recovery

The sea otter recovery plan (USFWS 2013), establishes the goals of the recovery program: establish a framework within which recovery actions are undertaken to ensure the long-term survival of the southwest Alaska DPS of the northern sea otter and to control or reduce threats to the species to the extent that it no longer requires the protections afforded by the ESA, and therefore warrants delisting. Although subject to change, full recovery of the southwest Alaska DPS is currently envisioned as a cessation of further population declines with viable numbers of

sea otters present throughout the current range of the DPS. Threats to the species will be adequately identified, and will have sufficiently abated to ensure the high probability of the survival of the southwest Alaska DPS for at least 100 years. The current status of the population does not meet these criteria.

4.2 Short-Tailed Albatross

Status in the Action Area

These wide-ranging seabirds are found throughout the North Pacific and Bering Sea within the Action Area. The current population estimate is 4,354 individuals. The population growth rate is approximately 7.5% per year (range from 5.2 - 9.4%; USFWS 2014a). A small number of recent sightings have occurred in the Chukchi Sea as well, suggesting that they may be increasing their range into Arctic waters. Waters around the Aleutian Islands are important for feeding, particularly during the summer non-breeding season. The diet of short-tailed albatross includes squid, shrimp, fish, flying fish eggs, and other crustaceans obtained from at or near the sea surface (Hasegawa and DeGange 1982, Tickell 1975, Tickell 2000). Albatross may be found in the Action Area during all times of year because juveniles and up to 25% of adults each year will forego returning to the North Pacific and Japanese nesting habitat.

The Aleutians and Bering Sea may be especially important during molting. Data from albatrosses captured at sea in the Aleutian Islands showed that most birds were undergoing extensive flight feather molt (R. Suryan and K. Courtot, unpublished data). Satellite tracking data indicated individuals were spending an average of 19 consecutive days (maximum of 53 days) within a 62-mile (mi) (100 km) radius of some Aleutian passes (R. Suryan and K. Courtot, unpublishe data). O'Connor (2013) examined locations of sub-adult short-tailed albatross and fishing locations of vessels in 2008 - 2011 and found albatross-vessel association hotspots at several canyons along the Bering Sea shelf.

Threats and Possible Stressors in the Action Area

Commercial Fishing in the U.S

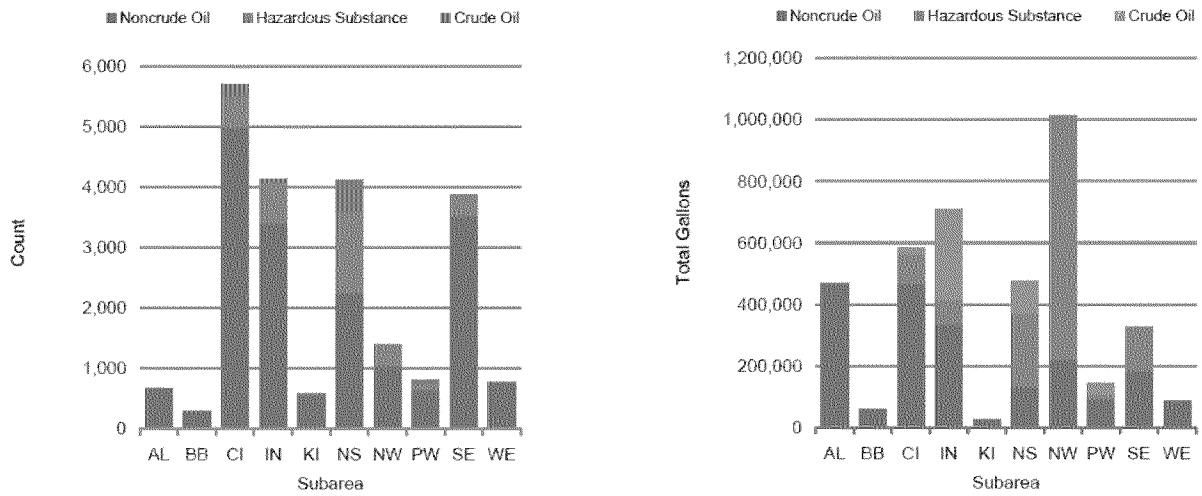
Short-tailed albatross are periodically captured in commercial longline, groundfish, and trawl fisheries. Birds dive after baited hooks as they are being set, get hooked, and drown while being dragged below the water's surface with the sinking line. The Service, NMFS, and the fishing industry have recognized this and enacted various means of reducing mortality. These measures have included: implementing an observer program to ensure accurate reporting of bycatch; requiring use of avoidance and minimization measures such as bird deterrence streamers (tori lines); supplying free streamer line kits to commercial longline vessel owners; and conducting a 50% cost-share program to reimburse owners of certain longline vessels for half of the costs of purchasing tori line-deployment booms. In addition, NMFS has conducted public awareness and education campaigns to improve use of streamers on smaller vessels.

Controlled and large scale field studies have demonstrated that properly deployed paired streamer lines are effective at reducing seabird attacks on the gear by 85 - 100% (Melvin et al. 2001). The effectiveness of streamer lines is borne out by bycatch data, which shows continued

reduction in bycatch rate since fishermen began using the lines in 1999 (NOAA 2007). Single streamer lines are slightly less effective than paired lines, reducing seabird bycatch by 96% and 71% for the sablefish and Pacific cod fisheries respectively (Melvin *et al.* 2001). Tools and techniques continue to improve; Melvin et al. (2011) compared a third wire snatch block, warp boom, and paired streamer lines on two trawlers in the eastern Bering Sea. They determined that bird strikes could be diminished by deploying streamer lines at least a meter above the third-wire block and by minimizing the aerial extent of the third wire.

Oil Spills

The number and volume of oil and other hazardous materials spills in the marine waters of the State of Alaska is highly variable. Between 1995 and 2012 the number of marine spills reported annually ranged from 11 - 37, and total annual spill volume ranged from 5,017 - 352,602 gal. Most spills in Alaska marine waters from 1995 - 2012 were non-crude oil spills (primarily diesel and other lighter fuels). Crude oil spills were much less frequent ranging from zero to two per year, with total volumes ranging from 0 - 924 gal. The Aleutian Islands region had the greatest volume of spills in marine waters from 1995 – 2012 (Figure 6; ADEC 2007).



AL-Aleutians, BB-Bristol Bay, CI-Cook Inlet, KI-Kodiak Island, NS-North Slope, NW-Northwestern AK, PW-Prince William Sound, SE-Southeastern AK, WE-Western AK

Figure 6. Number of spills by subarea and product (left) and gallons spilled by subarea and product (right) from ADEC (2007). [Top]

Shipping is a major source of spills in the Aleutian Islands and Bering Sea. Shipping between North America and East Asian countries is increasing, especially among deep draft shipping vessels travelling along the Great Circle Route (DNV and ERM 2010a, 2010b, 2014, Nuka 2014). Geographically, the greatest spill risk from vessels is predicted along the Aleutian Island chain, particularly at Unimak Pass and Akutan Pass (DNV and ERM 2010b) where short-tailed albatross concentrations may be high. Albatrosses that are molting in these areas may be less mobile and more sensitive to threats that occur in the vicinity, including oil spills. Due to the high overlap with important foraging areas for short-tailed albatross and high risk of spills in these areas, substantial impacts to adult and juvenile birds could occur. Shipping increases are

also likely along the west coast of Canada and the contiguous U.S. Spills in these areas could affect locations where a high proportion of immature short-tailed albatrosses have been tracked (Guy et al. 2013).

The risk of oil spills in the Bering and Chukchi seas is also increasing. As sea-ice recedes due to climate change, the potential for increases in Arctic shipping continues to grow. Although short-tailed albatross have only rarely been observed in the Chukchi Sea, the reduction in sea-ice and the increasing numbers of widely-ranging subadult short-tailed albatrosses may result in a greater number of albatrosses in Arctic waters (Day et al. 2013; Gall et al. 2013) where they could be exposed to petroleum products spilled in Arctic shipping accidents.

Another major source of spills is from oil and gas industries. At the present time, the Aleutians have limited potential for oil and gas development. Approximately 1.75 million offshore acres along the Alaska Peninsula are available for development, but current restrictions require development to be conducted from onshore facilities. Potential in the area is considered low to moderate and no large scale oil exploration or development is being conducted.

Although the risk of spills and potential for impacts to short-tailed albatrosses exists in many places throughout their range, most spills occurring in the Action Area would not affect enough albatross to raise concerns for the well-being of the population. This is because short-tailed albatross have a very broad range, spills generally have localized effects, and large spills with wide-spread impacts are highly unlikely to occur.

Recovery

A final recovery plan was completed in 2008 (USFWS 2008). The short-tailed albatross may be delisted under the following conditions: the total breeding population reaches a minimum of 1000 pairs; (population totaling 4000 or more birds); AND the 3-year running average growth rate of the population as a whole is ≥6% for ≥7 years; AND at least 250 breeding pairs exist on two island groups other than Torishima, each exhibiting ≥6% growth for ≥7 years; AND a minimum of 75 pairs occur on a site or sites other than Torishima and the Senkaku Islands. The listed population does not currently meet these criteria.

4.3 Polar Bear

Status in the Action Area

Two Polar Bear stocks occur within the Action Area: the Alaska-Chukotka (A-C) Stock and the Southern Beaufort Sea (SBS) Stock. The A-C stock is widely distributed on the pack ice of the northern Bering, Chukchi, and eastern Siberian seas (Figure 7; Garner et al. 1990; Garner et al. 1994). The constant movement of pack ice influences the movement of polar bears; this makes obtaining a reliable population size estimate from mark and recapture studies challenging. For example, polar bears of this stock move south with advancing ice during fall and winter and north in advance of receding ice in late spring and early summer (Garner et al. 1990). Experts estimate the stock to number approximately 2,000 polar bears (Aars et al. 2006). Currently, the International Union for Conservation of Nature (IUCN) Polar Bear Specialist Group classifies the A-C stock as declining based on reported high levels of illegal killing in Russia, continued

legal harvest in the United States, and observed and projected losses in sea-ice habitat (Table 6, Obbard et al. 2010).

The SBS stock is distributed across the northern coasts of Alaska, and the Yukon and Northwest territories of Canada (Figure 7). Estimates of the stock size of the SBS were 1,778 from 1972 - 1983 (Amstrup et al. 1986), 1,480 in 1992 (Amstrup 1995), and 2,272 in 2001 (USGS, unpublished data). Declining survival, recruitment, and body size (Regehr et al. 2006; Rode et al. 2010), low population growth rates during years of reduced sea-ice (2004 and 2005), and an overall declining population growth rate of 3% per year from 2001 - 2005 (Hunter et al. 2007) suggest that the SBS is now declining. Regehr et al. (2006) estimated the SBS to be 1,526 (95% CI: 1,211 - 1,841). Most recently, mark-recapture work from 2001 - 2010 estimated 2010 abundance to be 907 (95% CI: 548 – 1,270), but possible spatial heterogeneity in the population could bias abundance estimates (IUCN/SSC PBSG 2015). This suggests that the size of the subpopulation declined between the late 1990s and 2010. The status of this stock is listed as 'reduced' by the IUCN (IUCN; Obbard et al. 2010) and 'depleted' under the Marine Mammal Protection Act (MMPA).

Table 6. Status of polar bear stocks in the Action Area.

	IUCN Polar Bear Specialist Group[a]			
Subpopulation/stock	**Population status**	**Population trend**	**Population size**	**MMPA[b] Status**
Alaska-Chukotka	Reduced	Declining	Unknown	Depleted
Southern Beaufort Sea	Reduced	Declining	1,526 (95% CI: 1,211 – 1,841)	Depleted

[a] The Polar Bear Specialist Group is a research scientist group under the auspices of the International Union for the Conservation of Nature (IUCN); Obbard et al. (2010)
[b] Marine mammals listed under the Endangered Species Act are given a "depleted" status under the Marine Mammal Protection Act (MMPA).

[Top]

Typically, most polar bears from the A-C and SBS stocks occur in the active ice zone, far offshore, where they hunt for seals from broken pack ice throughout the year. Bears also spend a limited time on land to feed or move to other areas, although melting sea-ice may result in increased numbers of polar bears moving from the offshore ice onto land. Polar bears may also abandon melting sea-ice and/or use the terrestrial environment to transit to other areas. When fall storms and ocean currents result in bears coming to land, they may remain along the coast or on barrier islands until the ice returns. Polar bears may travel to land by swimming from remnant ice to terrestrial habitats. Polar bears occasionally den along the Chukchi Sea coast.

Polar bears have recently been documented offshore in the Action Area. Aerial surveys flown by the National Marine Mammal Laboratory (NMML [2013]) recorded 65 sightings of 277 individual polar bears in the Chukchi and Beaufort seas in all months of the study period (June-October) except June. Some of these sightings were repeat observations of the same animal (NMML 2013). Polar bears were observed on the beach or tundra along the coast or on barrier islands between Cape Lisburne and Demarcation Point from August to October, and were observed on sea-ice in September (NMML 2013). They were observed swimming at sea in all

months from July to October, generally near sea-ice or land. Exceptions to this included five sightings on 15 Aug, 25 Aug, 5 Sep, 15 Oct, and 18 Oct of polar bears swimming offshore in open water, with no sea-ice in the vicinity. These five polar bears were sighted in both seas, from approximately 30 - 110 km offshore (NMML 2013).

The Service designated polar bear critical habitat in 2010 (75 FR 76086). In January 2013, the U.S. District Court for the District of Alaska issued a decision vacating and remanding the final rule to the Service in *Alaska Oil and Gas Association et al. v. Salazar et al.* (D. Alaska; 3:11-cv-00025-RRB). Decisions regarding the District Court's order are currently pending, and no critical habitat designation is currently in place.

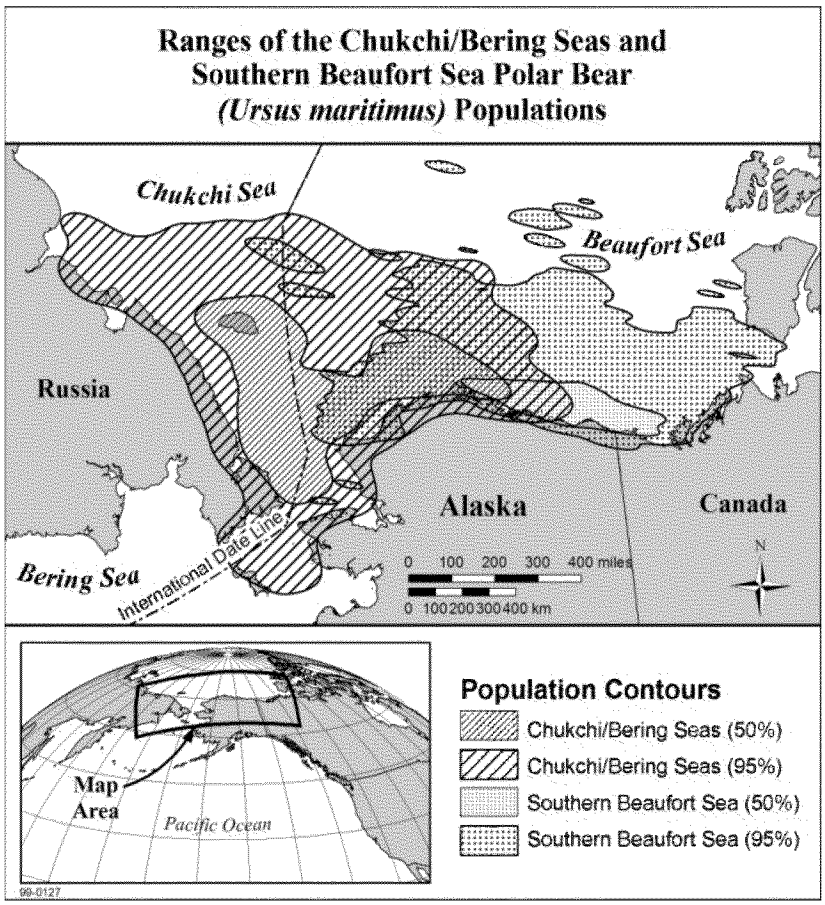


Figure 7. Ranges of Alaska polar bear stocks (73 FR 28212). [Top]

Threats and Possible Stressors in the Action Area

The two main stressors in the Action Area for the polar bear are loss of sea-ice resulting from climate change and subsistence hunting.

Loss of Sea-ice

Declines in sea-ice have occurred in optimal polar bear habitat in the southern Beaufort and Chukchi seas between 1985 - 1995 and 1996 - 2006, and the greatest declines in 21st century

optimal polar bear habitat are predicted to occur in these areas (Durner et al. 2009). These stocks are vulnerable to large-scale dramatic seasonal fluctuations in ice movements which result in decreased abundance and access to prey, and increased energetic costs of hunting. The A-C and the SBS are currently experiencing the initial effects of changes in sea-ice conditions (Hunter et al. 2007; Regehr et al. 2009; Rode et al. 2010). Regehr et al. (2010) found that the vital rates of polar bear survival, breeding rates, and cub survival declined with an increasing number of ice-free days/year over the Continental Shelf, and suggested that declining sea-ice affects these vital rates via increased nutritional stress.

Subsistence Harvest

Subsistence hunting of polar bears occurs within the Action Area. Subsistence hunting of polar bears is managed through international and other agreements. Harvest quotas are set by the Inuvialuit-Inupiat (I-I) Council and the U.S./Russia Polar Bear Commission (U.S./Russia Commission) for the SBS and A-C polar bear populations, respectively. Quotas are based on the best available scientific data and traditional ecological knowledge to minimize potential for over-harvest. Total reported polar bear harvest numbers, including all bears harvested from 2007 - 2011 in Alaska communities are as follows: Barrow, 49; Gambell, 9; Kivalina, 3; Kotzebue, 3; Little Diomede, 14; Nome, 1; Point Hope, 51; Point Lay, 2; Savoonga,16; Shishmaref, 6; Wainwright, 4; and Wales, 5 (78 FR 1942).

Southern Beaufort Sea stock

In 1988 the I-I Council established a sustainable harvest quota for the SBS population of 80 polar bears. In 2010, the Council adjusted the quota downward to 70 polar bears based on a revised population estimate of 1,526 (Regehr et al. 2006). The reported annual average combined Alaska/Canada harvest for the SBS population from 2004 - 2009 was 44. The 2008/2009 reported harvest for Alaskan North Slope villages was 25 polar bears (DeBruyn et al. 2010).

Alaska-Chukotka stock

Russia and the U.S. signed the *Agreement between the United States of America and the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population* (Bilateral Agreement) in 2000, which established the U.S./Russia Commission and provided a common legal, scientific, and administrative framework to manage the shared A-C polar bear population. Implementing legislation for the Bilateral Agreement was signed in the U.S. on January 12, 2007. In June 2010, the U.S./Russia Commission adopted an annual take limit of the A-C polar bear population of 19 females and 39 males (DeBruyn et al. 2010). Harvest will be split evenly between Native peoples of Alaska and Chukotka. The Alaskan share of the harvest is 29 total polar bears per year, which is below the average of 37 polar bears harvested each year between 2004 and 2008 (USFWS, unpublished data).

Oil and Gas Activities

Potential effects to polar bears from oil and gas exploration could arise due to disturbance from the presence of vessels and aircraft, noise from seismic surveys, and human bear interactions. Impacts of most of these interactions are expected to be minimal due to the impact avoidance and reduction measures applied by the oil industry and included in authorizations issued by the Service under the MMPA (USFWS 2012, USFWS 2013). Oil spills and spill response activities

may affect polar bears if bears or their prey come into contact with spilled or dispersed oil. Oil exploration and development is the greatest source of risk for spills in Northern Alaska. Offshore exploration in the nearshore Southern Beaufort Sea has been ongoing since 1982; exploration wells are planned to be drilled in the Chukchi Sea in the very near future (Figure 8).

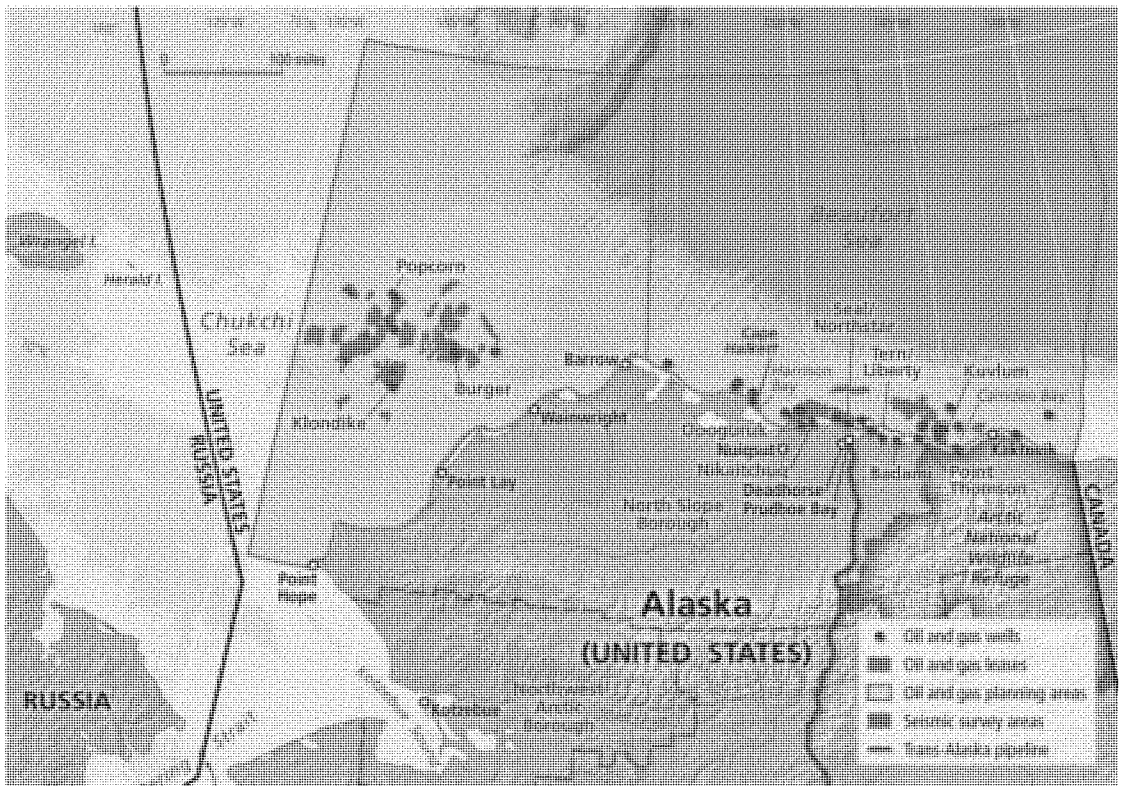


Figure 8. Oil and gas exploration and development areas in Northern Alaska (from Natural Research Council, in Fischman 2014). [Top]

More than 16 billion barrels (bbl) have been produced, and more than 2,000 wells drilled on the Beaufort Sea/North Slope. Seven large oil spills have occurred between 1985 and 2009. The largest oil spill occurred in 2006, where approximately 5,714 bbls (260,000 gal) leaked from flow lines near a gathering center. In 2009, a 1,095 bbl (46,000 gal) oil spill occurred as well. Both of these spills occurred at production sites. Historically, industry has had 35 small spills (those less than 50 bbls, 2,100 gal) totaling 26.7 bbls (1,121 gal) in the outer continental shelf. More recently, in 2012, a gas blowout occurred at an exploration well on the Colville River Delta where approximately 1,000 bbls (42,000 gal) of drilling mud and an unknown amount of natural gas was expelled (BOEM 2011a). The Bureau of Land Management (BLM) and BOEM modelled the likelihood of spills occurring during exploration and development in the National Petroleum Reserve-Alaska and in the Chukchi Sea (BLM 2012a and BOEM 2011b, 2000, respectively). BOEM (2014) estimated an average of 2 - 3 spills per year during exploration and 10 - 12 per year during development. Spill volume averaged 1.4 bbl (BLM 2012a).

Large (≥ 1,000 bbl) or very large spills (≥120,000 bbl) were considered extremely unlikely to occur during oil and gas exploration. BOEM estimated the occurrence and frequency of large and very large spills from wells in the Chukchi Sea at 0.003 (mean spill frequency per 1,000 years) and 2.39 x 10^{-5} (mean spill frequency per well), respectively (BOEM 2011b). The two sources of potential large crude oil spills are from pipelines and long duration blowout resulting from a well-control incident. The BLM estimated a 28% chance that one or more large crude oil spills would occur during 50 years. Based on information on past spills, spills volumes close to the lower end of the "large spill" range (1,000 bbl) are much more likely that spill volumes in the upper end of the range (119,999 bbl). BOEM (2014) considered spill sizes of 1,700 and 5,100 bbls to be the largest spill size likely to occur from a or pipeline or facility, respectively.

The BLM determined the only potential source of a very large oil spill (> 120,000 barrels) is a well-control incident that escalates into long duration blowout when all primary and secondary safeguards fail. The approximate occurrence rates worldwide for very large oil spills are about one for every 270 billion bbl produced (BLM 2012b). More locally (at Northstar), the statistical frequency of a blowout well leading to a very large oil spill was estimated at 9.4 x 10^{-7} per well drilled (for volumes > 130,000 bbl; BLM 2012b). Thus, while small spills (<50 bbl) are reasonably likely to occur, very large oil spills are extremely unlikely to occur, and none have occurred on Alaska's North Slope to date.

The majority of spills are anticipated to occur during the open-water season when bears from the A-C and SBS populations utilize sea-ice habitat as a platform for feeding and resting. As the ice recedes, the majority of the bears move with it. A small portion of bears can be found along the coast during this time, but a relatively large proportion of the A-C population tend to be found in the western Chukchi Sea region of the Russian Federation. Bears from the SBS predominantly utilize the central Beaufort Sea region of the Alaskan and Canadian Arctic during this time. These areas are well outside of the geographic region of oil exploration. Additionally, industry activity will occur only on a portion of the range of Alaska's polar bear. The offshore oil and gas exploration area in the Chukchi covers approximately 23% of the range of polar bear in the Chukchi Sea; active leases are approximately 2% of that area (USFWS 2013).

The overall risk of effects to polar bears is somewhat reduced because the majority of spills are likely to occur during the open water season, rather than during the ice-covered season when bears are most susceptible to impacts of spills and potential spill response activities. During this time, polar bears concentrate in shallow waters less than 300 m deep over the continental shelf and in areas with >50% ice cover to access ringed and bearded seals (Durner et al. 2004). In these areas, bears may be exposed to any remnant oil from the previous open-water drilling season or to oil released below ice because they are in potential oil exploration areas. Spilled oil could remain trapped in or under the ice near the source of release or concentrate and accumulate in leads and openings that occur during spring break-up and autumn freeze-up periods.

Amstrup (2006) estimated the probability that polar bears could be exposed to hypothetical oil spills using satellite locations from 194 collared bears in the vicinity of two production facilities, the Northstar Facility and the proposed offshore site for the Liberty Facility. Model parameters included time of year when bear density was highest, wind and current data, and hypothetical

spill size. Numbers of bears potentially oiled by a hypothetical 5,912 barrel spill (the largest spill thought probable from a pipeline breach) ranged from 0 - 74 depending month and ice conditions. The authors concluded that a spill of 5,912 barrels of crude oil from the proposed Liberty or Northstar Island could pose significant risks to individual polar bears, but no risk at the population level (Amstrup et al. 2006)

The Service also assessed the risk to Polar Bears from oil spills in the Chukchi and Southern Beaufort seas from oil exploration and development prior to issuance of authorizations under the MMPA (USFWS 2012, USFWS 2013). Based on the low likelihood of occurrence for large spills (BOEM 2011a,b; BLM 2012a,b), that analysis concluded that significant impacts to polar bears under the existing environmental baseline are possible, but highly unlikely.

Other Environmental Contaminants

Exposure to environmental contaminants other than petroleum compounds may also affect polar bear survival or reproduction in the Action Area. Persistent organic pollutants (POPs) and heavy metals are thought to pose the greatest potential threat. Contamination of the Arctic and sub-Arctic regions through long-range transport of pollutants has been recognized for over 30 years (Proshutinsky and Johnson 2001; Lie et al. 2003). Arctic ecosystems are particularly sensitive to environmental contamination due to the slower rate of breakdown of POPs, relatively simple food chains, and the presence of long-lived organisms with high lipid levels that favor bioaccumulation and biomagnification. Consistent patterns between organochlorine compounds, mercury contamination, and trophic status have been documented in Arctic marine food webs (Braune et al. 2005).

Polar Bear Research

Currently, ongoing polar bear research takes place in the Action Area. The long-term goal of these research programs is to gain information on the ecology and population dynamics of polar bears to help inform management decisions, especially in light of climate change. These activities may cause short-term injury to individual polar bears targeted in survey and capture efforts and may incidentally disturb those nearby. In rare cases, research efforts may lead to injury or death of polar bears. Polar bear research is authorized through permits issued under the MMPA. These permits include estimates of the maximum number of bears likely to be directly harassed, subjected to biopsy darting, captured, etc., and include a condition that halts a study if a specified number of deaths, usually four to five, occur during the life of the permit. Permits are typically issued for a five year period.

Other Activities

Polar bear viewing at village whale bone piles may result in disturbance of polar bears by humans on foot, ATVs, snow machines, and other vehicles. Although difficult to quantify, these disturbances are usually temporary and localized, limiting the duration and severity of impact.

Recovery

The Service has assembled a diverse team of stakeholders, known as the Polar Bear Recovery Team, to draft a Conservation Management Plan for polar bears. The plan is scheduled to

become available soon, and may reflect some of the conservation priorities of the 1973 *International Agreement on the Conservation of Polar Bears* (1973 Polar Bear Agreement) signed by the nations of Canada, Denmark on behalf of Greenland, Norway, the Russian Federation, and the U.S., including prevention of overharvest and special protections for females with cubs (Prestrud and Sterling 1994). Additional considerations may include measures to minimize range contraction and rates of population decline. At the current time, the potential for recovery of the polar bear populations in the Action Area remains uncertain.

4.4 Walrus

Status in the Action Area

Although only a portion of the total range of the Pacific Walrus occurs within the Action Area, walruses are highly mobile and wide-ranging, and are not considered to belong to discrete populations. Therefore, the information described in the Status of the Species section also applies within the Action Area. In the U.S. EEZ, there are 19 known walrus haulouts, four of which are located in Bristol Bay and are used primarily in summer by bulls. Five haulouts are located on the shores of the Bering Strait and St. Lawrence Island and are especially important in spring and fall as the population moves between wintering and summering grounds. The remaining six are along the coast of the Chukchi Sea and are used by females and juveniles primarily in summers with low sea-ice. The most recent estimate of the worldwide population of Pacific walrus is 129,000 (95% CI: 55,000 - 507,000; Speckman et al. 2010). The accuracy of this estimate is not suitable for determining recent population trends, but declines are thought to have occurred since the 1970s and 1980s.

Threats and Possible Stressors in the Action Area

Recent (2007 - 2011) changes in Arctic sea-ice have altered patterns of walrus migration into and use of the Chukchi Sea (Jay et al. 2012, Figure A-25 in Status of the Species). Recently, Jay et al. (2012) observed walruses further north in the Chukchi Sea in June and July than was previously observed by Fay (1982). This coincides with recent increases in open water and lower sea-ice concentrations during these months. In September and October of 2009, 2010, and 2011, Jay et al. (2012) documented walruses foraging nearshore in depauperate prey biomass areas instead of in historical offshore areas. Walruses forage on the seafloor for benthic invertebrates such as clams, snails, seaslugs, and polychaete worms. The disappearance of sea-ice over the continental shelf likely caused walruses to haul out on shore in large numbers, a behavior that did not commonly occur previously (Fay et al. 1984). Walruses, however, continued to use Hanna Shoal as a core foraging area (Jay et al. 2012).

The NMML has documented walruses during aerial surveys in the Action Area within oil exploration areas for the past several years (NMML 2010, 2011, 2012, 2013). In 2013, NMML (2013) documented 11,974 individuals in 447 walrus sightings from June to October, all months of the Chukchi Sea portion of the survey, with largest numbers in July and August. No walrus haulouts on the northwestern Alaskan coastline were observed in 2012 (NMML 2013), although they were observed at coastal haulouts in previous years (e.g., NMML 2010).

Loss of Sea-ice
Loss of sea-ice during summer has caused walruses to become increasingly dependent on land-based haulouts, both throughout their range and in the Action Area. In August of 2007, 2009, 2010, and 2011 the pack ice retreated beyond the continental shelf, and walruses were observed hauled out on land at several locations between Point Barrow and Cape Lisburne in 2007 (Thomas et al. 2009, Clarke et al. 2011). Historical haulouts at Icy Cape have been comprised of a few thousand animals, which is much smaller than recent haulouts near Point Lay. In 2010 and 2011, walruses hauled out about three miles north of Point Lay. In early August 2011 (8 - 17 August) when sea-ice had receded north, walruses started to congregate nearshore; they formed a haulout by mid-August (NMML 2012). In 2011 the haulout formed about a month earlier than in 2010 (MacCraken, USFWS, unpublished data) and remained present into October (6-17 October; NMML 2012). In September 2009, a haulout of approximately 2,500 - 4,000 walruses was documented on land near Icy Cape (NMML 2010; Christman et al. 2010), suggesting a similar scenario to 2007 when pack-ice retreated away from offshore feeding grounds. A mortality event of 131 animals from unknown causes was documented at the Icy Cape site in 2009; the deaths were due to trampling, most likely due to a stampede due to a disturbance at a large haulout; the haulout was likely caused by the loss of sea-ice over the Chukchi Sea continental shelf (Fischbach et al. 2009).

In previous years, other investigators have linked walrus deaths at other Chukchi Sea coastal haulouts to trampling, exhaustion from prolonged exposure to open sea conditions, and separation of calves from their mothers (Fischbach et al. 2009). The potential for mortality events such as that at Icy Cape in 2009 may increase with increasing use of summer haulouts in response to loss of sea-ice over the continental shelf. However, haulout monitoring and protection programs have kept disturbances to a minimum and no large mortality events have occurred since 2009.

Subsistence Harvest
As summer sea-ice in the Chukchi Sea recedes and coastal haulouts form along the coast, the increased time walruses spend on land could provide opportunity for additional harvest. However, the Eskimo Walrus Commission passed a resolution in 2008 addressing hunting at these newly forming haulout areas, advising restraint and caution. Haulout monitoring and protection programs have been successful at managing hunting in a way that keeps disturbances to a minimum. About five animals have been harvested from the Point Lay haulout each year, typically as the haulout begins to form and relatively few animals are present.

Oil and Gas Activities
Walruses may be affected by oil and gas exploration and development due to encounters with or noise from offshore marine deep-penetration surveys, high resolution surveys, seismic surveys and exploratory drilling activities. Walruses at haul outs may be disturbed by the presence of vessels and aircraft. Impacts of most of these interactions are expected to be minimal due to the avoidance and reduction measures applied by the oil industry and included in authorizations issued by the Service under the MMPA (USFWS 2012, USFWS 2013). These authorizations require reporting of potential harassment. In 2012, industry reported 34 encounters of 184

walruses, of which, nine met the definition of Level B harassment, as defined under the MMPA. From vessels, industry reported 566 encounters involving 9,809 walrus, of which 164 MMPA met the definition of Level B harassment. No encounters occurred at terrestrial haulouts in 2012.

Small spills are likely to occur from oil and gas activities, as described in the Environmental Baseline for Polar Bears. Development in the Southern Beaufort Sea is not likely to affect Pacific walruses due to their limited range in this area. Development in the Chukchi Sea has not yet been demonstrated, and is not considered reasonably certain to occur, but exploration is planned for this area in the near future. If development were to occur, the risk of large spills occurring in the Chukchi Sea is projected to increase. BOEM (2014) estimated a 75% chance of one or more large spills occurring over the course of 77 years, and a 25% chance of no spills from development in the Chukchi Sea. The estimated chance of a very large oil spill remains exceedingly small, on the order of 10^{-4} - 10^{-5} (BOEM 2014). The likelihood of walruses contacting oil is proportional to the volume and spatial extent of the oil. For small spills the likelihood of exposure, and the number of walruses likely to contact oil if exposure does occur, are low. Large spills have a greater potential for impacts to large numbers of animals, but the probability of occurrence in the region is low (BOEM 2011b).

Material spilled into the Chukchi and during exploration would generally be spread with the currents, depending on the spill location, timing, extent of sea-ice, wind conditions, and freshwater inflows. Currents generally travel from south to north from the Pacific through Bering Strait (Figure 9). In some years there are also counter-currents created by seasonal flows and upwelling. These include the Siberian Coastal Current, which flows southward through Long Strait, and the Barrow canyon current, which brings Arctic waters into the Chukchi Sea (Weingartner et al. 2005; Woodgate et al. 2005; Woodgate et al. 2014).

Hanna Shoal (Figure 10) has shallow water and moderate to high benthic productivity (Dunton 2013). Walruses forage there in the tens of thousands (Brueggeman et al. 1990; MacCracken 2012) from June-October, and the area is considered a core area of foraging (Jay et al. 2012). This area corresponds with the oil and gas exploration area in the Chukchi Sea. Spills are most likely to occur there during the open water season when large numbers of walruses may be foraging in Hannah Shoal. The spill scenario with the greatest potential impacts to walrus would likely involve a large spill occurring within 60 km of the coast near a large haulouts. Spills under or in ice could also be problematic due to difficulty of cleanup in ice. Material not cleaned up could become part of the ice substrate and be eventually released back into the environment during the following open water season.

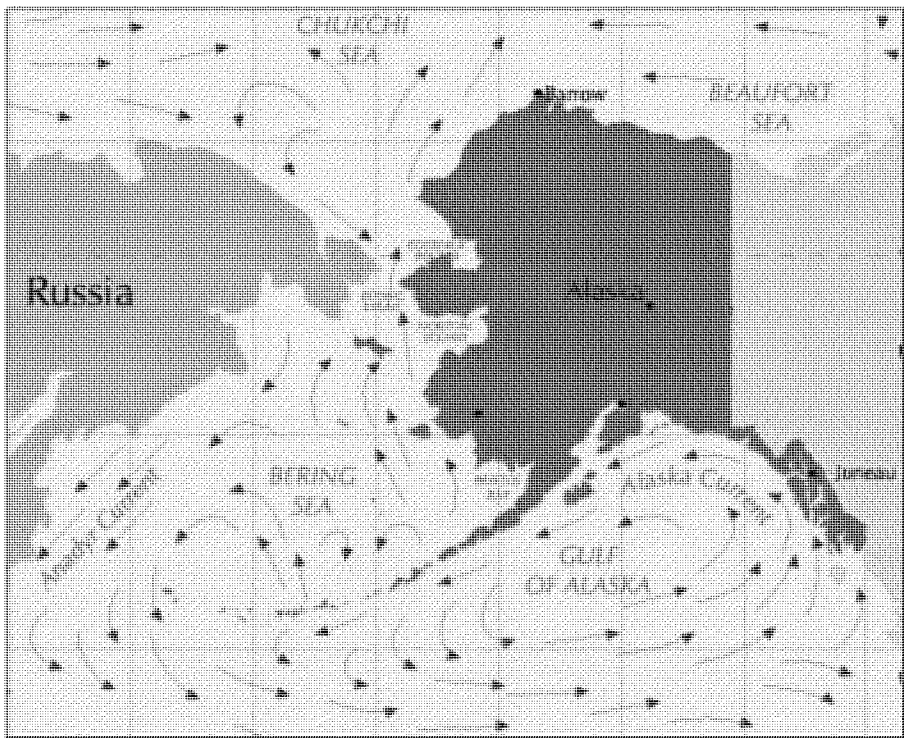


Figure 9. Ocean currents near Alaska from (Pearson 2004 - 2015) [Top]

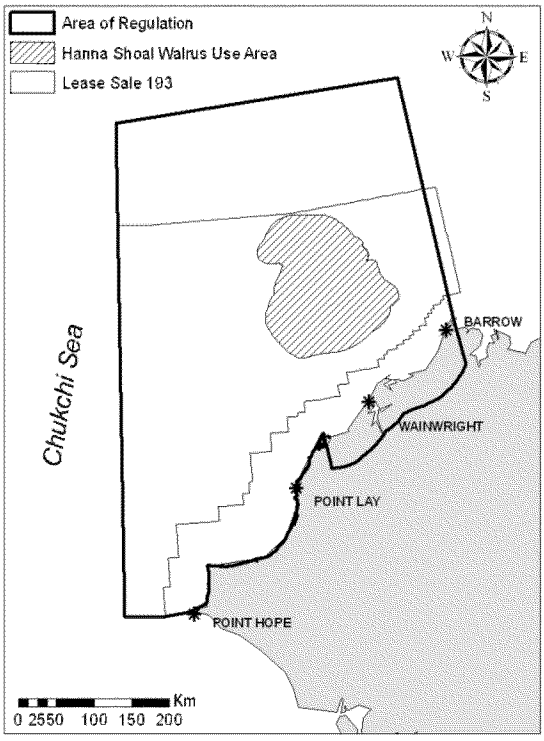


Figure 10. Hanna Shoal Walrus Use Area based on Jay et al. (2012). Image from 78 FR 1942. [Top]

The relative importance to walruses of oil and gas development and the associated risk of spills were evaluated in relation to other potential threats in a Bayesian belief network model by Garlich-Miller et al. 2011). These models incorporate three key elements; (1) important explanatory and response variables, (2) cause and effect relationships, and (3) probabilities representing the belief that a variable will be in a given state. These models are useful for formalizing and quantifying the opinions of experts (Marcot et al. 2006). Factors affecting walrus survival and recovery were ranked in order of importance. The most important factors influencing rankings were changes in harvest levels, followed by Greenhouse gas emissions, predation, disease, shipping, oil and gas development, other removals, and commercial fishing. Oil and gas development was considered to be two times more important than commercial fishing or shipping. The resulting mean probability estimate for negative effects on the population (a measure of relative contribution of each stressor) from oil and gas development was 0.12 (0.1 - 0.2) compared with 19.3 (17 - 20.8) for harvest (Garlich-Miller et al. 2011).

Although fuel and oil spills have the potential to cause adverse impacts to walruses, oil and gas exploration activities are not considered a major threat (USFWS 2012, USFWS 2013, Garlich-Miller et al. 2011). BOEM considers the likelihood of a blowout occurring during exploratory drilling in the Chukchi Sea as negligible (BOEM 2011a). Furthermore, various measures applied to and by the oil industry reduce the baseline risk of spills and the degree of impact that may result. These measures include:

- Offshore exploration activities in the Chukchi will be limited to the July 1 - November 30 open-water season to avoid seasonal pack ice;
- Onshore or near shore activities will not occur in the vicinity of coastal walrus haulouts.
- All support vessels and aircraft will be required to maintain a 1-mile buffer area around groups of walruses hauled out on land;
- Oil operators incorporate spill prevention equipment and methods during fuel transfers and hazardous material handling and storage;
- Protocols are in place to train field personnel to follow procedures and BMPs;
- Industry plans for spill prevention and response plans are required;
- Regulatory approval and oversight is required (exploratory drilling activities conducted on the outer continental shelf follow BOEM regulations at 30 CFR Part 550 and 30 CFR Part 250, respectively);
- Measures to prevent loss of well control are developed based on site-specific information and include redundant pollution prevention equipment, testing and verification that equipment is working properly, and training and testing of personnel in well control procedures;

For these reasons, any impacts associated with an operational spill are expected to be limited to a small number of animals. Oil spill risk associated with shipping is currently minimal. To date, limited shipping occurs in the Chukchi Sea due to seasonal constraints such as the formation of winter sea-ice.

Noise

Anthropogenic sources of noise in the arctic include vessels (e.g., for shipping and oil and gas activities) and airguns used during seismic surveys. The increase in human activities made possible by reductions in sea-ice is increasing the level of underwater noise in the Arctic Ocean, including in areas where this level of activity is unprecedented (Moore et al. 2012). In the Chukchi Sea, seismic activities are likely the greatest contributor to anthropogenic noise, followed by vessels. Industry minimization measures require operators to avoid walruses during seismic surveys, which may reduce likelihood of population-level effects, but cumulative impacts of sounds from multiple sources may influence the ability of walruses to communicate (Moore et al. 2012).

Recovery

The Service does not set recovery goals for species that are designated as candidates for listing. Therefore, no specific targets have been established for maintaining current population sizes or addressing threats to the species. Factors associated with climate change (i.e., loss of sea-ice) and hunting are the main threats identified thus far and are likely to continue into the foreseeable future, leaving the status of the species in the Action Area uncertain.

4.5 Spectacled Eider

Status in the Action Area

Much of range of the spectacled eider is within the Action Area; the Status of the Species section describes the current status and factors affecting this species in the Action Area. The most recent range-wide estimate of abundance of spectacled eiders was 369,122 (364,190– 374,054 90% CI; Larned et al. 2012a). Aerial surveys suggest the population growth rate is approximately stable over the long term (0.99, 90% CI: 0.98 - 1.01) and in the last 10 years (1.00, 90% CI: 0.97 - 1.03) (Larned et al. 2012a). Currently, this species consists of three primary breeding populations: those on Alaska's North Slope (ACP or Arctic Coastal Plain), the Yukon-Kuskokwim Delta (Y-K Delta), and northern Russia (Figure 11). The Y-K Delta and North Slope populations declined between the 1970s and the early 1990s (Warnock and Troy 1992; Stehn et al. 1993; Ely et al. 1994). The entire species overwinters in polynyas (areas of unfrozen sea water surrounded by ice) in sea-ice south of St. Lawrence Island where they feed on benthic invertebrates, especially mollusks and crustaceans. They may also forage on pelagic or free-floating amphipods.

Warnock and Troy (1992) documented an 80% decline in spectacled eider abundance from 1981 - 1991 in the Prudhoe Bay area. Since 1992, the Service has conducted annual aerial surveys for breeding spectacled eiders on the ACP. The 2010 population index based on these aerial surveys was 6,286 birds (95% CI, 4,877–7,695; unadjusted for detection probability), which is 4% lower than the 18-year mean (Larned et al 2011). In 2010, the index growth rate was significantly negative for both the long-term (0.987; 95% CI, 0.974–0.999) and most recent 10 years (0.974; 95% CI, 0.950–0.999; Larned et al. 2011). Stehn et al. (2006) developed a North Slope-breeding population estimate of 12,916 (95% CI, 10,942–14,890) based on the 2002–2006 ACP aerial index for spectacled eiders and relationships between ground and aerial surveys on the Y-K Delta. If the same methods are applied to the 2007–2010 ACP aerial index reported in Larned et

al. (2011), the resulting adjusted population estimate for North Slope breeding spectacled eiders is 11,254 (8,338–14,167, 95% CI).

The Y-K Delta spectacled eider population is thought to have declined by about 96% from the 1970s to 1992 (Stehn et al. 1993). Evidence of the dramatic decline in spectacled eider nesting on the Y-K Delta was corroborated by Ely et al. (1994), who found a 79% decline in eider nesting near the Kashunuk River between 1969 and 1992. Aerial and ground survey data indicated that spectacled eiders declined 9–14% per year from 1985–1992 (Stehn et al. 1993). Further, from the early 1970s to the early 1990s, the number of pairs on the Y-K Delta declined from 48,000 - 2,000, apparently stabilizing at that low level (Stehn et al. 1993). Before 1972, an estimated 47,700–70,000 pairs of spectacled eiders nested on the Y-K Delta in average to good years (Dau and Kistchinski 1977).

Fischer et al. (2011) used combined annual ground-based and aerial survey data to estimate the number of nests and eggs of spectacled eiders on the coastal area of the Y-K Delta in 2011 and evaluate long-term trends in the Y-K Delta breeding population from 1985 - 2011. In a given year, the estimated number of nests reflects the minimum number of breeding pairs in the population and does not include non-nesting individuals or nests that were destroyed or abandoned (Fischer et al. 2011). The total number of spectacled eider nests on the Y-K Delta in 2011 was estimated at 3,608 (SE 448), the second lowest estimate over the past 10 years. The average population growth rate based on these surveys was 1.049 (90% CI: = 0.994–1.105) in 2002–2011 and 1.003 (90% CI: = 0.991–1.015) in 1985–2011 (Fischer et al. 2011). Log-linear regression based solely on the long-term Y-K Delta aerial survey data indicate positive population growth rates of 1.073 (90% CI: = 1.046–1.100) in 2001–2010 and 1.070 (90% CI: = 1.058–1.081) in 1988–2010 (Platte and Stehn 2011).

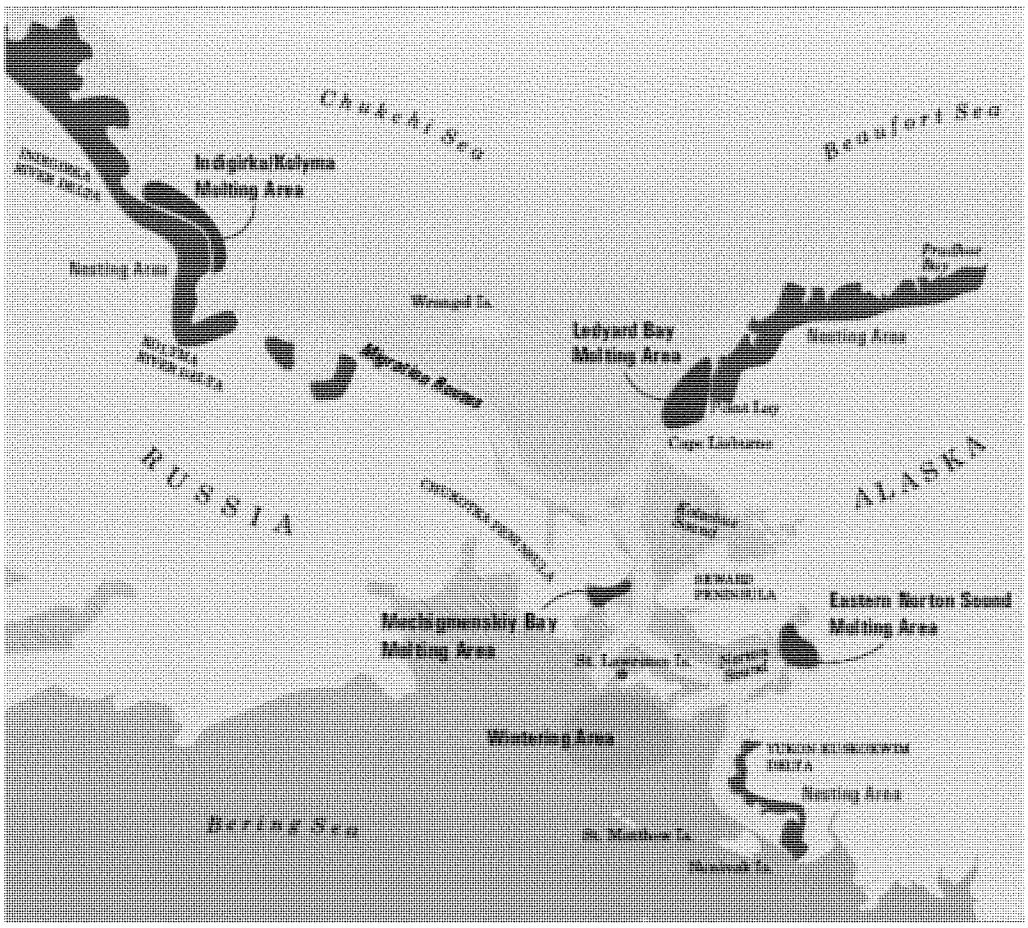


Figure 11. Distribution of spectacled eiders. Molting areas (green) are used July through October. Wintering area (yellow) are used October through April. The full extent of molting and wintering areas is not yet known and may extend beyond the boundaries shown. [Top]

Critical Habitat Designation and Use

In 2011, critical habitat was designated within Ledyard Bay and Norton Sound for molting spectacled eiders (66 CFR 9146). Critical habitat also includes areas on breeding habitat on the Y–K Delta and wintering habitat in the Bering Sea between St. Lawrence and St. Matthew Islands. These areas total approximately 10,098,827 hectares (100,988.3 square kilometers; 38,991.6 square miles; 24,954,638 acres). The PCEs for Y–K Delta Unit include all portions of the vegetated intertidal zone, and all open water inclusions within that zone. The PCEs for the Norton Sound Unit and the Ledyard Bay Unit include all marine waters greater than 5 m (16.4 ft) and less than or equal to 25 m (82.0 ft) in depth, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community. The PCEs for the wintering unit include all marine waters less than or equal to 75 m (246.1 ft) in depth, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community.

Threats and Possible Stressors in the Action Area

Oil Spills

Spectacled eiders face the greatest potential for exposure to spills along the nearshore coast near their North Slope breeding and molting habitats. Eiders may pass though the Chukchi Sea Planning Area while *en route* to North Slope breeding habitat. Recent information about spectacled and other eiders indicates that they probably make extensive use of the eastern Chukchi Sea spring lead system (Matt Sexson, unpublished data; Figure 12). Spring aerial observations have documented dozens to several hundred common and spectacled eiders in open water leads and several miles offshore in relatively small openings in rotting sea-ice in the eastern Chukchi Sea (Figure 12; USFWS 2010). Surveyors recorded a single spectacled eider in Klondike Prospect area on 8 September and a single spectacled eider off transect in Burger Prospect area on 16 September (Gall and Day 2010; Figure 8). Birds also stage near oil and gas developments in the Southern Beaufort Sea prior to or after the breeding season. Risk of exposure to spills varies with the amount of time spent in the area and the locations used. Males are less likely to spend time in the area and when they do stage here, they spend less time and use areas closer to shore than do females. These differences are likely a result of seasonal changes in ice cover (Petersen et al. 1999, TERA 2002).

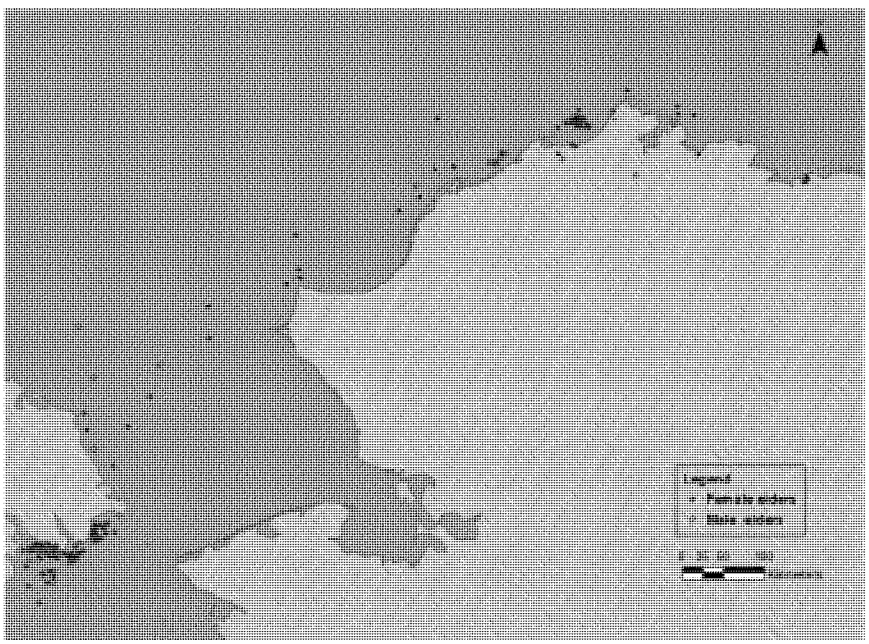


Figure 12. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders in the eastern Chukchi Sea from 1 April – 15 June 2010 and 1 April – 15 June 2011. Additional locations from the northern coast of Russia are not shown. Eiders were tagged on the North Slope during the 2009 and 2010 breeding seasons. Data provided by Matt Sexson, USGS Alaska Science Center (USGS, unpublished data). [Top]

Stehn and Platte (2000) estimated the probability that waterfowl, including spectacled eiders, could be exposed to hypothetical oil spills using information from six systematic aerial surveys flown in late June, July, and August, 1999 and 2000 in the vicinity of the proposed offshore site for the Liberty Facility in the Southern Beaufort Sea. Model variables included spill duration, timing, oil spill trajectories obtained from MMS, and hypothetical spill size. Aerial survey results yielded 148 birds observed during two surveys in seven total locations in July and August. Adjusted population estimates for the area were 540 birds in July and 30 in August. A mean estimate of 40 -

52 birds (maximum 139) were exposed to oil in July, and a mean of 0 (maximum 1) was exposed in August. The estimated proportion of the population exposed was 0.002 - 0.003 (max 0.096) in July, and 0 in August. Of the species considered, spectacled eiders were among the least likely to have a high proportion of their populations exposed to oil because of their widespread distribution or tendency to occur farther from the spill source (Stehn and Platte 2000). Spills occurring on the terrestrial nesting habitat may affect individuals, but generally have a limited ability to spread beyond the immediate spill area or to affect many nesting birds.

Spectacled eiders use molting areas from July to late October/early November. Females from the North Slope molt in Ledyard Bay, along the Russian coast, and near St. Lawrence Island. A substantial portion of the Ledyard Bay Critical Habitat Unit (LBCHU) overlaps with the Chukchi Sea Planning Area. An oil spill in the Chukchi Planning Area could reach the LBCHU and potentially affect the physical and biological features important to migrating and molting spectacled eiders. Most spills projected to occur from the oil and gas exploration are expected to be of very low volume. Small spills would have to occur directly adjacent to or within the LBCHU to affect the habitat or the eiders, and no exploration or development is currently planned in the area. As such, baseline risks of impacts from spills in the LBCHU are minimal. However, oil development is gradually spreading westwards across the North Slope from the original hub at Prudhoe Bay; expansion of industrial development is likely to continue.

Relatively few spills occur in the Northwest due to low population density and limited industrial activity, but spills that do occur can be large; a 200,000-gallon magnesium oxide spill occurred at a mining operation in 1998 (ADEC 2007; Figure 13). Listed species could be affected by an upland spill such as this if contaminants released to surface water were to flow downstream to marine habitat in the Bering and Chukchi seas. To date, no such events have resulted in measurable impacts to listed species. However, future development may increase spill potential in the Northwest; the U.S. Army Corps of Engineers (USACE) is currently investigating options for a deepwater port on the Seward Peninsula (Joling 2014).

The risk of oil spills in the Alaska has increased since 2009 (DNV and ERM 2010a, 2010b). Eight Arctic nations have signed onto agreements that acknowledge the need for improved safety information and response (Arctic Council 2011, 2013). These agreements recognize the increased marine shipping traffic, potential for oil pollution, and the need for greater response capacity in the harsh Arctic environment.

Risk of spills in the wintering area in the lead complexes south/southwest of St. Lawrence Island are minimal. Currently there is no planned oil or gas development in the area and limited shipping. Shipping that does occur in this area generally avoids areas with ice cover where the spectacled eiders are most likely to be found.

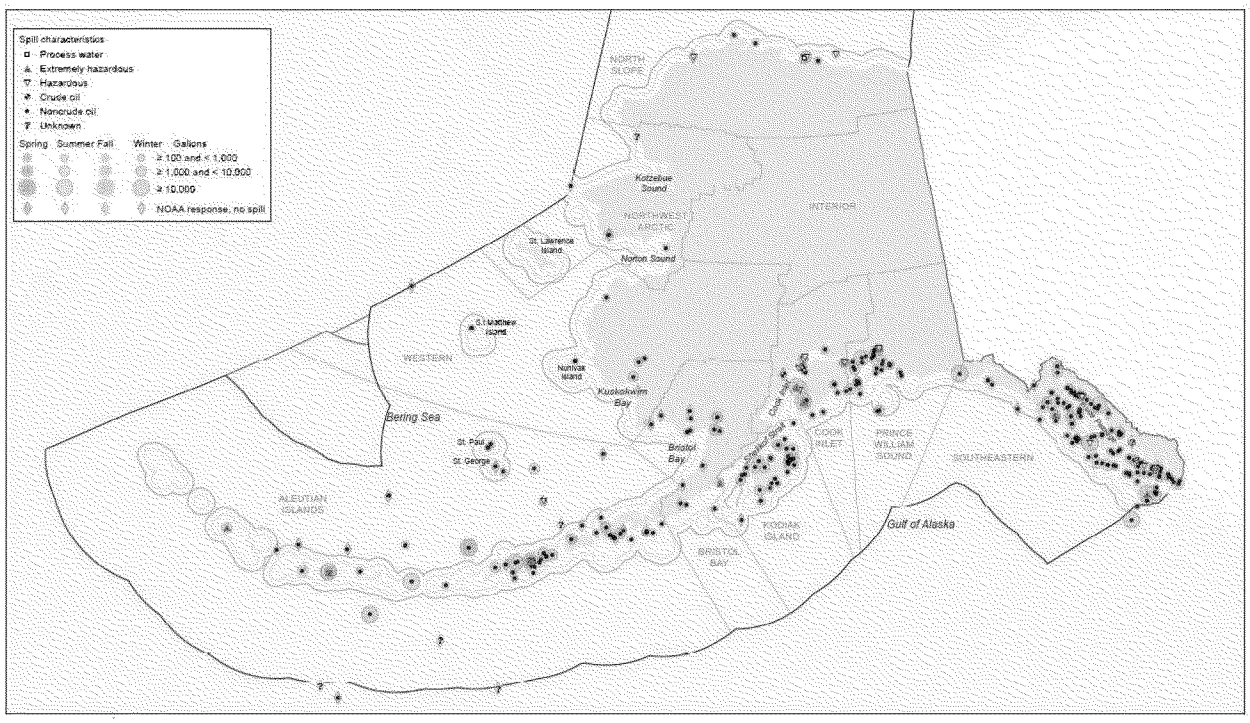


Figure 13. Hazardous materials spills reported in Alaska marine waters from 1995 - 2012 (adapted from a figure created by Windward Environmental, LLC (2014) for the Unified Plan BA using data available in 2012.) [Top]

Research

The Service has issued permits under Section 10 of the ESA to authorize take of endangered or threatened species for purposes of propagation, enhancement, or survival. Annual reporting requirements associated with these permits for spectacled indicate 11 spectacled eider adults and five eggs have reportedly died as an indirect result of research activities since. Scientific, field-based research is increasing on the ACP as interest in climate change and its effects on high latitude areas continues. While many of these activities have no impacts on listed eiders as they occur in seasons when eiders are absent from the area, or use remote sensing tools, on-the-ground activities and tundra aircraft landings are likely to disturb a small number of listed spectacled eiders on the breeding grounds each year. There has been little research outside of the breeding habitat.

Incidental Take

Activities occurring across the range of the spectacled eider have been reviewed for compliance with section 7 of the ESA. Lethal and non-lethal incidental take has been issued for various types of projects including oil and gas development and exploration, infrastructure development, subsistence harvest, wastewater facilities, powerlines, and research. Levels of authorized take have ranged from zero to 12 adults and two to 130 eggs/ducklings. The majority of the incidental take has been for loss of eggs/ducklings, which is of much lower significance for survival and recovery of the species than the death of an adult bird. For example, spectacled eider nest success recorded on the Y-K Delta ranged from 18 - 73% (Grand and Flint 1997), and average clutch size was five eggs (Petersen et al. 1999). From nests that survived to hatch,

duckling survival to 30-days ranged from 25 - 47% on the Y-K Delta (Flint et al. 2000). Over-winter survival of one-year old spectacled eiders was estimated at 25% (P. Flint pers. comm.), with annual adult survival of 2-year old birds (that may enter the breeding population) of 80% (Grand et al. 1998). Using these data (in a very simplistic scenario), for every 100 spectacled eider nests on the Y-K Delta, between two and 17 adult females would be expected to survive and recruit into the breeding population (USFWS 2014b). To date, incidental take of spectacled eiders has not reached a level of concern for management of the species.

Recovery

The Spectacled Eider Recovery Plan (USFWS 1996) presents research and management priorities with the objective of recovery and delisting so that protection under the ESA is no longer required. Although the cause or causes of the spectacled eider population decline is/are not known, factors that affect adult survival are likely to be most influential on population growth rate. These include lead poisoning from ingested spent shotgun pellets, which may have contributed to the rapid decline observed in the Y-K Delta (Franson et al. 1995; Grand et al. 1998), and other factors such as habitat loss, increased nest predation, over harvest, and disturbance and collisions caused by human infrastructure. Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (Y-K Delta, North Slope of Alaska, and Arctic Russia): 1) is stable or increasing over 10 or more years and the minimum estimated population size is at least 6,000 breeding pairs, or 2) number at least 10,000 breeding pairs over three or more years, or 3) number at least 25,000 breeding pairs in one year. Spectacled eiders do not currently meet these recovery criteria.

4.6 Steller's Eider

The range of the Steller's eider is entirely within the Action Area; see the *Status of the Species* section for more information. Here, we consider further the existing environmental baseline risks from spills.

Status in the Action Area

The Arctic Coastal Plain Near Barrow

The vicinity immediately near Barrow supports the largest known concentration of nesting Steller's eiders in North America. Standardized ground surveys of 135 km^2 near the Barrow road system conducted since 1999 found an average density of 0.66 birds per km^2 (Rojek 2006) and estimated a Steller's eider breeding population of 84 birds (Rojek 2008). The highest numbers of Steller's eiders observed during ground surveys at Barrow occurred in 1999 with 135 males and in 2008 with 114 males (Safine 2011). Total numbers of nests found (those found viable [containing one or more viable eggs] and post-failure) ranged from 0–78 during 1991–2011, while the number of viable nests ranged from 0–27. Steller's eider nests were found in 12 of the 19 years sfrom 1991 to 2010 (Safine 2011). Most recently, 47 Steller's eider nests were found in 2014. The average population size of Steller's eiders breeding in the ACP was estimated at 576 (292–859, 90% CI; Stehn and Platte 2009).

Yukon-Kuskokwim Delta

Since the early 1990's, only a few pairs of Steller's eiders have nested on the Y-K Delta (Paul Flint, USGS, pers. comm.; Brian McCaffery, USFWS pers. comm.). In no single year have more

than three nests been found, despite extensive ground-based nest search efforts throughout the Steller's eider critical habitat area. Most recently, one Steller's eider nest was found near the mouth of the Tutakoke River on the central Yukon-Kuskokwim Delta in 2013 (Sowl 2013).

Critical Habitat Use and Designation

In 2001, the Service designated 2,830 miles^2 (7,330 km^2) of critical habitat for the Alaska-breeding population of Steller's eiders at historic breeding areas on the Y-K Delta, a molting and staging area in the Kuskokwim Shoals, and molting and wintering areas in marine waters at Seal Islands, Nelson Lagoon, and Izembek Lagoon (USFWS 2001). No critical habitat for Steller's eiders has been designated on the ACP. The Primary constituent elements of Steller's eider critical habitat in the Y-K Delta unit include all land within the vegetated intertidal zone, along with all open-water inclusions within that zone. The primary constituent elements for units designated for molting and wintering are marine waters up to 9 m (30 ft) deep and the underlying substrate, the associated invertebrate fauna in the water column, the underlying marine benthic community, and where present, eelgrass beds and associated flora and fauna (66 CFR 8850). The invertebrate fauna, including gastropods, bivalves, crustaceans, echinoderms, and macrobenthic invertebrates provide food for Steller's eiders (Petersen 1980

Threats and Possible Stressors in the Action Area

Oil Spills

Fuels and oils are toxic to Steller's eiders (Holmes et al. 1978, Holmes et al. 1979, McEwan and Whitehead 1980, Leighton et al. 1983, Holmes 1984, Leighton 1993, Rocke et al. 1984, Yamato et al. 1996, Glegg et al. 1999, Trust et al. 2000a, Esler et al. 2000) and their prey (e.g., amphipods and snails; Newey and Seed 1995 as cited in Glegg et al. 1999, Finley et al. 1999), and exposure of Steller's eiders to oil in harbors in Alaska has been documented (Miles et al. 2007). Therefore, we believe that petroleum hydrocarbons entering the marine environment from anthropogenic sources are likely to adversely affect Steller's eiders and their habitats.

Before fall migration in breeding and non-breeding years some Steller's eiders rest and forage in coastal waters of the Chukchi and Beaufort Sea (Figure 14). In breeding years, flocks of males have been found to stage along the coast near Barrow and may remain in the area until the second week of July. In non-breeding years, flocks are composed of both sexes and depart earlier (North Slope Borough Department of Wildlife Management, unpublished data). In breeding years, females may use the coastal areas later in the season. In 2008, 10 - 30 Steller's eider adult females and juveniles were observed daily from late August to mid-September (USFWS, unpublished data). In 2011, Safine (2012) investigated post-hatch movements of 10 Steller's eider hens with VHF transmitters and found females and fledged juveniles in nearshore waters of the Chukchi and Beaufort seas within approximately 18 km of Point Barrow from late August through early September. A small spill would likely affect a limited number of individuals near the spill site, but large spills that occur in near Point Barrow during the breeding season could affect a large number of Steller's eiders.

Steller's eiders congregate on the Kuskokwim Shoals during the molting season and prior to moving northward as the sea-ice breaks up and recedes. Over 15,000 Pacific wintering Steller's

eiders have been observed in Kuskokwim Bay at one time (Larned and Tiplady 1996). Satellite tracking and band recovery data described in Martin (2001) and Rosenberg et al. (2011) suggested disproportionately high use of Kuskokwim Shoals by molting Alaska-breeding Steller's eiders. In 2000 and 2001, two of three and five of ten marked birds molted in this area, respectively (Martin 2001). Although samples sizes were small, the apparent importance of this area to molting eiders prompted the Service to designate approximately 3,813 km^2 in the Kuskokwim Shoals as critical habitat (USFWS 2001). Currently, there is no oil development in the region; potential hazards due to shipping are limited to risk of spills from fuel barges *en route* to local villages. However, a large-scale gold mine is planned in the region in the near future. Project proponents have identified transportation of large amounts of fuel and other hazardous materials via the Kuskokwim River as a possible component of the project (Donlin Gold 2015).

After molting in the Kuskokwim Shoals, Alaska-breeding birds dispersed to various wintering locations along the Alaska Peninsula, some of which have also been designated as critical habitat. Several of these areas are harbors with significant levels of vessel traffic and industry, especially near Unalaksa (Dutch Harbor), Akutan, and Cook Inlet, and Kodiak. Spill risk in the Aleutians is generated by high levels of shipping, as described in the Environmental Baseline sections for the short-tailed albatross and sea otter. Cook Inlet and Kodiak Island also support substantial shipping associated with urban centers and fishing industries. Kodiak is listed as number four among the top 50 ports in the U.S. based on fisheries harvest volume. Vessel traffic ranges from small fishing and recreational vessels to large oil tankers and freight vessels. Both crude (though uncommon) and refined oil products are shipped through Cook Inlet and the waters adjacent to Kodiak Island. The Kodiak Area SCP (ADEC and EPA 2010) summarizes findings from a risk assessment completed in 1998. Important conclusions highlight the risk of ammonia spills from fish processing facilities, the large volumes of fuel stored by the USCG in Kodiak, and large number of underground storage tanks on former defense sites. Foreign-flag freight vessels, also pose a spill risk, especially early in transit when vessels carry large quantities of bunker crude oil (ADEC and EPA 2010). Hazards highlighted by the Cook Inlet SCP also include the area's strong tidal currents and seasonal ice (ADEC and EPA 2010).

Indeed, Larned (2000), expressed concern for the survival and reproductive success of the large number of Steller's eiders observed in harbors. The likelihood of exposure to spills in these areas is higher than in undeveloped areas, resulting in a substantial possibility that spill exposure can cause adverse effects to individual listed eiders. However, the tendency to disperse to various areas during the winter greatly reduces the risk that the listed population as a whole could be exposed to spills during winter.

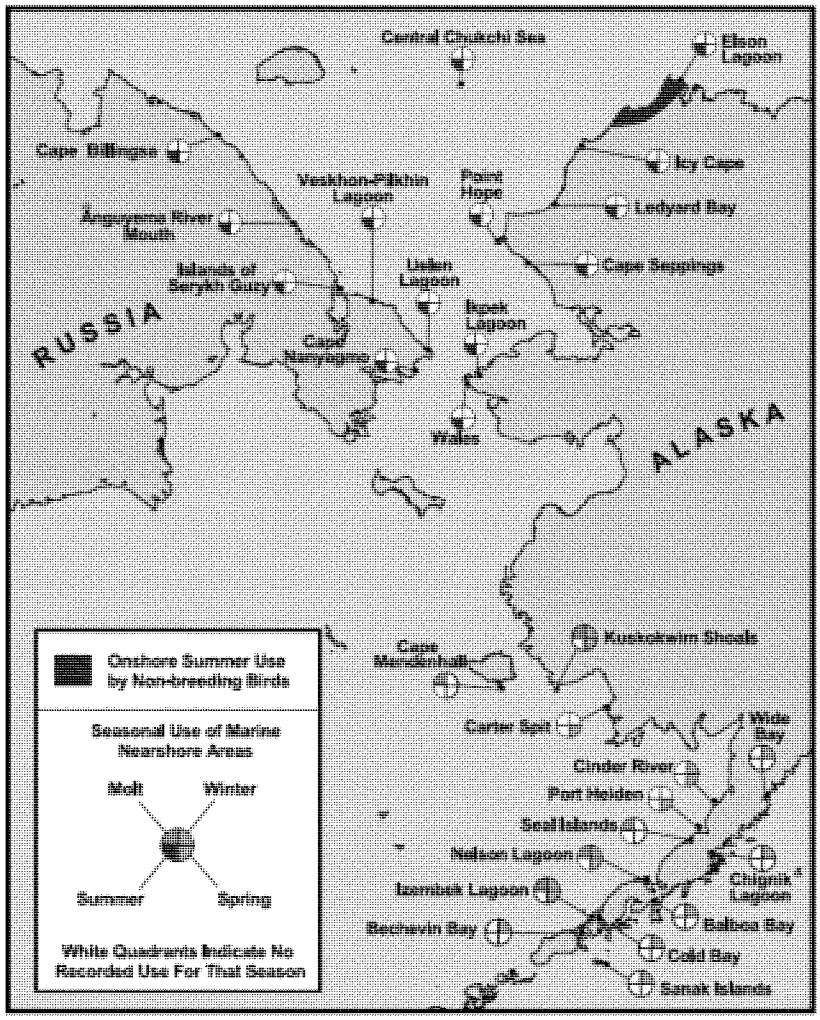


Figure 14. Distribution of Alaska-breeding Steller's eiders during the non-breeding season, based on locations of 13 birds implanted with satellite transmitters in Barrow, Alaska, during June 2000 and June 2001. Marked locations include all those at w which a bird remained for at least three days. Onshore summer use areas comprise locations of birds that departed Barrow, apparently without attempting to breed in 2001 (USFWS 2002). [Top]

Incidental Take: Research

The Service has issued permits under section 10 of the ESA to authorize take of endangered or threatened species for purposes of enhancement of propagation or survival. Annual reporting requirements reveal that 1,179 adults and 89 eggs were authorized to be taken as an indirect result of research activities between 1997 and 2012 (Table 7). These include permits issued to salvage and opportunistically collect up to 68 Steller's eider eggs from the Alaska-breeding population for a captive breeding program at the Alaska Sea Life Center. To date, 31 eggs have been taken. The eiders taken in these research programs have provided biological information and the eggs have been used to establish a captive breeding population of the species to ultimately improve our understanding of their reproduction in the wild and help future efforts to recover the species.

A total of 37 Steller's eiders were reported as actually taken, *incidental* to research activities, from 1997 to present. Because those birds were all from the wintering population, we applied the correction factor and determined that approximatelyonebird from the Alaska breeding population has died incidental to research activities. In addition to incidental take, since listing there have been 16 permitted and 16 actual, direct and *intentional* takings of Steller's eider adults on the wintering grounds. It is statistically unlikely that any of those individuals were from the North American breeding population.

Table 7. Incidental (i.e., unintentional), lethal take permitted by the Service for Steller's eiders under §10 of the ESA.

	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012*
Adult	965	12	18	26	29	16	14	24	28	18	25	0	3	1	0
Chick	5	4	5	19	7	7	7	7	7	7	0	0	7	7	0
Egg	0	0	108	114	0	24	24	24	44	20	0	0	0	0	0
Nest	0	0	0	20	3	3	3	5	5	5	2	0	<1	0	0

*As of May 1, 2012 [Top]

Incidental Take: Other Federal Actions

Since listing, permits have been issued for the incidental, lethal take of about 100 Alaska breeding Steller's eiders (Table 8). Although reporting is required upon issuance of an incidental take permit, it is not consistently provided, so we do not know how many eiders have been affected by disturbance, non-lethal, or lethal take. The level of take that has been authorized has not been expected to cause management concerns for the species.

Table 8. Incidental take of Steller's eiders permitted by section 7 of the ESA from 1997 to present.

Action	Year	Incidental Take	Estimated	Life Stage	Lethal
Akutan Mooring Basin	2003	Contaminants	9	Adults	N
Akutan Mooring Basin	2003	Collisions	1	Adults	Y
Akutan Transportation	2007	Disturbance	20	Adults	N
Alaska State's Mixing Zones Regulation	2011	Contaminants	36	Adult	Y
Barrow Airport Expansion	2006	Habitat Loss	29	Eggs/Chicks	N
Barrow Gas Fields Well Drilling Program	2011	Loss of	22	Eggs/ducklings	N
Barrow Global Climate Change Research Facility Phase 1 & 2	2005 & 2007	Collisions	1	Adults	Y
	2005 & 2007	Habitat Loss	25	Eggs/Chicks	N
Barrow gravel pad and 60-man camp	2012	Loss of	22	Eggs/ducklings	N
Barrow Hospital	2004 & 2007	Habitat Loss	17	Eggs/Chicks	N
Barrow Landfill	2003	Habitat Loss	1	Nest/y for 45 y	N
Barrow Tundra Manipulation Exp.	2005	Habitat Loss	1	Eggs/Chicks	N
	2005	Collisions	2	Adults	Y
Barrow Wastewater Treatment	2005	Habitat Loss	3	Eggs/Chicks	N
BLM Northern the National Petroleum Reserve-Alaska	2008	Disturbance	12	Eggs/Chicks/y	N
	2008	Collisions	<1	Adult	Y
BP Alaska's Northstar Project	2009	Collisions	≤ 1 /year	Adult	Y
Chignik Bay Tank Farm	2002	Contaminants	5	Adults	N
Chignik Dock	2002	Contaminants	4	Adults	N
Chignik Lagoon Tank Farm	2001	Contaminants	14	Adults	N
Chukchi Sea Lease Sale 193	2007	Collisions	1	Adults	Y
Fairweather Seismic	2003	Disturbance	66	Adults	N
False Pass Harbor	2001	Contaminants	4	Adults	N
USFWS Sport-harvest Regulations	2006	Harvest	1	Adults	Y

Goodnews Bay Processor	2008	Disturbance	28	Adults	N
Intra-service on Subsistence Hunting Regulations	2005	Harvest	17	Adults	Y
	2006	Harvest	14	Adults	Y
	2007	Harvest	Unspecified	Adults	Y
	2008	Harvest	Unspecified	Adults	Y
	2009	Harvest	Unspecified	Adults	Y
	2010	Harvest	Unspecified	Adults	Y
	2011	Harvest	4	Adult	Y
	2012	Harvest	4	Adults	Y
Nelson Lagoon Tank Farm	2003	Contaminants	20	Adults	N
	2003	Collisions	1	Adults	Y
NOAA National Weather Service Office in Barrow	2008	Collisions	1	Adults	Y
	2008	Disturbance &	< 10	Eggs/ducklings	N
NPDES-GP	2001	Collisions	1	Adults	Y
Oil and Gas Activities in the Beaufort and	2012	Collisions	1	Adults	Y
Sandpoint Harbor	2002	Contaminants	11	Adults	Y
	2002	Habitat Loss	1	Adults	N
	2002	Collisions	1	Adults	Y
Unalaska harbor	2007	Habitat Loss	1	Adults	N
	2007	Contaminants	1	Adults	N
	2007	Collisions	1	Adults	Y

[Top]

Recovery

The Steller's eider Recovery Plan (USFWS 2002) establishes criteria for reclassifying the species from threatened to endangered when either: (a) the population has ≥ 20% probability of extinction in the next 100 years for three consecutive years; or (b) the population has ≥ 20% probability of extinction in the next 100 years and is decreasing in abundance. The Alaska-breeding population would be considered for delisting from threatened status if it has ≤ 1% probability of extinction in the next 100 years, and each of the northern and western subpopulations are stable or increasing and have ≤ 10% probability of extinction in 100 years. A revision of the population viability analyses (PVA) for both the Alaska-breeding population and the Pacific population of Steller's eiders (Runge 2004) concluded that without reintroduction of breeding birds to the wild population, the listed population is at high risk of extinction (Swem and Matz 2008). Continuing efforts are needed to achieve recovery goals.

4.7 Summary

Habitat conditions throughout much of the range of listed species in Alaska are relatively pristine. Risks of spills are greatest in areas of oil and gas development, in urban areas and centers of industry, and along important marine shipping routes. Oil and hazardous material spills are most likely to have localized impacts to a small amount of habitat, affecting few listed animals. Large spills, although exceedingly rare, may affect large numbers of listed animals and have widespread impacts on habitat. Causes of population decline and current threats vary by species. Changes in ecosystem processes, whether involving changes in climate or predator/prey trophic interactions (sea Status of the Species for sea otters), are more important for the long-term outlook for Alaska's listed species than any other single factor. Historic spills have not been identified as a cause of decline; the risk of future spills has not been identified as a limitation to recovery.

5.0 EFFECTS OF THE ACTION

In this section we analyze direct, indirect, interrelated and interdependent effects of the Action on listed species to determine if implementation of the Unified Plan is likely to reduce the likelihood of survival or recovery for each listed species or adversely modify critical habitat in the Action Area. This BO relied upon the statutory provisions of the ESA to complete our analysis of impacts to critical habitat, rather than on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02.

We used an ecological risk assessment framework similar to a process developed and employed by the EPA (2000; Figure 15). Ecological risk assessments are formatted to include the following steps: problem formulation; exposure analysis; hazard analysis; and risk analysis. Our Effects Analysis followed these steps, replacing the term, "Hazard Analysis"' with "Response Analysis" because some outcomes of oil spill response may be beneficial rather than negative.

The Exposure Analysis is a population-level assessment, using a hypothetical worst-case scenario, and based solely on the spatial scale of the response actions worst-case scenario relative to the distribution of the listed species and critical habitat. In it, we considered whether the implementation of the Unified Plan could reduce the likelihood of survival or recovery for each listed species or adversely modify critical habitat under worst-case scenario conditions. The Response Analysis is an individual-level impact assessment, and consideration of the effects of spill response actions on quantity, quality, or availability of physical or biotic features (PCEs) impacting the value of critical habitat at any spatial scale.

The Risk Characterization Analysis combines evaluations of Exposure and Response, with factors that modify likelihood of occurrence. To credibly identify an ecological risk, there must be exposure, an adverse response to that exposure, and a measurable and significant likelihood of occurrence. We predicted impacts to current population viability of listed species by evaluating changes in an individual's fitness (e.g., impacts to survival, growth, and reproduction) and evaluating whether individual impacts would affect the population. If we predicted a reduction in either 1) population viability or 2) the conservation value of critical habitat, we evaluated the probability of appreciably reducing survival or recovery of the listed species.

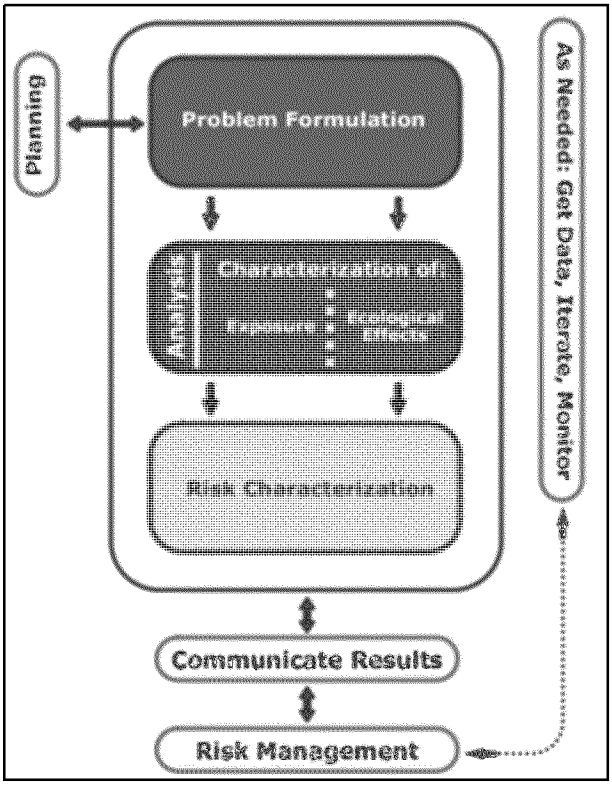


Figure 15. The standard steps of an ecological risk assessment (EPA 2000). [Top]

5.1 Exposure Analysis

Methods

We evaluated the potential for population-level exposure to harmful actions proposed by the Unified Plan by first considering a plausible but hypothetical worst-case scenario oil spill that could imperil a listed population or could cause widespread degradation to the value of the designated critical habitat. The worse case scenario was selected based on what event could have the worst outcome (the largest impact) for the species and critical habitat. If the hypothetical worst-case-scenario oil spill alone was not likely to imperil the population, we assessed the scale of additive impacts of stressors resulting from spill response that would be needed to have this effect. We conducted this Exposure Analysis because the effects from a spill are inherently difficult to separate from the effects of spill response. If extinction probability is low after considering the spatial extent of a worst-case scenario oil spill combined with oil spill response activities, then it is unlikely that spill response actions alone or in smaller events could jeopardize the continued existence of a listed species. Steps for the exposure analysis for each listed species follow.

- When available, existing population models were used to assess and predict functional extinction (Mcgowan and Ryan 2010).
- The maximum extent of spill response actions were assumed by hypothesizing a plausible worst-case scenario spill (i.e., EVOS or DHS).

- Worst-case spill scenario was assigned using a reality-based assessment of the species range in proximity to the most likely type of spill (i.e., tanker accident versus oil well blow out).
- Species distribution in space and time was based on life history described in the Status of the Species section.
- Maximal extent of a hypothetical action was overlain on the geographic distribution of a listed species to evaluate potential exposure.
- Estimated number of individuals lost was compared with published estimates for minimum viable population (MVP) sizes to determine severity of population impacts given a worst-case scenario.

Assumptions

The following assumptions were made to facilitate the Exposure Analysis:

1. Within the hypothetical spill extent, 100% mortality of exposed animals was assumed. This assumption will likely overestimate impacts, but is the most conservative and protective approach for assessment of impacts for the listed species.
2. The scale of a spill response action is generally consistent with the scale of the spill. While some spill response actions, especially use of dispersants, may change the dimension of the potential impact (e.g., move spilled oil to the water column instead of the surface), we assumed no response measures vastly increase the impact of the spill.
3. A worst-case scenario in southwest and southcentral Alaska, including the Bering Sea, Bristol Bay and Aleutians, would not exceed the scale of the 1989 EVOS. On March 24, 1989, the Tanker Vessel Exxon Valdez ran aground on Bligh Reef in Prince William Sound. At least 10.8 million gallons of North Slope crude oil was spilled (EVOS 2009). Over the two months following the spill, the oil spread to the southwest along the coast, fouling beaches and marine waters as far as 800 km (500 miles) from the source of the spill. An estimated 2,100 km (1,300 miles) of shoreline in Prince William Sound, the Kenai Peninsula, Kodiak Island and the Alaska Peninsula were oiled; surface oil was detected over approximately 28,000 km^2 (11,000 mi^2) of ocean (EVOS 2009).
4. In the Chukchi and Beaufort seas, a worst-case scenario would not exceed the scale of the DHS. The DHS began on April 20, 2010, following the explosion and sinking of the Deepwater Horizon oil rig. The exploratory well flowed for 87 days. An average of 11,130 tons of gas and oil compounds were released per day (equal to about 59,200 bbls of liquid oil per day) (Ryerson et al. 2012). An estimated total of 4.9 million bbls (210 million gal) of oil was released (USCG 2011). Surface oil was detected on an aggregate total of 180,000 km^2 (68,000 mi^2) of ocean (Skytruth 2010). Total length of oiled coastline was approximately 1,728 km (1,074 miles); the oil slick traveled 357 km (222 miles) from the location of the leaking well (Norse and Amos 2010). The visible surface slick represented about 15% of the total leaked gas and oil; about 36% remained underwater (Ryerson et al. 2012). During the spill, 1.84 M gal of chemical dispersants were applied below the sea surface and to oil slicks at the surface (White et al. 2014). Appendix E provides additional information as to why subsea dispersant application is not considered in this BO.
5. Less than 1% of all Steller's eiders occurring on the wintering grounds in Alaska are from the listed population (see Status of the Species for more information). Because the

Alaska breeding population mixes with non-listed Russian-breeding birds during the non-breeding season there is no way to distinguish between populations.

Species-Specific Analyses

Northern Sea Otter

We evaluated the scale of the worst-case scenario for the listed DPS of northern sea otter by assuming an event the size of EVOS occurred within their range. The EVOS was selected because sea otters range throughout southwest Alaska where oil and gas development is limited, but shipping is common. A major international ship transit route (the Great Circle Route) passes through sea otter critical habitat in the Aluetians and is used by oil tankers. To evaluate population-level effects, the spatial extent of an EVOS-sized spill was superimposed on the range of the listed sea otter (Figure 16). We estimated the longest end-to-end measurement of the area affected by EVOS (a straight line estimate) by measuring the maximum extent from an ArcGIS shapefile (EVOS 1993). The EVOS (1993) shapefile is a convex hull polygon, and includes all detected oil, thus represents the maximum extent of the spill. We overlaid this maximum-extent polygon onto a polygon depicting the range of the listed otter. We estimated the maximum linear extent of habitat occupied by listed sea otters covered approximately 2,972 km, compared with the linear extent of EVOS (1,045 km). Comparing these values, approximately 35% (1045/2972 = 0.352) of the spatial extent of the listed sea otters could be affected by an EVOS-sized spill.

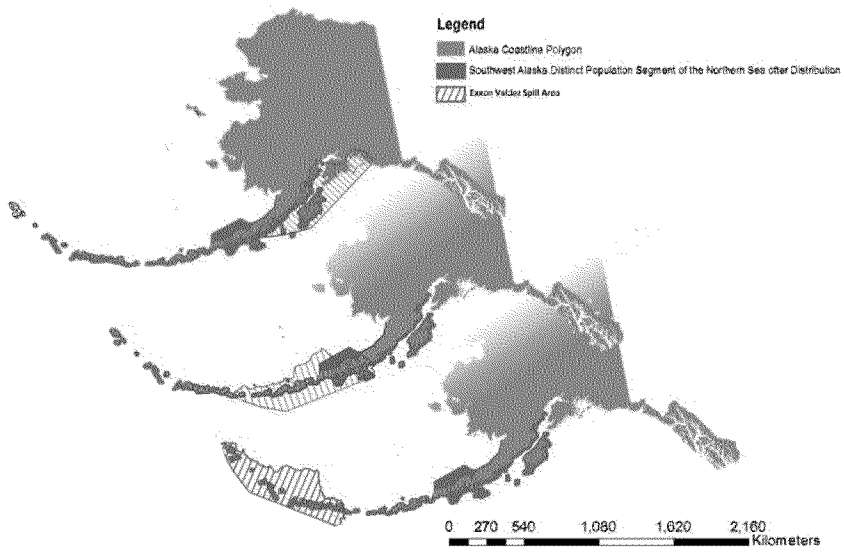


Figure 16. Exxon Valdez spill area (EVOS 1993) superimposed on the range of the listed sea otter. [Top]

To assess the maximum number of otters potentially affected, we estimated the density of sea otters within the area of a hypothetical EVOS-sized spill. Density was estimated by dividing the most recent population estimate in each sea otter management unit (USFWS 2014b) by the area

of habitat potentially occupied by listed sea otters within those management units from data published by the Service (USFWS and USGS 2015; Table 9). The highest density estimate was 1.79 sea otters per km^2.

The amount of sea otter habitat affected by EVOS was documented during post-spill sea otter surveys. Approximately 17,027 km^2 was impacted by the spill: 2,358 km^2 in Prince William Sound (Bodkin et al. 2002); 4,131 km^2 in Kenai Peninsula (Bodkin and Udevitz 1994); 4,601 km^2 in Kodiak and Afognak islands; and 5,937 km^2 along the Alaska Peninsula (Degange et al. 1995). Assuming a maximum density of 1.79 otters per km^2 and an area of impact of 17,027 km^2, the total number of sea otters that would be affected in the worst-case scenario is 30,478 individuals (17,027 x 1.79 = 30,478). The current minimum population estimate of listed sea otters is 45,064 (USFWS 2014b). If a hypothetical event removed 100% of affected otters from the spill area, 14,586 would remain, representing a 67.6% decline (45,064 - 30,478 = 14,586; [1-(14586/45064)] x 100 = 67.6%).

Table 9. Density of northern sea otters by management unit (USFWS and USGS 2015).

Management Unit	Area in Range of otters (km^2)	Population estimate:	Minimum population:	Density of otters/km^2
Bristol bay	24,326	11,253	8,535	0.46
Kodiak, Kamishak, Alaska Peninsula	13,971	25,018	21,063	1.79
South Alaska Peninsula	15,235	9,758	8,158	0.64
Western Aleutian	10,149	8,742	7,309	0.86
Total	**63,681**	**54,771**	**45,064**	

[Top]

A 74% decline in the number of listed sea otters was compared to the estimate of MVP size; a MVP is the smallest size required for population persistence over a specified length of time (Shaffer 1981). A recent population viability analysis (PVA) determined the critical density below which there is a >5% probability of extinction within a 25-year period. We equate this to the MVP because it represents the minimum population size with 95% probability of continued existence in the absence of additional stressors. MVP size was estimated by region as follows: 703 in the Western Aleutians; 338 in the Eastern Aleutians; 406 in Bristol Bay; 368 in South Alaska Peninsula, 368; 507 in Kodiak, Kamishak, and Alaska Peninsula; an estimated total of 2,322 otters ensures a high probability of survival of the listed sea otter (USFWS 2014b).

Under our assumed worst-case scenario, approximately 14,586 listed sea otters would remain in areas unaffected by the spill. This value represents more than six times the estimated MVP size (i.e. the number of otters required to sustain the population; [14,586/2,322] = 6.28). Using this model, a worst-case scenario at least 40% larger than EVOS with a 100% mortality rate would be needed to place the species at risk of extinction. This is because a 40% larger area equals 1.4 times the spill area (17,027 km^2 x 1.4 = 23,838 km^2 affected). The number affected within the larger area would be 23,838 km^2 x 1.79 otters/km^2 = 42,670 sea otters. The total population is 45,064. Subtraction of 42,670 otters during a spill 40% larger that EVOS would leave 2,394

otters remaining (45,064 – 42,670 = 2,394). Only a spill response on an event 40% larger than EVOS could potentially jeopardize the continued existence of the listed sea otter.

We evaluated effects of oil spill response on sea otter critical habitat by considering the effects of a hypothetical worst-case scenario on the physical and biological features of the habitat of primary importance to the sea otter. The physical and biological features susceptible to oiling include food resources and kelp beds in shallow water near shore. In a worst-case scenario, we assumed that food resources were rendered unsuitable to support the affected population and kelp beds were removed within the entire spatial extent of the spill and response areas. The species-level consequences would be no different than what was described under our 100% mortality model, resulting in a 74% reduction in the number of otters. Using the MVP model above, the remaining critical habitat would be sufficient to support the listed otter population.

Short-tailed Albatross

The short-tailed albatross' oceanic range includes the Bering Sea, Gulf of Alaska, North Pacific Ocean, Russia's Sea of Okhotsk, and recently, a few birds have been observed in the Chukchi Sea. However, because they range primarily south of St. Lawrence Island in Alaskan waters, the most realistic worst-case scenario oil spill for this species is EVOS. This scenario is appropriate due to frequent use of the Great Circle Route through the Aleutian Islands by shipping vessels, including tankers.

Estimation of individual short-tailed albatross potentially affected at the spatial scale of EVOS was accomplished by calculating their core-range density. Albatrosses travel widely across vast oceans, and their habitat use is not uniform. However, at-sea observations and satellite telemetry data reveal preferred areas near continental shelf breaks and island passes. To focus our assessment on the core range of the species, we analyzed 95% kernel density from a database containing all available observation data (USFWS unpublished data). Kernel density is used for estimating distributions and habitat preference across a wide variety of taxa including albatross (Hyrenbach et al. 2002; Lichti and Swihart 2011). Using this technique, we estimated the area comprising the core density of short-tailed albatross is 1,179,457 km^2; 62.3% is within or near the U.S. EEZ (Figure 17).

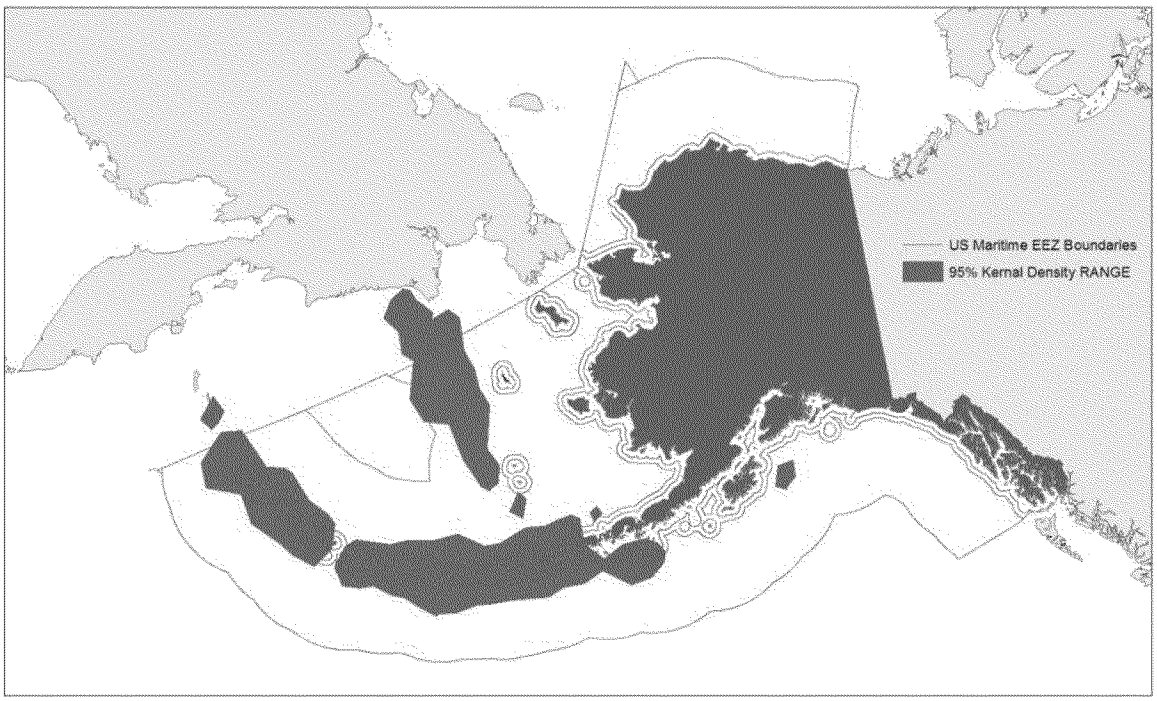


Figure 17.Short-tailed albatross range in the U.S. Exclusive Economic Zone, as estimated from 95% kernel density. [Top]

The density of albatross within the core range was calculated using the most recent population estimate of 4,354 individuals (USFWS 2014a), yielding a density of 0.0037 birds per km^2 (4,352/1,179,457 = 0.0037). This estimate assumes the entire population occurs within the 95% core range area, and is evenly distributed throughout. To assess the proportion of the population impacted by a hypothetical worst-case scenario oil spill, the density estimate of 0.0037 albatross/km^2 was multiplied by131,880 km^2, the maximum area of the EVOS spill, which was estimated with a convex hull polygon of the spill area (EVOS 1993) using ArcGIS Xtools Pro 9.0. Our area calculation overestimates published values for the area affected by EVOS because it is created from the convex hull polygon, which includes areas between points where no oil was detected. For the purposes of this effects analysis, we believe this overestimate is acceptable because it is conservative, capturing the entire range of possible impacts. Therefore, the number of albatross affected by a hypothetical worst-case scenario the size of EVOS would be 487 short-tailed albatross (0.0037 albatross/km^2 x 131,880 km^2 = 487 albatross).

Assuming 100% mortality from the hypothetical oil spill, the listed population of short-tailed albatross would be reduced by 11.2% (487/4,354 x 100 = 11.2%). Finkelstein et al. (2010) estimated the minimum number of individuals necessary to sustain the short-tailed albatross population is 100 adults. Finkelstein (2010) further postulates that for short-tailed albatross, a quasi-extinction threshold of 100 adults may be conservative given their ongoing recovery from near extinction in the early 20th century when population numbers may have fallen below 100 breeding-age adults (Austin 1949). Thus, the number of albatross remaining after our hypothetical worst-case event would be nearly 39 times the MVP size of 100 adults (4,354 – 487 = 3867). According to our model, an oil spill at least 8.7 times larger than EVOS would

appreciably reduce survival or recovery of short-tailed albatross (8.7 x 131,880 km^2 = 1,147,356 km^2 affected; 1,147,356 km^2 x 0.0037 albatross/km^2 = 4,235 albatross affected, 4,354 – 4,235 = 119 albatross remaining). Because these conditions are highly unlikely to occur given the current state of oil and gas use, transportation, and development within the action area, we have determined that baseline conditions plus spill response actions would be highly unlikely to cause species-level impacts to the short-tailed albatross.

Polar Bear

We estimated the number of polar bears affected by a hypothetical worst-case scenario oil spill by overlaying the geographic extent of DHS with the geographic distribution of polar bears (Figure 18). The DHS was selected because it is the worst spill in U.S. history and resulted from oil and gas exploration, and the polar bear's range overlaps regions of offshore oil and gas exploration and development. Using the convex hull polygon technique described above, we utilized cumulative daily satellite imagery (NOAA and UNH 2015) and delineated 405,569 km^2 as the spatial extent of the DHS. Due to the deep water source of the spill and subsurface use of dispersants in the DHS, the extent of surface oil may not fully represent the area of impact in the Gulf of Mexico, but it was the best available spatial geographic information available at the time of this analysis.

An estimated 20,000 - 25,000 polar bears (Obbard et al. 2010) range over land and water spanning an area of about 24 M km^2 (Figure 18). Based on current population estimates, the combined size of the two U.S.-managed subpopulations is 2,907 (2,000 for the A-C stock + 907 for the SBS stock = 2,907). We estimated the combined marine range of the SBS and A-C stocks as defined by IUCN/PBSG 2009) using ArcGIS Xtools Pro 9.0 to be 1,591,928 km^2. Our effects analysis considered a hypothetical, worst-case scenario oil spill similar to the DHS-sized well blowout with an area of 405,569 km^2. This area covers a small fraction, just 1.7% of the polar bear's global range ([405,569 km^2 / 24,000,000 km^2] x 100 = 1.7%) and approximately 25% of the 1,591,928 km^2 in the combined range of the SBS and A-C stocks ([405,569 / 1,591,928] x 100 = 25%). Assuming habitat impacts equate to a proportional impact to the population, we expect a 25% decline in the A-C and SBS stocks or a loss of 727 bears; 3.6% of the minimum estimated global population size ([727/20,000] x 100 = 3.6%). Our estimate of the proportion of the global population affected by the worst-case scenario used the minimum estimated population size because it represents a larger proportional impact to the population and therefore is a more conservative estimate of impacts to the population.

To ensure our analysis did not underestimate effects, we hypothesized the DHS-sized oil spill eliminated all of the individuals in the SBS and A-C stocks. This extremely unlikely exposure scenario would result in a loss of 2,907 polar bears from the global population. Using the lower bound for the global population estimate of 20,000 bears, and subtracting 3,000 bears from both U.S.-managed sub-populations in their entirety (recognizing that the 2,907 estimate implies false precision where numbers are actually uncertain), approximately 17,000 polar bears would remain in the global population. Reed et al. (2003) used PVA to estimate MVPs for 102 vertebrate species, one of which was polar bears. The authors defined the MVP as having a 99% probability of persistence for 40 generations and estimated the MVP size for polar bears at 4,519

animals (Reed et al. 2003). The estimate for the remaining population is 3.8 times the MVP of 4,519, leaving a considerable safety factor for the global polar bear population.

Using these estimates and assumptions, an event would have to occur on a scale five times greater than our hypothetical event to leave behind a population size near the MVP for polar bears (5 x 3,000 = 15,000 bears lost; 20,000 – 15,000 = 5,000 bears remaining). Such an event would then have to be followed by spill response actions as described in the Unified Plan that further reduced the population below the MVP. Hence, spill response actions would need to be five times greater than the effects of this worst-case spill event. Considering the entire geographic distribution of the polar bear, a hypothetical worst-case scenario oil spill would have to decimate eight out of the 19 largest populations. These populations occupy approximately 5,794,330 km^2, or an area 14.3 times larger than the maximum extent of impact of DHS (405,569 km^2 x 14.2869 ≈ 5,794,330 km^2). In conclusion, it is extremely unlikely that polar bears could be exposed to a spill response scenario at a scale that could jeopardize their continued existence.

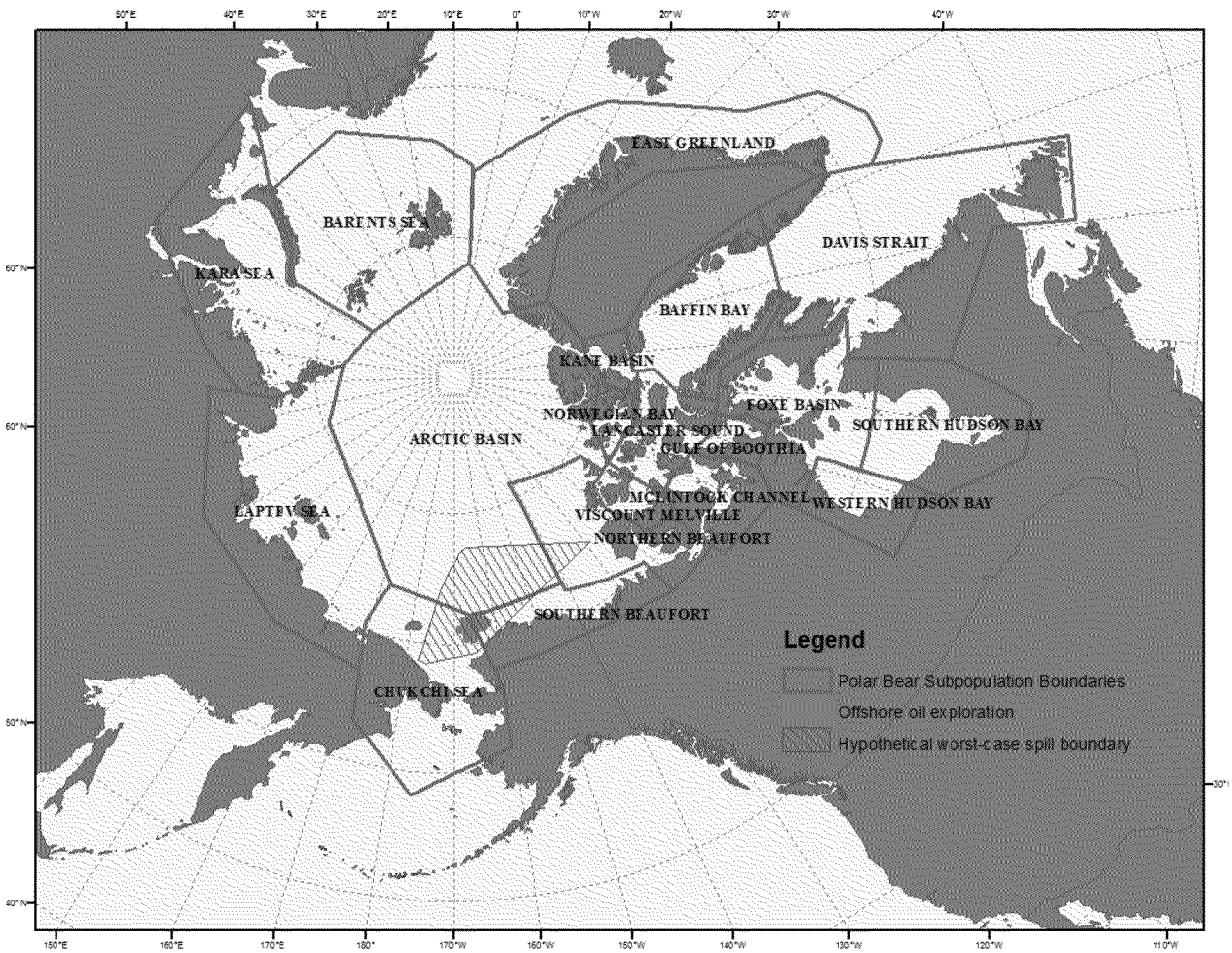


Figure 18. Polar bear range and subpopulations, with hypothetical worst-case scenario spill superimposed. [Top]

Pacific Walrus

We estimated the number of Pacific walrus affected by a hypothetical worst-case scenario oil spill by overlaying the geographic extent of DHS with the geographic distribution of the walrus. The DHS was selected because as with polar bears, the range of the walrus overlaps oil and gas exploration areas. We calculated number of walruses affected in two ways: first, by assuming walruses were lost in proportion to the amount of habitat affected; second, by calculating numbers of walruses lost based on numbers of haulouts affected. As with polar bears, the geographic extent of surface oil from a DHS-like oil spill is hypothesized to cover 405,569 km^2.

Population surveys, haulout monitoring, and satellite tracking studies indicate Pacific walruses generally occur in three areas during summer and autumn: Bering Sea, western Chukchi Sea and eastern Chukchi Sea. Most males occupy the Bering Sea; juveniles and adult females are distributed in Russian waters in the western Chukchi Sea near Wrangel and Herald islands, and another subset of females and young are in the eastern Chukchi Sea with high densities in the Hanna Shoal area (Fay 1982; Jay et al. 2012). Pacific walrus across their range are most vulnerable to oil spills in the Chukchi Sea because all breeding females are distributed there as they follow the retreat of ice in the spring (Burns 1965; Fay et al. 1997), and offshore drilling is planned for this area (ASRC 2012). Given these vulnerabilities, a DHS-sized oil spill in the Chukchi Sea was considered the worst-case scenario for evaluation of the scale of spill response.

Walrus habitat in the Chukchi Sea extends to the edge of the continental shelf (the 150-m isobaths; Jay et al. 2010). Much of the Chukchi Sea is suitable habitat for walrus except for where water depths exceed 100 m (USFWS 2013). The Service estimates walruses occupy 600,000 km^2 in the Chukchi. A DHS-sized oil spill there could affect 67.6% of Pacific walrus habitat ([405,569/600,000] x 100 = 67.6). Currently, the best estimate of numbers of Pacific walruses is 129,000 animals (Speckman et al. 2011). An assumed 100% mortality rate of animals exposed to a DHS-sized oil spill that affects 67.6% of walrus habitat would result in a loss of 87,197 individuals (129,000 x 0.676 = 87,179).

Habitat use by walruses in the Chukchi Sea is highly variable from year to year depending on conditions of sea-ice. Historically, tens of thousands of walruses gathered in coastal areas along the Russian shores of the Chukchi Sea (Fay 1982; Kochnev 1999, 2004, 2006). During recent years of limited sea-ice, large haulouts consisting of greater than 10,000 animals have been documented along both the eastern (U.S.) and western (Russian) shores (Ovsyanikov et al. 2007; Kavry et al. 2008; Fischbach et al. 2009; Clarke et al. 2011). Twelve haulout sites are known along the Russian coast and 11 along the U.S. Coast; four additional haulouts are commonly seen along the shores of Wrangel and Herald islands (Garlich-Miller et al. 2011). If a DHS-sized oil spill were to occur from the Chukchi Sea oil and gas exploration area, it could affect 16 haulouts, based on the maximum distance oil was observed from the DHS well site. Assuming an equal distribution among haulouts and loss of 100% of animals at affected sites, a DHS-sized event would result in loss of 59% of the population (12+11+4=27; [16/27] x 100 = 59%). This degree of impact would result in loss of 76,444 animals (129,000 x 0.59 = 76,444).

Of these two methods of estimating the impacts to walruses, the former would result in a greater degree of impact than the latter, and is therefore is more conservative. In order to ensure that our

analysis does not underestimate potential impacts, we assumed the worst-case scenario resulted in loss of 87,197 animals. Under this scenario, 41,803 walruses (129,000–87,179 = 41,803) would remain.

An estimate of MVP is unavailable for Pacific walrus. The polygynous mating system of walruses (Fay et al. 1984) necessitates inflating the theoretical MVP compared to random breeding systems because the effective population size must be greater to maintain similar genetic diversity (Franklin 1980; Soule 1980; Thompson 1991). Minimum population sizes ranging from 1,000 - 10,000 have been recommended for conservation of wild vertebrates (Traill et al. 2007; Thompson 1991; Salwasser et al. 1984; Belovsky 1987; Soule 1987). Reed (2003) used PVA to estimate MVPs for 102 vertebrate species and found the mean and medians were 7,316 and 5,816 individuals (respectively), and recommended that in the absence of sufficient information to conduct a PVA reflecting species' demographic parameters, adopting an MVP of 7,000 adults is a conservative value to ensure persistence of wild species.

An estimated population size of 41,803 Pacific walrus remaining after a hypothetical worst-case scenario oil spill the size of the DHS in the Chukchi Sea is six times greater than the Reed (2003) conservative MVP size of 7,000 animals ([41,803 / 7000] = 5.9). This level of impact alone is not likely to imperil the species. However, an oil spill 40% larger than DHS with a 100% mortality rate may cause concern for the species. Multiplying 1.4 by 405,568 km^2 to represent a spill 40% larger than DHS yields a 567,796-km^2 area. This larger area is approximately 95% of the total available walrus habitat in the Chukchi Sea ([567,796 / 600,000] x 100 = 94.6). An equivalent reduction in the population would leave 6,924 walruses remaining (129,000 – [129,000 x 0.946] = 6,924). Therefore a spill would need to exceed the scale of DHS by 40% or more to potentially jeopardize the species. In conclusion, Pacific walrus are not likely to be exposed to spill response actions at a scale that could have species-level impacts. The listed population is too dispersed relative to the scale of the Action.

Spectacled Eider

We estimated the number of spectacled eiders affected by a hypothetical worst-case scenario oil spill by overlaying the geographic extent of EVOS with the geographic distribution of the eiders where the entire world population congregates during winter: the designated critical habitat in the polynyas between St. Lawrence and St. Matthew islands. During winter, 370,000 spectacled eiders congregate in large, dense flocks in pack ice openings south of St. Lawrence Island in the central Bering Sea (Larned et al. 1995c; Larned et al. 2012). Spectacled eiders from all three known breeding populations use this wintering area (USFWS 1999a); no other wintering areas are currently known. An EVOS-sized event occurring here would have the potential to affect a substantial portion of the designated critical habitat and could affect the entire listed population. Because spectacled eiders occupy three major breeding areas (coastal areas in Russia, the North Slope, and the Y-K Delta), a major spill event occurring in their breeding range would not affect the entire population, even if that event were a well blowout the size of DHS. Therefore, an event in the wintering habitat was selected as the worst-case scenario based on the potential to affect the largest number of birds. EVOS was selected because there is no oil or gas development in this region of the Bering Sea.

The area provides physical and biological resources (the PCEs) of critical habitat necessary for the survival of wintering spectacled eiders. These include marine waters greater than 5 m (16.4 ft), and less than or equal to 25 m (82.0 ft) in depth, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community.

The area affected by a hypothetical EVOS-sized spill would exceed the size of the designated critical wintering habitat (Figure 19). Spilled oil could affect all the birds in the area and could reduce the quantity and quality of benthic invertebrates eaten by eiders. If we assume that exposure to such an event would result in 100% mortality of eiders and complete loss of the food values present in the critical habitat unit, we must conclude that the species would be in peril of extinction and the value of the critical habitat would be severely degraded. Any additional stressors imposed by spill response activities that further reduced the fitness of individuals or caused additional habitat degradation, no matter how large those stressors were, could cause the continued existence of the species to be jeopardized or could adversely modify the critical habitat.

The worst-case scenario evaluation for this species indicates that there is potential for exposure and associated impacts at the species level. This scenario relies on assumptions that allow the analysis to overestimate the effects that would be observed in a real world situation. It does not address the variables that would determine actual exposure levels or the likely individual responses of spectacled eiders if such an event were to occur. It is therefore not intended to evaluate the effects of such a scenario under real-world conditions. To do this, we consider potential stressors arising from spill response in the Response Analysis section and we incorporate the level of risk faced by the species given the existing environmental baseline in the Risk Assessment section below.

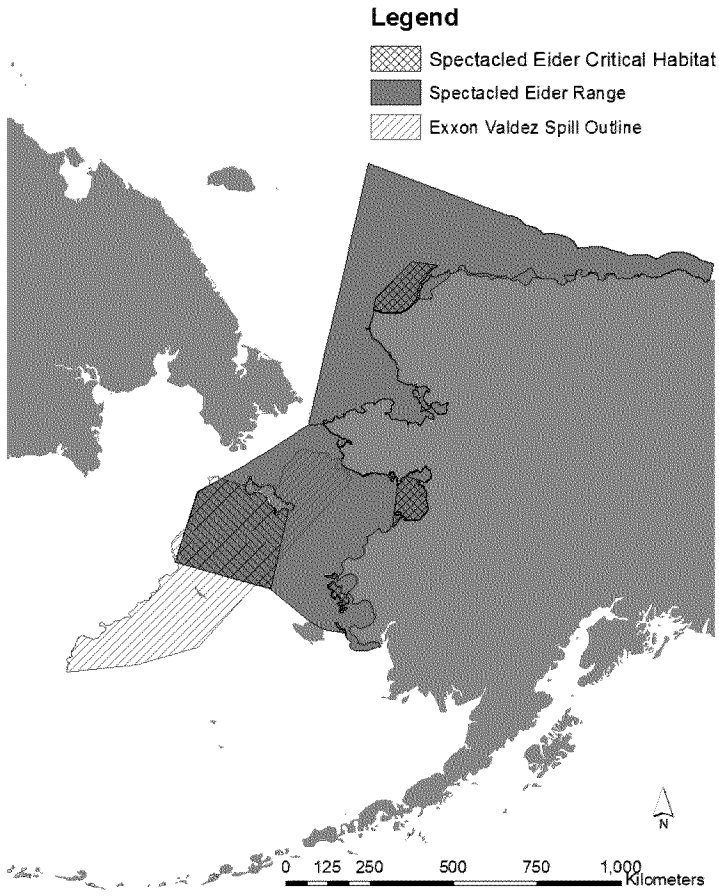


Figure 19. Map of Alaska and Russia showing critical habitat for spectacled eiders with the spatial extent of the Exxon Valdez oil spill superimposed over critical habitat designated for winter use. [Top]

Steller's Eider

Two hypothetical worst-case scenario oil spills were evaluated as for the Steller's eider: a large and prolonged hypothetical spill like the DHS, occurring near the breeding grounds in the Arctic Coastal Plain (ACP); and a hypothetical spill like EVOS occurring near the Kuskokwim Shoals Critical Habitat Unit (KSCHU) near the coast of the Y-K Delta. The reason we considered two scenarios for Steller's eiders was to evaluate potential for jeopardy AND adverse modification of critical habitat. The worst-case scenario was different for the listed species than for the habitat. The worst-case scenario for the species is a North-slope blowout affecting the large majority of Steller's eiders as they stage near the breeding habitat, but there is no critical habitat on the North Slope. The worst-case scenario for the designated critical habitat would be a large spill in a designated unit, but this type of event would not affect the entire population. Therefore, both scenarios were evaluated. For the other species with designated critical habitat, the evaluations of the worst-case scenario for habitat did not differ from the worst-case scenario for the species. A DHS-sized spill was considered a plausible scenario for the

listed Steller's eiders that nest on the ACP because nearshore coastal oil development occurs in the Southern Beaufort Sea.

Eiders stage along the coast near the Barrow Triangle prior to and after the nesting season as well as non-breeding years. It is not currently known whether all Alaska-breeding Steller's eiders stage in these areas, but evidence suggests this section of coastline provides important habitat for a large proportion of the listed population. The DHS affected approximately 1,728 linear km of coastline. A well blowout of this size in the Southern Beaufort Sea could affect an area nearly twice the length of coastline adjacent to Steller's eider breeding areas between Wainwright and the mouth of the Sagavanirktok River (approximately 900 linear km of coastline). We assume that if a DHS-type spill occurred during a breeding year, it could impact 90% of the North Slope breeding population and the remaining 10% would include non-breeders and birds nesting on the Y-K Delta. Although we are uncertain about the accuracy of this estimate, a small number of Steller's eiders are known to remain along the Alaska Peninsula and Kachemak Bay during the summer; approximately 100 have been observed in Kachemak Bay, while a few may spend the summer at Izembek Lagoon (Chris Dau, USFWS, unpublished data). It is not known whether Steller's eiders delay breeding until their second year, as some other eider species do (Baillie and Milne 1982), but for this analysis we assume the number of non-breeders plus the Y-K Delta population is not greater than 10% of the population.

The current estimated size of the ACP Steller's eider population is 576 individuals (95% CI: 292–859) (Stehn and Platte 2009), and on the Y-K Delta only a dozen or so birds are thought to breed (USFWS unpublished data). A worst-case scenario leading to 100% mortality of 90% of the population would leave only 60–80 animals, including Y-K Delta birds. However, because Steller's eiders stage asynchronously in coastal waters along the ACP; males use the area in June and July, females with broods can stay through September, we have unquestionably overestimated potential impacts. The actual degree of exposure to a DHS-sized event and the resulting impacts would vary among segments of the population.

Runge (2004) estimated a starting population size of 2,500 breeding female Steller's eiders had a 100% probability of declining below a MVP size of 50 birds in 20 years. This model incorporated input parameters with a high degree of uncertainty and assumed no immigration or emigration from Russian-breeding Steller's eiders (Runge 2004). This assumption may be incorrect, thus, these extinction probabilities for the Alaska-breeding population may be overestimated (Swem and Matz 2008). A reassessment of parameters used in Runge's (2004) PVA revealed unresolvable uncertainties in vital rates and resultant extinction probabilities, but still suggested that the Alaska-breeding population of Steller's eiders may now be critically imperiled (Swem and Matz 2008). Without significant increases in adult survival and reproductive success, or use of management techniques such as population augmentation, the listed entity is likely to become extinct within a few decades at most (Swem and Matz 2008). If 60–80 birds remained after a worst-case scenario oil spill, any additional stressor imposed by spill response activities could further reduce likelihood of survival of the species.

An EVOS-like oil spill occurring near the KSCHU during the molting season (August through September) is the worst-case scenario when considering impacts to Steller's eider critical habitat. The KSCHU is located in remote western Alaska at the mouth of the Kuskokwim River.

Currently, there is no oil development in the region, and potential hazards due to shipping are limited to risk of spills from fuel barges *en route* to local villages. However, a large-scale gold mine is proposed in the region, and fuel and hazardous material transportation to and from the mine is planned using barges on the Kuskokwim River (Donlin Gold 2015).

Steller's eiders congregate on the KSCHU both during the molting season in the fall and prior to moving northward as the sea-ice breaks up and recedes in the spring. Over 15,000 Pacific wintering Steller's eiders have been observed in Kuskokwim Bay at one time (Larned and Tiplady 1996). Satellite tracking and band recovery data described in Martin (2001) and Rosenberg et al. (2011) suggests disproportionately high use of KSCHU by molting Alaska-breeding Steller's eiders. In 2000, two of three, and in 2001, five of ten marked birds from Alaska-breeding Steller's eiders molted in this area (Martin 2001). Although samples sizes were small, the apparent importance of this area to molting eiders prompted the Service to designate approximately 3,813 km^2 in the KSCHU as critical habitat (USFWS 2001). After molting in the KSCHU, Alaska-breeding birds disperse to various wintering locations along the Alaska Peninsula and Cook Inlet, some of which have also been designated as critical habitat.

Steller's eiders generally feed in shallow water within 200 m of the coast but may use areas farther from the coast where water is shallow and benthic invertebrate food resources are available (Fox and Mitchell 1997; Bustnes and Systad 2001). The amount of habitat (area) within 200 m or in waters less than 9 m [30 ft] deep affected by EVOS is not available for comparison, but would be similar to that estimated for sea otters. Post-EVOS sea otter surveys targeted similar nearshore habitats to those used by eiders (Bodkin and Udevitz 1994; Degange et al. 1995; Bodkin et al. 1999), and estimated a total of 17,027 km^2 affected by EVOS. This would far exceed the 3,813 km^2 of critical habitat in the KSCHU. Spilled oil could reduce the quantity and quality of benthic invertebrates eaten by eiders. Steller's eiders rely on high-calorie foods during molt to support the increased energetic requirements associated with replacing feathers (Peterson 1981).

In the hypothetical worst-case scenario oil spill, we assumed that 100% of the food resources in KSCHU would be rendered unsuitable to support the survival of the species. Using the proportions of listed eiders tracked via satellite telemetry to molting grounds on the KSCHU from Martin (2001), we concluded an EVOS-like spill could significantly impact the KSCHU and have adverse effects on two-thirds of the listed Steller's eiders. Therefore, at the scale of a worst-case scenario oil spill, the additive impacts of associated response activities are likely to further adversely affect the listed population of Steller's eiders and their designated critical habitat. See the Response Analysis section for our evaluation of the potential stressors arising from spill response, and the Risk Assessment section for an assessment of the level of risk faced by the species given the existing environmental baseline.

Exposure Analysis Conclusions

In summary, our exposure analyses indicated the listed populations of Steller's and spectacled eiders are most vulnerable to the additive effects of a worst-case scenario oil spill plus response actions. Northern sea otters, short-tailed albatross, polar bears, and Pacific walruses are dispersed across extensive geographic ranges such that no spill and associated spill response

activity would be likely to have widespread impacts to the entire designated critical habitat or the species as a whole.

5.2 Response Analysis

In the previous section, we evaluated risk to populations from exposure to stressors caused by the implementation of the Unified Plan. In this section, we used the best available science to evaluate potential responses leading to reductions in an individual's fitness (mortality, morbidity, reduced reproduction, or other effects) or reduced conservation value of designated critical habitat as a result of implementation of the Unified Plan. Where data are limited, we considered effects to proxy species. Habitat evaluations included consideration of impacts to food resources eaten by listed species or their prey. We acknowledge when positive effects would result from mitigating exposure to oil, but do not analyze them in this section. Positive effects that minimize risk are discussed in the Risk Characterization Analysis.

Method and Assumptions

We evaluated individual responses to implementation of the Unified Plan. Actions in the Unified Plan include natural attenuation; mechanical countermeasures (booming; constructing barriers, dams, pits, and trenches; culvert blocking, skimming/vacuuming; sorption; flushing and flooding; steam cleaning and sandblasting; removing contaminated soil, sediment, vegetation, or natural debris); non-mechanical countermeasures (application of approved chemical dispersants by vessel or aircraft; *in situ* burning); tracking and surveillance (use of aircraft, all-terrain vehicles, or heavy machinery; installation of buoys; sampling); waste management (waste handling, storage, transport, treatment, and/or disposal; decontamination); and wildlife protection mitigation measures (recovery of contaminated carcasses; deterrence; pre-emptive captures and relocation; capture, treatment, and release of contaminated wildlife; strategic avoidance).

We evaluated *direct* and *indirect* responses to stressors. Direct responses are immediate impacts reducing an individual's fitness. Indirect responses are those that occur later in time or are mediated through deleterious effects on habitat (including food resources), and are reasonably certain to occur. We also consider interrelated and interdependent[4] actions. When considered biologically feasible, effects analyses assumed that listed individuals or designated critical habitat were exposed to an action, even if the probabilities of exposure are very low.

Spill response actions apply to a wide variety of spill types, but the most frequent and largest spills are of petroleum products, collectively referred to as "oil". For this reason, our analyses focus on the effects of oil, but the concepts discussed also apply to a wider variety of commonly spilled substances.

Following an oil spill, the composition of chemicals within the complex oil mixture changes via a process called "weathering". Important weathering processes include evaporation, dissolution,

[4] Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification; interdependent actions are those that have no significant independent utility apart from the action that is under consideration (50 CFR § 402.02); e.g., a private action activity that would not occur but for the proposed federal action.

biodegradation, emulsification, and photo-oxidation (Gong et al. 2014). Smaller, two-ringed polycyclic aromatic hydrocarbons (PAHs) are not very persistent in the environment. They can readily volatilize into the atmosphere, and more readily disperse in the water column relative to larger PAHs, where they are quickly degraded (Yamada et al. 2003). Thus, the relative concentration of larger-ringed PAHs is increased in weathered oil relative to fresh oil (Couillard 2005; Sammarco 2013; Martin 2014). The larger, more persistent PAHs are responsible for many of the serious toxic effects at low concentrations, such as dioxin-like activity, photo-enhanced toxicity, carcinogenicity, and fish cardio-toxicity. Thus, to determine efficacy of mitigation or response activities, it is imperative to characterize weathering and distribution, and the identity, toxicity, bioavailability, and environmental partitioning of the specific chemicals that remain in the aquatic environment (Adams 2014).

Natural Attenuation

Natural attenuation might be a spill response strategy when it is expected to be less harmful or of equal benefit to other response actions. Animals can be exposed to naturally attenuated oil through external physical contact (i.e., direct contact at the surface and in the water column, or for eggs, with parent feathers or nest material); ingestion through grooming, preening, or eating contaminated prey, and inhalation of volatile and aerosolized components (fumes) at the water's surface. The potential adverse consequences of natural attenuation of oil are described in Appendix F as comparison to effects of other spill response actions. Effects of exposures to oil include mortality (of adults, eggs, and young), skin and eye irritation, loss of fur or feather insulation leading to hypothermia, reduced growth, and symptoms of poisoning from ingestion including organ damage, DNA damage, and energetic costs from metabolism and detoxification. These and additional effects can manifest at the ecosystem level, resulting in radical changes in ecosystem structure and function (e.g., trophic cascade effects), such as occurred post-EVOS (Peterson et al. 2003). Natural attenuation represents a "no-action" scenario, but because the spill itself is not an action in the Unified Plan, adverse effects from the oil spill are not attributable to its implementation.

Mechanical Countermeasures

Oil spill response activities included in mechanical countermeasures are: booming, construction of barriers, dams, pits, and trenches, culvert blocking (in the Deflection and Containment phase of spill response); skimming, vacuuming, and sorption (in the Recovery phase); and flushing/flooding, steam cleaning and sand blasting, mechanical cleaning of sand, and removal of contaminated soil, sediment, vegetation, or natural debris in the (Removal/Cleanup phase). Although mechanical countermeasures may be employed in offshore areas (e.g., skimming), most will be employed nearshore, thus effects on the pelagic short-tailed albatross are considered discountable.

Steller's Eider, Spectacled Eider, Sea Otter, and Walrus

Habitat for eiders, otters and walrus could be degraded by spill response actions that disturb benthic invertebrates, especially sediment flushing, pressure washing or steam cleaning, dredging, soil removal, and removal of aquatic vegetation (specifically kelp). Many of these activities can damage or remove benthic invertebrates, causing a reduction in availability of food resources for listed species. Other actions can drive fresh spilled oil into substrates, where

contaminants may be more protected from active weathering than in open water or at the soil-water interface. These pockets of spilled oil may remain in place for years while gradually being released and taken up by benthic invertebrates, resulting in repeated exposures to foraging species over many seasons. Oil from EVOS has persisted in mussel beds in PWS for many years (Jewett et al. 2002; Carls et al. 2004) and is resistant to subsequent restoration efforts (Irvine et al. 2006). Aggressive cleaning of beaches can prolong or prevent natural recovery (Albers 2003). Although most disturbed intertidal and subtidal invertebrate communities would eventually recover, there would likely be a time lag in benthic prey productivity.

Areas where impacts to benthic invertebrates are of particular concern include designated CHUs and other habitats that are integral to reproduction or survival. These include Hanna Shoals (walruses), Ledyard Bay (spectacled eiders), Kuskokwim Shoals (Steller's eiders), molting and wintering areas along the Alaska Peninsula (Steller's eiders), and nearshore marine or freshwater feeding habitats near breeding areas on the Y-K Delta and near Barrow (spectacled and Steller's eiders), eastern Norton Sound (spectacled eiders).

Steller's and spectacled eiders may be affected by construction activities designed to corral or deflect oil in terrestrial nesting habitats and in freshwater lakes, streams, and ponds near the nesting habitat. These actions could result in temporary or permanent reductions in productivity from removal of nest sites or disturbance (see Disturbance section, below). Nesting areas on the Y-K Delta and Barrow, nesting ponds within those areas, and even individual nest sites (bowls) are re-used over multiple years (USFWS unpublished data). Destruction of nest sites, freshwater nesting pond shorelines, or shallow marine feeding area shorelines could have negative and potentially long-term effects on productivity.

Polar Bears

Mechanical countermeasures could elicit several different responses in polar bears. Noise from vessels and human activity may disturb bears, displacing them from the area, or could potentially attract bears due to their curious nature. Activities attracting bears could result in unintentional harassment, deterrence to prevent human/bear interactions, or lethal take of the bear. Unintentional harassment would most likely be infrequent, short-term, and temporary. Use of nonlethal techniques to move a bear away from humans would be much less likely, infrequent, short-term, and temporary. Lethal take of a polar bear from bear-human interaction related to spill response activity is extremely unlikely (78 FR 35364).

Non-mechanical Countermeasures

Non-mechanical countermeasures include application of chemical dispersants by vessel or aircraft and *in situ* burning.

Dispersants

Chemical dispersants displace oil from the water's surface into the water column, and their use is considered an environmental tradeoff. The decision to use dispersants must weigh the benefits to species and habitats that might be fouled by a surface slick against increased oil exposure and toxicity experienced by pelagic and benthic organisms. Benefits of dispersant use might be realized if untreated oil threatens highly aggregated, surface-dwelling animals or particularly

sensitive coastal areas; the tradeoff being negative impacts of dispersed oil on water-column organisms. While dispersants themselves are considered less toxic than direct oil exposure, acute and chronic effects of exposure to dispersants and dispersed oil on listed species is largely unknown. Key considerations for listed species in the Action Area include: 1) length of time dispersed oil remains in the water column, 2) fouling of benthic habitat via formation of oil-particulate aggregates, and 3) effects of dispersed oil exposure to pelagic organisms.\

The Baffin Island Oil Spill (BIOS) was an experimental attempt at examining effects of dispersed vs. undispersed oil on the biota of nearshore areas in the Arctic (Cross et al. 1987). Chemically dispersed oil was released from a diffuser pipe placed near the bottom of the study bay. Concentrations of dispersed oil exceeding 160 ppm were measured during the release. Three years of monitoring indicated that, while there was some organismal stress (e.g., gaping clams) immediately after the spill, the chemically dispersed oil had no significant long-term effects on the sediments or the biota. In comparison, a similar amount of oil was allowed to remain on the beach of a nearby bay without treatment, and gradually leached off the beach into the subtidal area where it was taken up by benthic organisms. Oil in sediments of both the dispersed and undispersed oil apparently caused a reduction in urchin densities two years after the releases, which may lead to alterations in macroalgal communities in subsequent years. The authors concluded that both dispersed and untreated oil apparently caused relatively minor damage to only a few species of shallow water epibenthos (Cross et al. 1987).

Biodegradation rates of oil in water in Alaskan field conditions are uncertain. Oil biodegradation is dependent on microbial growth, may be much slower in open-ocean than in laboratory conditions (NRC 2005). Furthermore, results from experimental studies to determine effects of dispersants on oil biodegradation rates may not accurately or realistically reflect natural situations because of the un-natural test conditions that are used (NRC 2005). However, microbial communities capable of metabolizing Prudhoe Bay crude oil have been found in Alaskan waters (McFarlin et al. 2014).

The environmental fate and behavior of PAHs in the aquatic environment is complex, and depends on chemical and physical properties of the spilled oil (viscosity, droplet size, composition, density and concentration), the suspended solids in the water column (mineralogy, grain size, organic matter content, density and concentration) and environmental conditions (temperature, pH, salinity, pressure, and hydrodynamic conditions). Dispersed oil can adhere to suspended particulate matter in the water column to form oil-suspended particulate matter aggregates (OSAs), some of which sink to the ocean floor, becoming a source of contamination to benthic organisms. The predominant PAHs in sediments are usually the higher-ringed PAHs (Neff 1985; Albers 2003; Lance et al. 2012). This phenomenon is well characterized in a general sense, as there are accumulations of large-ringed PAHs in sediments of industrial water bodies throughout the world (Neff 1985, Albers 2003). In a mesocosm study of PAH fate, smaller PAHs decreased rapidly from the water column and did not reach the benthos, but larger PAHs were vertically transported to the sediment where they posed a chronic toxicity hazard to benthic biota (Yamada 2003).

Dispersants can enhance the ability of PAHs to interact with and adhere to suspended particulate matter by several mechanisms, including increased dispersion of the oil into the water column and lowered viscosity of the oil. Following the DHS, researchers found that the presence of Corexit 9500 greatly increased sediment uptake of dispersed oil and PAHs (Gong et al. 2014). In contrast, other studies have shown a reduced rate of PAH sedimentation following dispersant application (Yamada 2003), demonstrating that the environmental fate of PAHs is complex and dependent on many factors. Weathered oil residues containing higher-ringed PAHs at elevated concentrations can be absorbed on sediments and persist for decades in some situations (Reddy 2002).

Oil and dispersed oil toxicity varies depending on the oil type, specific chemicals in the mixture, and on the bioavailability of those chemicals, environmental conditions, and other spill response strategies. The higher-molecular-weight PAHs (3- to 5-ring) are associated with the most serious toxic effects at very low concentrations, but they are only minimally bioavailable to aquatic organisms following a spill because they are not very water soluble. Often, when spilled oil is chemically dispersed, the concentrations of higher-molecular-weight PAHs in the water increase dramatically, and are much more bioavailable for uptake by aquatic organisms (Couillard 2005; Mu 2014; Wu 2012; Adams 2014; Martin 2014). However, under various exposure conditions, including a spiked-then-declining scenario, toxicity of chemically-dispersed North Slope crude to the copepod *Calanus glacialis*, juvenile Arctic cod *(Arctogadus glacialis),* and larval sculpin was much less than that of mechanically dispersed crude oil (Gardiner et al. 2013).

Dispersant use promotes the possibility and severity of photo-enhanced toxicity because it greatly increases the solubility of the larger PAHs (some 3-ringed and especially 4-ringed) that are phototoxic (Barron 2003). Weathered, Alaska North Slope crude was more toxic to Pacific herring (*Clupea pallasi*) embryos in the presence of sunlight, and application of dispersant further enhanced toxicity (Barron 2003).

Birds – Spectacled Eider, Steller's Eider, and Short- tailed Albatross

The use of dispersants during an oil spill can cause direct impacts (feather fouling or ingestion of toxic components) and indirect impacts (prey reduction, increased predation). Dispersants are complex mixtures of surfactants and solvents, and they are specifically designed to lower surface water tension (Singer et al. 1995). Reduction of surface water tension is associated with feather wetting causing birds to lose buoyancy when they are exposed to dispersant in seawater (Stephenson and Andrews1997). Mallards (*Anas platyrhynchos*) exposed to Corexit 9527 (1.2 ml of a 50% mixture into a 60 L swimming tank) exhibited a loss of buoyancy, but there was no significant increase in the basal metabolic rate (Lambert 1982). Molting birds are more vulnerable to wetting (Stephenson 1997), and at the same time have elevated energy demands due to the cost of feather synthesis.

Several studies have compared impacts of dispersants on water repellency of feathers. Birds exposed to Corexit 9527 remained wet for much longer than birds exposed to water (controls), and longer than oiled birds, suggesting the insulating properties of their plumage were affected, despite efforts to preen. Mixing of oil and dispersant appeared to increase the damage to plumage leading to progressive waterlogging (Lambert et al. 1982). In another comparison,

feathers submerged in solutions of seawater, seawater with Prudhoe Bay crude oil, or a mixture of seawater, Prudhoe Bay crude oil, and the dispersant Corexit 9500, indicated plain seawater or seawater plus Prudhoe Bay crude oil did not cause feather wetting. In contrast, feathers from both treatments containing Corexit 9500 (either in the presence or absence of Prudhoe Bay crude) quickly lost water repellency and "the feathers appeared folded in on themselves when removed from the solutions" (Duerr 2011).

Surfactants present in chemically treated oil may bind to the hydrophobic waxes in plumage, reducing the insulation properties of the feathers (Jenssen 1994). Oil-dispersant mixtures may be more potent at eliciting thermoregulatory effects than crude oil alone, and there may be taxonomic differences in sensitivity to dispersants (e.g.,common eiders [*Somateria mollissima*] may be more sensitive to the mixtures than mallards (Jenssen and Ekker 1991). Because even a thin sheen of oil could affect feather structure, use of dispersant would have to be highly effective (little or no remaining sheen or oil plus dispersant mixture) to mitigate oil exposure to birds from surface slicks (O'Hara and Morandin 2010).

A dosing study of Prudhoe Bay crude oil and Corexit 9527 on nesting Leach's storm-petrels (*Oceanodroma leucorhoa*) indicated that external exposure of adults to oil or an oil-dispersant mixture resulted in reduced survival of young to fledging (Butler et al. 1988). Significant differences in parental attendance at the burrow were observed at intermediate and high levels of oil and oil/dispersant exposure. But, only chicks exposed externally to an oil-dispersant emulsion via parental contact exhibited significantly reduced survival, with surviving chicks displaying reductions in weight gain and wing growth compared to controls and oil-exposed birds. They attributed decreased growth and survival of chicks whose parents were exposed to oil/dispersant mixture to a prolonged absence or death of the treated adult, as growth and survival reductions were similar to deficits observed in single-parent nests.

Oil and oil-dispersant mixtures are highly toxic to bird eggs. Albers (1979) found lower hatch success of eggs treated with Prudhoe Bay crude oil, Corexit 9527, and various oil-dispersant mixtures relative to untreated eggs; both Corexit 9527 alone and a 5:1 oil:dispersant mixture were both more embryotoxic than crude oil alone, and least toxic was a 30:1 oil:dispersant mixture. Eggs treated with 20 µl experienced reduced hatching success relative to controls, 15.5 µl induced 50% egg mortality, and 40 µl caused complete hatching failure (100% embryo mortality; Wooten et al. 2012). Albers and Gay (1982) found significantly reduced hatching success in birds exposed to oil relative to controls, and a more variable response in birds exposed to an oil-dispersant (Corexit 9527) mixture likely due to the physical and variable behavior of dispersed oil. Birds that encountered coalesced oil patches after dispersant use passed that oil onto eggs, resulting in reduced hatching, while those who did not encounter the coalesced oil had hatching success similar to controls.

In studies of immune system response to chemical toxin exposure, mallards were exposed to sublethal concentrations of South Louisiana crude oil, Bunker C fuel oil (BCFO), Corexit 9527, and oil-Corexit mixtures (Rocke et al. 1984). Ingestion of oil or oil-Corexit mixtures had no effect on avian cholera antibody-producing capabilities. A temporary nervous system disorder (lack of motor coordination and reduced mobility) was noted in birds receiving the highest dose

of Corexit (5.0 ml/kg of a 1:10 dilution), which had resolved the next day. Oil and oil-Corexit mixtures did not induce this reaction. Ingestion of BCFO and Corexit mixtures induces a highly significant increase in liver weights and decrease in spleen weights, and a higher percentage mortality in treated mallards challenged with avian cholera relative to controls.

Marine mammals – Sea Otter, Polar Bear, Pacific Walrus
Information on effects of dispersants on sea otters, polar bears, and walrus is sparse, with limited information on sea otters, although the widespread use of dispersants in the DHS sparked toxicity studies using Corexit formulations on rodents as mammalian test species, with endpoints focusing on neurotoxicity, pulmonary and cardiovascular function, and other effects. Like marine birds, dispersants can adversely affect marine mammals from either/both direct or indirect exposure. For example, Williams et al. (1988a) found that sea otter pelts oiled or exposed to fresh crude oil plus Corexit 9527 increased the thermal conductance (i.e., decreased the insulative quality) of the fur.

One year after the DHS, dolphins exposed to chemically dispersed oil exhibited hypoadrenocorticism (a decreased secretion of corticotropic hormone causing immune dysfunction and other symptoms consistent with adrenal toxicity), and were five times more likely to have moderate to severe lung disease, than unexposed dolphins (Schwacke et al. 2013). Forty-eight percent of the dolphins from exposed populations were given a guarded or worse prognosis, and 17% were graded as poor or grave, indicating that they were not expected to survive (Schwacke et al. 2013). It is not known whether dispersant use worsened the outcome for this population, as the effects of dispersed oil cannot be compared with or separated from the effects of oil alone.

Indirect Effects on Invertebrate Prey of Listed Species
Dispersant use may result in increased concentrations of toxic components - primarily PAHs into the water column, and OSAs into sediments. However, discerning cause and effect and reaching conclusions regarding the relative influence of dispersed oil versus oil versus dispersant alone is difficult and highly dependent on the toxicity testing details, including exposure methods and duration and analytical techniques to quantify PAH concentrations (Fingas 2008).

The environmental conditions sought for dispersant use as outlined in the Unified Plan (e.g., calm seas and unweathered oil), could result in more negative effects to pelagic and benthic prey compared to other response methods. In areas such as spectacled eider critical habitat units in the Bering Sea, Ledyard Bay and Norton Sound; Steller's eider critical habitat units on the north side of the Alaska Peninsula; and Pacific walrus foraging habitat across the Chukchi Sea, negative impacts to benthic invertebrates is of particular concern.

Benthic invertebrates are important as food for Steller's eiders, spectacled eiders, sea otters, and walruses, and have pelagic larval life stages. Epstein et al. (2000) found that dispersed oil caused impaired settlement rates, the appearance of morphological and behavioral deformations, rapid tissue degeneration, and high toxicity to coral larvae species. Alameda et al. (2014) investigated effects of oil, Corexit 9500A, and dispersant-treated oil on the survival and growth rates of barnacle nauplii and the larval acorn worms. Growth rates were significantly reduced

after exposure to chemically dispersed crude oil and Corexit 9500A at concentrations commonly found in the water column after dispersant application in crude oil spills. Hansen et al. (2012) found that following exposure of copepods to chemically and naturally dispersed oil, the dispersants slightly increased the specific toxicity of the oil at median and low dosage levels, but reduced the toxicity at high levels.

Pelagic fish and invertebrates, particularly squid, are important as prey for short-tailed albatross. While no information is available regarding effects to squid, various investigators have examined the effects of dispersants on fish. Effects differ by species and exposure levels. Use of dispersants was found to increase the exposure of the ovoviviparous Rockfish (*Sebastes schlegeli*) to oil in the water column (Jung et al. 2009). McEachern (2014) conducted toxicity tests of chemically dispersed oil on the early life stages of the red drum (*Sciaenops ocellatus*). Fish exposed to dispersed oil presented with one or more gross abnormalities including: cardiac edema, skeletal abnormalities, yolk sac edema, finfold abnormalities and decreased growth. Dussauze et al. (2014) studied impacts of chemically dispersed oil on adult polar cod (*Boreogadus saida*). Oil alone reduced O_2 consumption but dispersants did not produce this effect or increase oil toxicity; no difference in contamination levels were observed between fish exposed to oil and dispersed oil. Lin et al. 2009 found age-related differences among Chinook salmon (*Oncorhynchus tshawytscha*) exposed to oil and dispersed oil, and concluded that dispersant treatment significantly decreased the lethal potency of crude oil to salmon smolts.

Walruses may be particularly sensitive to large-scale impacts to benthic invertebrates. Walruses require approximately 29 - 74 kg (64 - 174 lbs) of food per day (Fay 1982) and must periodically haulout onto ice or land to rest between feeding bouts. Their seasonal migrations along the ice-edge take them northward over the highly productive continental shelves of the Bering and Chukchi seas in the summer (Garlich-Miller et al. 2011). Aerial surveys in the eastern Chukchi Sea found that 80–96% of walruses were closely associated with sea-ice and that the number of walruses observed in open water decreased significantly with distance from the pack ice (78 FR 35364). As ice edges retreat more rapidly due to climate change, females are forced to travel longer distances from the land-based haulouts (Udevitz et al. 2009). Therefore, foraging habitat closer to shore is becoming more valuable to walruses and thus more important to protect from negative effects of an oil spill and oil spill response activities. In 2010 and 2011, more than 20,000 walruses hauled out near Point Lay and many traveled to the Hanna Shoal area to feed before returning to Point Lay (78 FR 35364).

In-situ Burning

In-situ burning is used to reduce the volume of spilled oil and the concentrations of toxic volatile compounds in saltwater, freshwater, wetland, and upland environments. Because *in-situ* burning works best when oil is corralled, it may be considered for use in leads or polynyas. When in proximity to in-situ burning, listed species could be adversely affected directly through exposure to smoke or ingestion of burned residues. Indirect effects of this activity are also possible, if benthic prey or aquatic habitats are smothered by burned residues sinking to the seafloor.

Toxic constituents of smoke generated by *in-situ* burning include carbon dioxide, water, particulates ("soot"), sulfur dioxide and nitrogen dioxide (eye and respiratory irritants), carbon

monoxide, and PAHs and other volatile compounds (Allen and Ferek 1993; Scholz et al. 2004). PAHs in the oil may be higher than in the smoke plume (Fingas et al. 1993), although concentrations of PAHs with five or more rings (the more toxic ones) were 10–20 times greater in smoke than in oil from an experimental burn of Alberta Sweet crude oil (Benner et al. 1990). Other toxins produced by combustion of organic materials such as polychlorinated dibenzodioxins and dibenzofurans may also be present (Aurell and Gullett 2010).

Concentrations of particulates, PAHs and other toxic components in the smoke would vary with burn efficiency, type of oil, and burn conditions, but the Newfoundland Offshore Burn Experiment (NOBE) showed that, "past a mile or two downwind," particulates were the only contaminant of concern (Barnea 1999). Particulates, small pieces of solid or liquids (e.g., dusts, soot, fumes, mists, fogs, sprays) that remain suspended in the air long enough to be inhaled, make up about 10–15% of oil smoke plumes (Barnea 1999; Scholz et al. 2004), making the plumes very black. Inhalation of *in-situ* burn smoke would likely result in short-term respiratory distress for all listed species, and birds could become disoriented if caught in the smoke cloud.

The residue that remains after burning can be: semi-solid (gel-like), as from diesel burning (Buist 1998); tarry lumps, as from burning medium crude (Fingas et al. 1994); stiff and taffy-like, as from burning North Slope crude during the EVOS (Allen 1990 as cited *in* Scholz et al. 2004); or a brittle solid (Buist et al. 1994, as cited *in* Scholz et al. 2004). Burn residues can float or sink, depending on density, slick thickness, and burn efficiency (NOAA 2015), and the properties of the original oil (e.g., specific gravity and percent of distillation residue after burning; Scholz et al. 2004). Residues may foul feathers or fur (NOAA 2015). For example, although burn residues from heavy oils did not stick to feathers, burn residues from diesels and lighter crudes did (Buist and Trudel 1995 as cited *in* Scholz et al. 2004). Residues could be ingested by fish, birds, and marine mammals. Effects of ingestion of burn residues would likely be similar to ingestion of weathered oil (Leighton 1995) for sea turtles (who readily ingest and are fouled by tarballs; Van Vleet and Pauly, 1987) and birds (Stubblefield et al. 1995). Weathered oils, although generally less toxic than fresh, can still cause a wide variety of negative effects upon ingestion, including gastrointestinal and organ injury, and toxic metals can be enriched in the burn residue compared to the parent oil (Scholz et al. 2004).

The amount of PAHs in oil is often reduced by >99% during *in-situ* burning (ADEC et al. 2008). An efficient burn will remove most of the volatile toxic materials from the residue; an inefficient burn will be less effective (ADEC et al. 2008). Burn residues are generally higher in metals and higher-molecular weight PAHs than unburned materials. Although toxic, they are thought to be relatively stable in (i.e., don't dissolve from) the burn residue, which reduces their availability to aquatic biota. The NOBE experiment demonstrated low acute toxicity of burn residues to sand dollars, oyster larvae, inland silversides (*Menidia beryllina;* Daykin et al. 1994), rainbow trout (*Oncorhynchus mykiss*), three-spine sticklebacks (*Gasterosteus aculeatus)* and sea urchin fertilization (Blenkinsopp et al. 1997); and burn residues showed no acute toxicity to amphipods and very low sublethal toxicity to marine snails (burying behavior) (Gulec and Holdway 1999) (NOAA 2015). When burn residues sink, however, they may smother benthic habitats and animals, especially in embayments, dense communities, or small freshwater waterbodies. Sunken oil residues cannot be effectively cleaned up (NRC 1999).

In terrestrial habitats with highly organic substrates, including tundra habitats where spectacled and Steller's eiders nest, *in-situ* burning can liquefy oil, allowing it to sink into the substrate if the water table is low (Scholz et al. 2004). Weathering rates would be slow in cold, generally acidic and often anaerobic Arctic conditions, so relatively fresh oil may persist for years, even after burning. Although less toxic than fresh oil, burn residues in terrestrial habitats can smother plants and microbes, be very sticky or dense, and be difficult to remove by natural processes such as rain (Scholz et al. 2004).

Non-mechanical countermeasures summary

The effects of non-mechanical countermeasures on listed species depend on the spill type, the bioavailability of those chemicals, environmental conditions, and spill response strategies used. Dispersant use and *in situ burning* may lead to direct toxicity, uptake of contaminants by pelagic and benthic organisms, loss of insulative properties of feather and fur, embryotoxicity, and smothering of benthic invertebrates. Use of dispersants reduces the impacts of oil exposure for some species, while increasing impacts to other. Generally, when dispersants are used effectively and appropriately, the net environmental effects are not substantially worse than those of the spill (Lessard and Demarco 2000; EPA 2013). In many cases, when impacts of dispersants plus oil have been documented to be worse than effects of oil alone, the differences are often only slight (i.e., Albers 1979; Lambert et al. 1982). However, when the use of dispersants results in exposure to spills that would not otherwise affect listed species, the impacts can be severe. Similarly, *in situ* burning can significantly decrease the toxicity of spilled substances before they are incorporated into the water column, thereby benefitting pelagic and benthic species, but can spread airborne particulate pollution, causing impacts to avian species.

[Top]

Disturbance

Disturbance is a negative effect that may occur during all response activities. Disturbance (e.g., forced movement of animals in response to human actions or activities, see Appendix B for complete definitions) may have no direct adverse effect if it is brief or temporary; however, longer disturbances can result in increased energetic expenditures, displacement from optimal feeding areas, injury, and mortality, especially for vulnerable individuals such as molting birds or dependent young. Disturbance would cause incidental take by harassment if it significantly disrupts normal behavior patterns such as breeding, feeding or sheltering.

The Unified Plan identifies measures for reducing the potential to disturb to listed species. The Wildlife Protection Guidelines (ARRT 2012) specify that during an oil spill, the Service may provide, through the Federal Aviation Administration and USCG, advisories to aircraft or mariners requesting pilots and vessel operators to avoid walrus haulouts and migratory bird concentration areas. Pilots and captains can then select alternate routes, thereby avoiding the wildlife areas and preventing disturbance. Copies of advisories are provided by the FOSC to all federal and state agency and agency-contracted on-site personnel. In addition, a news release may be prepared by Service representatives for distribution by the FOSC to appropriate news media representatives. Service personnel may also recommend that agency on-site monitors accompany nearshore and/or shore-based activities to help minimize or eliminate unacceptable levels of disturbance.

Northern Sea Otter

Sea otters may be disturbed by spill response activities including vessel traffic, aircraft overflights, and onshore activities. Behavioral reactions to disturbance may include: increased alertness; vigilance; agonistic behavior; escape behavior; or temporary or permanent abandonment of an area (van Polanen Petel et al. 2006). In addition to behavioral responses, otters may exhibit physiological responses (e.g., increased heart rate, hormonal response; loss of immune function, decreased body weight, impaired reproductive function, and abnormal thyroid function (Harms et al. 1997; Tempel and Gutierrez 2003). Either type of response results in a diversion from one biological activity to another. That diversion may cause stress (Goudie and Jones 2004), which redirects energy away from fitness-enhancing activities such as feeding and mating (Frid and Dill 2002). The consequences of behavioral modification have the potential to be biologically significant if they impact growth, survival, and reproduction.

Sea otters in Alaska have been observed avoiding areas with heavy boat traffic but returning to those same areas during seasons with less traffic (Garshelis and Garshelis 1984). Northern sea otters may exhibit escape behaviors in response to the presence and approach of vessels, including: 1) diving and/or actively swimming away from a boat; 2) entering the water when previously hauled-out; and 3) disbanding and scattering of groups (Udevitz et al. 1995). Conversely, southern sea otters only exhibited mild behavioral changes in response to boats passing within hundreds of meters and appear to have habituated to boat traffic (Riedman 1983; Curland 1997). Southern sea otters exposed to recorded noises associated with oil and gas activities exhibited no changes in the presence, density, or behavior, however, they displayed repeated, slight reactions to airborne engine noise (Riedman 1983, 1984).

Sea otter behavior is suggestive of a dynamic response to disturbance, abandoning areas when disturbed persistently and returning when the disturbance ceased. The potential adverse consequences of disturbance are relatively rare among sea otters; they appear to be generally resistant to the negative effects of sound and visual distraction, evidenced by changes in presence, distribution, or behavior in response to such disturbance (Riedman 1984; Ghoul et al. 2012a,b; Reichmuth and Ghoul 2012). Additionally, when sea otters have displayed behavioral responses to acoustic stimuli, they quickly become habituated and resume normal activity (Davis et al. 1988, Ghoul et al. 2012b). Some degree of disturbance from vessel traffic may occur during a spill response, but the impacts are expected to be short in duration, and impacts to the fitness of an individual are not anticipated. While large, ongoing spill response actions are more likely to cause repeated disturbances and may result in impacts to individual fitness, habituation to the presence of project vessels and noise associated with ongoing actions are expected as well.

Collisions between vessels and sea otters may occur during spill response actions. Sea otters occupy waters up to 91 m deep (300 ft, 50 fathoms) and spend several hours a day foraging. Collisions are infrequent and usually involve smaller, fast-moving vessels, including skiffs rather than larger vessels (V. Gill, BOEM, pers. comm.). Sluggish reaction time resulting from exposure to oil or other spilled material may reduce the ability of the animal to avoid the oncoming vessel.

Short-Tailed Albatross
While little is known about the effects of disturbance on Short-tailed Albatross in the marine environment, they are reported to voluntarily follow fishing vessels at sea, which suggests that the presence of spill response vessels would not cause disturbance to birds in the general area. While nesting on land they are very resistant to disturbance (USFWS 2008). Hazing and deterrence efforts at sea, discussed under the Wildlife Protection Measure section, would cause take by disturbance to these animals.

Polar Bear
Though polar bears are curious and may investigate novel activities, they also may move away from noise and vessels, aircraft, or humans (Ireland et al. 2009). Of four polar bears observed in the Beaufort Sea in 2006 during oil and gas seismic surveys, one was feeding and did not alter its behavior, two (a mother and cub) entered the water, and one was observed already swimming and continued to swim (Funk et al. 2006). The energetic costs of retreating from vessels or aircraft may be minimal if the event is short and the animal is otherwise unstressed. For example, retreating from an active icebreaker may produce minimal effects for a healthy animal on a cool day; however, on a warm spring or summer day, a short run may be enough to overheat a well-insulated polar bear (78 CFR 35364).

If a vessel were to encounter a swimming bear, it will most likely result in temporary behavioral disturbance only. Indeed, observations from monitoring programs report that when bears are encountered in open water swimming, bears have been observed retreating from the vessel as it passes (USFWS unpublished data in 78 CFR 35364). Icebreaker support for spill response in frozen seas could introduce loud noise into the environment, especially if a ship has to reverse and repeatedly ram thick ice (Davis and Malme 1997). Transient or hunting bears on the ice may have their movements or hunting behaviors altered or interrupted by these disturbances. In 2012, four industry operators in the Chukchi Sea reported seven responses to their activities by polar bears that met the MMPA definition of Level B take (about 13% of observed bears). We interpret these reported interactions to indicate that most vessel/polar bear interactions would result in only minor, short-term behavioral changes.

In rare cases, human-bear encounters could cause harm to individual bears. Examples include if a female is separated from her cub(s), or if normal activities such as resting, feeding, or nursing are disrupted to the point that the individuals involved are physiologically impacted, or if the bear must be hazed or killed to protect human life. The possibility of harmful impact likely varies with the number, duration, or intensity of the encounters, and the bear's physiological state prior to the encounter.

Walrus
Walrus are sensitive to most disturbances, and we anticipate this to be the case for any spill response activity. As social animals, walrus travel and haul out to rest in densely packed groups of a few individuals to several thousand (Gilbert 1999; Kastelein 2002; Jefferson et al. 2008). Disturbance reactions are variable, depending on age, sex, and size and haulout substrate (Fay et al. 1984). Females with calves appear to be most sensitive to disturbance, and animals on shore

are more sensitive than those on ice (Fay et al. 1984). When hauled out groups are disturbed and stampede, calves and young are vulnerable to trampling injuries and mortality (Fay 1980; Fay and Kelly 1980). In 2007, more than 3,000 calves died along the Chukotka coast due to stampedes caused by humans and polar bears. The potential for disturbance events to result in animal injuries, mortalities or mother-calf separations increases with the size of walrus aggregations (78 FR 35364).

In addition to trampling injuries, disturbed walrus may suffer increased stress and energy expenditure, and interference with feeding or communication. Cows and calves are especially wary; cows may spend less time with calves on land; calves may spend too much time in the water, resulting in impaired thermoregulation. Severe, prolonged or repeated disturbances could potentially displace individuals or herds from preferred feeding or resting areas (78 FR 35364).

Reactions of walruses to aircraft are thought to vary with aircraft type, range, and flight pattern, in addition to group composition and size. Helicopters are more likely to elicit responses than fixed-wing aircraft, and walruses are particularly sensitive to changes in engine noise and are more likely to stampede when aircraft turn or bank overhead, although researchers conducting aerial surveys for walruses in sea-ice habitats have reported little reaction to small fixed-winged aircraft above 305 m (1,000 ft) (78 FR 35364).

The reaction of walruses to vessel traffic appears to be dependent upon vessel type, distance, speed, and previous exposure to disturbances. Underwater noise from vessel traffic could "mask" ordinary communication between individuals. Icebreaking vessels have the greatest potential for disturbances since these operations typically require the vessel to accelerate, reverse direction, and turn rapidly, maximizing propeller cavitations and resulting noise levels. Icebreaking activities can displace some walrus groups up to several kilometers away; however most groups of hauled out walruses showed little reaction beyond 800 m (0.5 mi) (Brueggeman et al. 1990). Environmental variables such as wind speed and direction are also thought to contribute to variability in walruses' response to vessels (78 FR 35364).

Spectacled and Steller's Eider

Oil spill response activities could disturb eiders and potentially result in breeding depression or displacement from preferred nesting habitat. Disturbance during the nesting and brood-rearing period (approximately June 5–August 15) could adversely affect individuals by: 1) displacing adults and or broods from preferred habitats during pre-nesting, nesting, and brood rearing, leading to reduced foraging efficiency and higher energetic costs; and 2) flushing females from nests or shelter in brood-rearing habitats, exposing eggs or ducklings to inclement weather and predators. Hens may also damage eggs as they are flushed from a nest (Major 1989) and may abandon nests entirely, particularly if disturbance occurs early in the incubation period (Livezy 1980, Götmark and Ählund 1984). We anticipate that mechanical countermeasures such as construction of barriers, dams, pits, and trenches in and around freshwater nesting areas will have greater temporary effects on nesting birds than marine activities.

Disturbance during staging, molting, or wintering could also affect energetic balances during these crucial times, resulting in infirmity or mortality, depending on disturbance severity and the

particular location. For example, the only known wintering area (and critical habitat) for spectacled eiders is around polynyas south of St. Lawrence Island, in a relatively shallow area with a rich benthic bivalve prey base. Disturbance and displacement from this habitat could negatively affect the energy balance of wintering birds by causing increased energy expenditure and barring access to critical food items. Evidence for disturbance impacts to Steller's eiders during winter is ambiguous; in Kachemak Bay and Unalaska, wintering Steller's eiders appear unaffected by human activities on adjacent shorelines, but sensitivity to boat traffic in the Izembek Lagoon Critical Habitat Unit has been documented (Ward et al. 1996).

The severity of disturbance and displacement will likely depend upon the duration, frequency, and timing of the disturbing activity. Response activities for a large oil spill could continue for many months; even responses to small spills occurring during the very short summer nesting season could result in disturbance to individuals and reduced productivity for that year.

Tracking and Surveillance

Tracking and surveillance activities involving aircraft, vessels, all-terrain vehicles, or heavy machinery are used to monitor spill extent and behavior, and to determine spill exposure risk to sensitive environmental resources including listed species. Tracking buoys and sampling devices may also be deployed. These activities would primarily result in disturbance to listed species, which was discussed above (Disturbance section). Disturbance may have no direct effects if it is brief or temporary; however, it can result in increased energetic expenditures, displacement from optimal feeding areas, injury, and mortality, especially of vulnerable individuals such as molting birds or dependent young.

Waste Management

The Unified Plan describes methods to handle, store, transport, treat, decontaminate, and dispose of waste including: open burning, incinerating, landfilling, bioremediating, and recycling. The methods and treatments depend on the type and amount of material spilled and the resources available for waste management. The Unified Plan specifies that waste management should be conducted in compliance with legal requirements and in a manner that minimizes environmental and public health impacts.

When waste management is conducted as specified by the Unified Plan, residual materials produced by or remaining after waste treatment may be released in the environment within lawful limits established by ADEC and EPA. Treated effluents would be required to meet state water quality standards, reducing risk, but can potentially further degrade waterbodies previously affected by a spill or other sources of contaminants.

The RP is responsible for developing and implementing the waste disposal plan for a specific incident, and oversight of the plan is normally the responsibility of the ADEC. Impacts to listed species and critical habitat from materials discharged during improper, illegal, or insufficient waste management or from accidents involving waste materials are not authorized by the Unified Plan.

Extreme weather or other conditions may increase the likelihood of accidental releases during handling or transport of wastes. Some wastes (e.g., oil emulsions, oily water, and hazardous wastes) cannot be treated in Alaska and must be transported to the contiguous United States. In these cases, longer transport distances could increase the probability that a spill, associated with the Action, will occur. These activities may contribute a small incremental increase in risk of spills in Alaska. Furthermore, accidental spills of large quantities of dispersants could occur when building, maintaining or resupplying stockpiles.

Wildlife Protection Measures

The Unified Plan specifies measures that may be taken to protect wildlife from exposure to spill materials including deterrence (i.e hazing), and pre-emptive capture and relocation. Additionally, measures include subsequent treatment, and release of contaminated wildlife; recovery of contaminated carcasses; and strategic avoidance of sensitive areas. Recovery of carcasses may cause incidental disturbance during cleanup efforts, but is primarily beneficial, especially for preventing exposure to scavenging polar bears. Strategic avoidance of sensitive areas also considered beneficial if it reduces the disturbance from spill response activities without compromising exposure risks.

Hazing involves utilizing visual, auditory, and other exclusionary methods to deter animals away from spilled material. Techniques include: 1)causing avoidance by installing balloons, reflector tape, snow fencing, or electric fencing; 2) using noisemakers such as horns, alarms, propane exploder cannons, pistols with caps, screamers, bangers or firing shotguns with cracker shells, rubber bullets, or bean bags. The selection of the appropriate deterrent methods depends on the species involved, the surrounding environment, and the spill situation. In some cases, the animals must be deterred repeatedly and frequently because of behavioral patterns or habituation to the disturbance.

The primary adverse effect of deterrence is disturbance. The physiological and behavioral consequences are the same as described in the Disturbance section, however this disturbance is intentional to reduce exposure to toxic chemicals. While the disturbance is intentional, the activity is still considered incidental to the Action. Herding Pacific walruses away from a spill site may be feasible for those animals already in the water, but as specified in the Unified Plan, hauled-out animals should be left alone due to the risk of trampling if stampeding occurs.

The capture of wildlife, whether conducted pre-emptively to prevent chemical exposure or for treatment and rehabilitation, is considered an extreme spill response measure. It is intended to be conducted only when there is a significant risk to listed species (i.e., there is both a high probability of exposure to spilled material and a high likelihood of severe adverse response to exposure) and there is a reasonable likelihood of a beneficial outcome for the animal. Pre-emptive capture and relocation of polar bears is only feasible if suitable relocation sites are nearby. Their large body size and potential aggressive response behavior makes the pre-emptive capture challenging and limits the utility of this strategy to small numbers of bears only. Risks involved with capture, whether prior to, or following exposure to spills, may result in excessive energy expenditures from capture avoidance, unintentional overdose of immobilization drugs,

and adverse physical responses due to combined impacts of contaminant exposure and capture stress. Furthermore, attempting to capture Pacific walruses, either for pre-emptive prevention of spill exposure or for treatment after exposure is not currently feasible because of this species' sensitivity to disturbance and the potential danger to personnel posed by their large body size and belligerent behavior. Capture of a listed animal constitutes take by harassment at a minimum, but may result in survival of an animal that would otherwise die. The choice to conduct wildlife capture is made on a case-by-case basis.

Capture and handling of wildlife can increase exposure to infectious diseases, and animals exposed to contaminants may have suppressed immune function. Close contact in treatment facilities and during transport may result in infection to an individual. Diseases may also be transmitted across animals in shared facilities. Moreover, treated animals may spread diseases among wild populations following release. While disease transmission is considered unlikely, the Unified Plan recognizes this concern when considering undertaking wildlife protection activities. Proper quarantine procedures, involvement of wildlife health experts, and use of appropriate veterinary practices can be facilitated by Service personnel during spill response and would likely reduce the risk of disease transmission.

The Unified Plan incorporates various tools for minimizing the adverse effects of deterrence and capture efforts, including the Wildlife Protection Guidelines (ARRT 2012) and the Interagency MOA for ESA Consultation (USCG et al. 2001). The Wildlife Protection Guidelines specify who may conduct and oversee deterrence and capture activities. The guidelines include forms and checklists for evaluating circumstances, following standard procedures, obtaining equipment, and documenting decisions. The guidelines also include species-specific information and considerations, additional resources including reference information and manuals, and tools for ensuring sufficient spill response capacity. The guidelines and the MOA both specify that the Service will be consulted whenever actions may affect listed species. The Service has developed additional tools which provide guidance during spill response and ensure that our involvement will help to reduce the likelihood of potential adverse impacts from hazing and capture (see, for example, http://www.fws.gov/Contaminants/FWS_OSCP_05/FWSContingencyTOC.htm; USFWS 2005; Services' Oil Spill Response Plan for Polar Bears in Alaska (USFWS 2015). The Unified Plan also specifies that a capture and release plan must be in place prior to the capture of wildlife, and identifies Federal and State approvals that must be obtained in advance. These activities are conducted only by personnel who have been trained in wildlife protection protocols and have appropriate Federal permits. Each of the requirements identified in the Unified Plan improves the chance that wildlife protection efforts will be conducted appropriately and effectively, thus minimizing the overall number of animals impacted by the spill.

Interdependent and Interrelated Actions

Interrelated and interdependent actions are those which have no independent utility apart from the proposed action. They depend on the larger action for their justification (50 CFR §402.02). Interrelated and interdependent actions related to oil spill response activities include those not explicitly directed by the Unified Plan, but result from decisions made under the Unified Plan.

A large and concentrated influx of people and supplies can occur during an event. Depending on the size of a spill, this associated movement of people and supplies can be the equivalent of a small community and may include increased flights or marine vessel traffic, human activity, water and energy consumption, waste, noise, and heavy equipment. These actions may increase stressors on the environment in marine or coastal areas. Disturbance effects on listed species are discussed in the Disturbance section of this effects analysis.

Predator and scavenger populations (e.g., fox, gull, raven [scientific name]) may be increasing on the North Slope near sites of human habitation such as villages and industrial infrastructure (Eberhardt et al. 1983, Day 1998, Powell and Bakensto 2009), due to the availability of anthropogenic food sources in villages and oil fields, and alternative nesting/denning sites on human-built structures (Day 1998). If not handled appropriately wastes from spill responders could result in an influx of new predators and scavenger. Increased predator /scavenger populations on or near the nesting grounds of Steller's or spectacled eiders (i.e., North Slope or Y-K Delta) is likely to result in higher nest predation rates (Obritschkewitsch et al. 2001, Rojek 2008, Safine 2011.).,

Response Analysis Conclusions and Synthesis

In this response analysis, we considered the direct, indirect, and cumulative effects of potential spill response actions on listed species and their habitat. We evaluated spill response actions as stressors, and considered the environmental, biological, physiological, and behavioral responses likely to be exhibited by individuals of a listed species. We examined the available scientific and commercial data to determine if an responses to stressors would reasonably be expected to reduce an individual's fitness (i.e., survival, longevity, reproductive potential) . We also evaluated the impact of direct and indirect stressors on the quantity, quality, or availability of physical or biotic features of designated critical habitat.

We conclude that spill response actions have the potential to cause adverse effects on individuals and habitat through a variety of mechanisms. Mechanical countermeasures, particularly aggressive shoreline cleaning, dredging, and vegetation removal are likely to impact benthic food resources of Steller's eiders, spectacled eiders, otters, and in some circumstances, walruses. Use of dispersants may adversely affect listed species and habitat by increasing the spatial dimensions affected by a spill bydispersing oil into the water column. Dispersants may also facilitate formation of OSAs, which may increase the likelihood that benthic invertebrates will become contaminated. Use of dispersants may increase the bioavailability of more-toxic components of oil relative to undispersed oil. Finally, strong evidence suggests using dispersants increases the probability of feather wetting. *In situ* burning may produce smoke and residues that are toxic to animals and cause smothering of benthic invertebrates that are important prey species for Steller's and spectacled eiders, otters and walrus. Lastly, all response efforts can cause disturbance of individual animals.

We acknowledge that oil spill response is beneficial to the environment in general and actions under the Unified Plan will result in beneficial effects to listed individuals and their habitat. Mechanical response measures can reduce the amount of material in the environment and the affected area. Dispersants and *in situ* burning can reduce the concentration and thus the toxicity

of spilled material and speed biodegradation. Spill tracking and surveillance can reduce exposure to animals by identifying concentrations of animals in the spill's trajectory prior to exposure. Wildlife protection measures can prevent exposure and improve survival rates for animals that have been exposed. The net benefit to listed species and habitats is evaluated in the next section.

5.3 Risk Characterization Analysis

In this section, we integrate the likelihood of population-level exposure with the severity of individual-level effects to characterize the risk from the oil spill response as described in the Unified Plan. We assess the risks to listed species from the action, given the likelihood of exposure and the likelihood and severity of harm.

Methods

We use all the information provided in this BO (e.g., description of action, baseline, status of species) to assess the probability of exposure and severity of impacts are likely to jeopardize the continued existence of a listed species or adversely modify critical habitat. Additionally, we consider protective measures specified in the Unified Plan that are likely to mitigate potential impacts.

Probability of Exposure

Some level of exposure risk from spill response exists for all listed species covered in this BO. The degree of exposure is highly dependent on the temporal and spatial overlap of the individuals and their habitat and the extent of spill response activities. Intuitively, we conclude that direct impacts are most likely where spill response actions occur and larger spills will be associated with larger spill responses. Indirect impacts may affect animals in areas outside of the spill site or may have prolonged (chronic) effects beyond the duration of the spill event. Indirect impacts from reduced forage quantity or quality may continue after the spill response ends and could therefore affect more individuals than direct impacts. Because most spills in the Action Area have been small, we anticipate this trend will continue into the foreseeable future and adverse effects of the Action will likely be temporary and localized.

The Exposure Analysis provided a framework for evaluating the consequences of maximal exposure to the Action, and demonstrated that the actions described in the Unified Plan were unlikely to pose a significant risk to the continued existence of the listed northern sea otter, polar bear, short-tailed albatross, or Pacific walrus due to an exceedingly low likelihood of exposure to the response action at a spatial scale using hypothetical worst-case scenario oil spills as a proxy. We concluded that while individuals may be harmed during a spill response event, populations of these listed species are highly dispersed, making exposure at the scale of jeopardizing their continued existence exceedingly unlikely. Of these listed species, critical habitat has been designated for the sea otter. Impacts to their critical habitat will depend on the scale of the event, but while risks posed by spill response actions implemented under the Unified Plan could reduce its conservation value, negative impacts to critical habitat as a whole is exceedingly low.

Risk from Response Activities

Choosing a spill response action involves understanding tradeoffs of environmental effects. Use of chemical dispersants during a large offshore spill of crude oil may result in a greater area of effect and degree of impact on subsurface pelagic species than an untreated spill (Trudel 1982). However, spill response activities, particularly use of dispersants, may also reduce the direct impacts and likelihood of exposure to oil on the sea surface. Spill response actions can determine the likelihood of impacts on many environmental parameters, and in many spills, several response actions are conducted simultaneously, however, the actions are intended to improve environmental protection, including protection of listed species and critical habitat.

The signal of adverse effects from spill response activities would have to measurably amplify the adverse effects of the spill to be recognizable. If a spill were to occur on a scale large enough to place the continued existence of a listed species at risk or to significantly impair critical habitat, the spill response actions would then need to impose additional stressors significant enough to jeopardize the species or adversely modify critical habitat.

Scientific literature on ecosystem-level effects of dispersants on animals and habitat indicate the impacts are not substantially worse than the effects of the oil (see Response Analysis section). Various factors govern the effectiveness and toxicity of dispersants and their effects on pelagic and benthic food webs are not fully understood. While studies concluded that direct application of dispersants to birds can present a high hazard, proper application of dispersants can limit environmental exposure by diluting both the oil and the dispersant throughout the water column, reducing its concentration. Further, dispersants are not to be applied directly to birds or other animals and are intended only for surface application.

The Unified Plan's Dispersant Use Plan (ARRT 2014) and specifications provided by EPA/USCG (EPA and 2015; Appendix D) stipulate procedures that increase the chances that dispersants will be used in an appropriate and effective manner.

Steller's and Spectacled Eiders

The Response Analysis examines available scientific and commercial data to determine responses of individuals and impacts to critical habitat given their exposure to the Action. Individuals exposed to spill response activities may experience reductions in fitness, either from direct impacts, or from the effects of the activities on habitat. Indirect effects to habitat and forage may be severe, from dispersant use in particular, as described in the Response Analysis. However, whether those individual responses translate into risks to the species will depend on likelihood of exposure on a scale of consequence to the species. For Steller's and spectacled eiders, the probability of exposure, combined with the likelihood of fitness-reducing responses, is sufficient to raise concerns about whether actual spill response actions could adversely affect enough individuals to have consequences at the population level.

The probability of large spills in areas where listed eiders occur is low. Further, spills that are likely to occur are small, resulting in a low overall level of risk to the animals or their critical habitat. The frequency of occurrence of very large and catastrophic spills, such as those used to inform the hypothetical exposure analyses, is exceedingly low.

Factors Affecting Risks

There are several programmatic measures in the Unified Plan that reduce risk to all species, but there are other factors that influence spill risk and response in remote arctic environments. We discuss these more general factors here before considering risk to listed species more specifically.

Difficulty of Spill Response in Alaska

Despite a low probability of large oil spills in the Action Area, the distance from established population centers, limited daylight in winter, persistent sea-ice, rough ocean conditions, and hostile weather increase the difficulty of spill response activities relative to more temperate and populated areas. A high-energy marine environment will facilitate dispersion of the spill, but may also impede response activities. Cameron *et al.* (2011) noted that large spills at sea are difficult to contain and may spread over hundreds or thousands of kilometers, and that the threats posed by a spill in the Arctic are magnified by the limited resources available in the region for effective response. A prompt response is critical for efficacy of *in situ* burning and use of dispersants. The window of opportunity to use dispersants is typically within hours to 1 - 2 days after a spill; thereafter, the oil may become weathered and difficult to disperse (National Research Council 2010).

Presence of sea-ice can limit detectability and access to spilled material making access difficult or impossible and allowing contaminants to drift long distances prior to melting the following spring or summer. It can also limit effectiveness of skimmers. Ice may complicate the use of dispersants. To be effective during an open-water oil spill, the dispersant must be able to reach the oil slick, mix with the oil, and cause the oil to disperse into small droplets. Dispersants work best when a moderate amount of mixing energy exists. Ice dampens the mixing energy of ocean waves, but vessel propellers or high-pressure water systems can be used as an additional source of energy (Sørstrøm et al. 2010). Recent research indicates that dispersants may be used effectively in a broken ice environment with the development of improved delivery systems and introduction of extra mixing energy (Sørstrøm et al. 2010).

In some cases, the presence of ice can aid spill response activities. Cold weather slows weathering of oil, allowing more time for effective use of spill response actions. Ice can serve as a natural containment device preventing rapid spread of oil across the ocean surface. It can also concentrate and thicken the oil, allowing for more efficient skimming, dispersant application, and *in situ* burning operations. Shore-fast ice can form a protective barrier along shorelines. But in general, the difficulties of oil spill response in icy arctic environments are expected to outweigh the benefits and increase the risks to listed species.

Factors limiting the probability of a worst-case scenario

Drilling depths and well pressures in Chukchi Sea development, as well as improvements, such as blowout prevention technology, reduce the risk of a catastrophic well blowout like the DHS occurring in Alaska. The blowout causing the DHS occurred in 5,000 ft (1,524 m) of water with well pressures of approximately 15,000 psi (approximately 103,421 kPa) (Schmidt 2012). Drilling depths for the Chukchi Sea exploration are expected at approximately 150 ft (46 m) and

well pressures to not exceed 3,000 to 4,000 psi (approximately 20,684 - 27,579 kPa). Furthermore, improvements in industry and regulatory prevention measures have been made to reduce the risk of a similar event occurring in the future. Improvements have been made in blowout prevention technology, casing and cementing techniques, and requirements for redundant barriers during decommissioning. These improvements will be required for all exploratory drilling operations in the Chukchi Sea by the permitting agencies, and the BOEM/BSEE considers the likelihood of a blowout occurring during exploratory drilling in the Chukchi Sea as negligible (BOEM 2014).

The potential for an event similar to EVOS has been reduced by industry actions and the efforts of the USCG and other agencies in the years following that tragic spill. Significant improvements have been made in vessel tracking and monitoring, weather forecasting, communications, and vessel design. Double-hulled tankers are the industry standard, and single hulled vessels are being phased out. This alone is predicted to cut the risk of spills from cargo ships by a factor of four (DNV and ERM, 2010task2a). Despite these improvements, the amount of vessel traffic in areas used by listed species continues to rise. Although the likelihood that an EVOS-sized event could occur is small, we remain to be concerned because of the potential ecological harm it could cause.

Impact Avoidance and Minimization Measures

The effectiveness of BMPs for protection of wildlife during a spill depends on many factors. Actions improving response efficiency and effectiveness can reduce the size of the spill and thus the impacts to listed species and habitat. Of particular importance is the prompt availability of appropriate response resources and personnel. Indeed, one of the greatest protective devices for listed species and critical habitat may in fact be the framework provided in the Unified Plan for spill response preparedness. Components of the Unified Plan that contribute to spill response preparedness include:

- Detailed information regarding local spill risks, response strategies, and resources provided in SCPs;
- Guidance for training, spill drills, and equipment deployments;
- Resources identifying probable sources of hazardous materials and likely spill sites;
- The variety of technical guidance documents that have been prepared to supplement the Unified Plan (e.g., Nuka 2006; ACS 2010; API et al., 2001; NOAA et al., 2010).

These resources, together with industry standards (including spill prevention and response plans, equipment, and activities) and regulatory oversight, reduce the likelihood of spills and improve the response outcomes when spills do occur. Thus, the Unified Plan as a whole is a key component of reducing risk to listed species.

Incident-specific consultation

The Interagency MOA for Spill Response (USGS et al. 2001) establishes the role of Service on an advisory capacity to the Unified Command during an event. Incident-specific mitigation measures are to be provided to the Unified Command by the Service to minimize the impact of oil spill response activities to listed species. Emergency consultation is documented in a *post hoc* Biological Opinion describing the effects of the spill response activities and enumerating the amount and extent of incidental take.

Wildlife Protection Guidelines
Appendix G of the Unified Plan describes the Wildlife Protection Guidelines for Alaska (ARRT 2012). It includes BMPs for responding to oiled wildlife and wildlife threatened by spills. It is available as a resource for responders during spill response training and during a spill, and it provides guidance to the FOSC to reduce the risk of take and harm to listed individuals.

The Dispersant Use Plan
Various stipulations in the Dispersant Use Plan minimize risks to listed species; a preauthorization zone offshore of the Aleutian Islands will speed the decision making process and allow dispersants to be applied to spills promptly, when they are most effective. Preauthorization of dispersant use however, creates a risk dilemma. Preauthorization may reduce Service involvement in the decision to apply dispersants, resulting in an increased exposure risk for listed species.

Preauthorization in the offshore regions of the Aleutian Islands is intended to ensure certain vessels and facilities (including tank vessels that carry crude oil) maintain a minimum dispersant use capability in accordance with a 2009 USCG rulemaking (33 CFR 154). This preauthorized zone was identified by the ARRT as an area where additional spill response capacity is needed due to existing spill risk, distance from spill response centers, limited labor force, finite local resources, challenging weather, and other conditions. Various characteristics of the selected preauthorization zone demonstrate the ARRT's efforts to minimize risk. These include the exclusion of nearshore habitats used by several listed species, and incorporation of avoidance areas. The avoidance areas were excluded from the preauthorization zone due to concerns about potentially-harmful ecological effects of dispersing oil in areas of high documented short-tailed albatross use (see Appendix D). The preauthorization zone does not include critical habitat of any listed species under the Service's jurisdiction.

For areas outside the preauthorization zone, the decision process, criteria specified for consideration, and conditions/stipulation specified in the Dispersant Use Plan are all intended to facilitate effective dispersant use and minimize chances of adverse impacts to the environment. The decision process includes notifying EPA, DOI, DOC, and State and Tribal representatives of intent to use dispersants. Testing and monitoring protocols are initiated and followed prior to full-scale dispersant application. The following additional conditions/stipulations apply:

- The preauthorization of dispersant use (inside the Preauthorization Area) only applies to crude oil.
- Prolonged application of dispersants that exceeds 96 hours is not preauthorized.
- Additional monitoring is required for prolonged applications (>96 hours). Conditions will be assessed on a daily basis to determine whether dispersant application(s) will continue.
- Subsea dispersant use is not a potential response action identified in the Unified Plan.
- Dispersant delivery will not displace or interfere with mechanical or other response operations.
- Dispersant applications will only be carried out in daylight conditions.

- Dispersants will only be applied in areas where the water depth is ≥ 20 m (10 fathoms or 60 ft) and at sufficient distances from shore to ensure that sensitive nearshore and benthic habitats are not affected by dispersants and/or dispersed oil.
- Dispersant applications will maintain a minimum 500 m (1,640 ft) horizontal separation from swarming fish, rafting flocks of birds, marine mammals in the water, and/or marine mammal haulouts.
- Dispersants will not be sprayed on flocks of birds or other congregations of animals.
- To avoid disturbances at walrus haulouts, any dispersant-related aircraft will comply with all applicable horizontal and vertical distance restrictions issued by the Service.
- DOI and/or DOC will provide a specialist in aerial surveying of marine mammals and pelagic birds to accompany monitoring teams to help ensure compliance with the above requirements. If DOI and/or DOC cannot provide the appropriate specialist(s), a third party acceptable to the DOI and/or DOC will be identified to accompany the monitoring team.
- Any monitoring required by the incident-specific section 7 compliance will be conducted.
- Incident-specific consultation is required for any situation in which dispersant use may affect listed species or critical habitat.

These conditions reduce the likelihood that listed species will be jeopardized or critical habitat adversely modified by dispersant use.

Tracking, Surveillance, and Deterrence Activities

Tracking and surveillance allows identification of vulnerable animals during spill response activities that may be hazed or proactively relocated to minimize harm. It is probable that some spill response activities will increase disturbance through human or boat traffic in the area. It is also probable that injury to individuals will occur from hazing or capture, but if done correctly and according to the Wildlife Protection Guidelines the net effect of these activities should reduce the likelihood of harm to listed species and reduce the take of individuals potentially affected by spilled oil.

Species-specific Synthesis

Northern Sea Otter

The implementation of the Unified Plan may result in adverse effects to individual sea otters and some proportion of their critical habitat as a result of direct exposure to dispersed oil, physical manipulations of habitat associated with mechanical spill response actions, and/or chemical changes in habitat following use of dispersants or *in situ* burning. The risk of population level effects from spill response activities is low. The maximum scale of plausible impact was examined under a hypothetical worst-case scenario equivalent to EVOS. Because sea otters are distributed across the entire spatial extent of sea otter critical habitat, only a massive event, at least 40% larger than EVOS, occurring where sea otter density is highest across its range, would jeopardize the population or the adversely impact the conservation value of critical habitat (see Exposure Analysis). An alternate scenario is the scale of spill response would need to exceed the scale of the effects of the worst-case spill by 40% or more to expect a similar, catastrophic result. The likelihood of such an event is exceedingly low, and is further reduced by modern industry

protections that were not in place at the time of EVOS, such as vessel tracking and requirements that tankers be double-hulled.

The response of sea otters and their critical habitat to actions implemented under the Unified Plan will depend on intensity, scale, duration, location, and type of activity. The importance of international shipping lanes, presence of industrial centers, and the increasing level of transit through sea otter critical habitat results in a level of risk that cannot be ignored. As described in the Response Analysis, the greatest risk of large-scale or widespread adverse impact is likely to be from the use of dispersants due to impacts to benthic invertebrate food resources.

Impacts to critical habitat are of concern if they affect the "primary constituent elements (PCEs)", i.e., the biological and physical features that are essential to the conservation of the species. Mechanical spill response actions may affect each of the PCEs of sea otter critical habitat, including shallow rocky areas less than 2 m (6.6 ft) deep (PCE 1) and within 100 m (328 ft) of Mean High Tide (MHT) (PCE 2), kelp forests (PCE 3), and prey resources (PCE 4). Kelp beds may also be affected by repeated vessel traffic. Prey resources are more likely to be affected by non-mechanical spill response actions than other PCEs. Impacts from mechanical measures and vessel activities will generally be localized near the spill response site; impacts to prey resources (especially from use of dispersants) may be more widespread.

The food value of benthic invertebrate communities may be reduced following exposure to spill response actions. Benthic invertebrate communities and kelp forests may recover in suitable areas in a relatively short time period, or may not reestablish. Intertidal and subtidal communities in southwest Alaska are highly dynamic, and have undergone several phase shifts between alga- and herbivore-dominated states in recent decades (Estes et al. 2004). Growth and colonization is influenced by nutrient inputs, currents, and upwelling (Menge 2000), the scale of disturbance (Thrush et al. 1996), and the abundance of grazers such as urchins (Mann 1973). While these factors confound predictions of critical habitat response to the Action, none of the anticipated impacts will cause permanent habitat loss. If habitat is left undisturbed following spill response actions, it will continue to provide habitat for sea otters after a period of recovery. Reductions in habitat value, although temporary, could impact the survival or recovery of sea otters, if they occur on a large enough scale.

Planning and prevention components of the Unified plan and associated SCPs are the first defense tactics that will benefit the northern sea otter due to a resultant reduction in potential for spills to occur. Spill responder networks, SCPs, Wildlife Protection Guidelines, Dispersant Use Guidelines, and technical guidance documents developed for and detailed in the Unified Plan also help to improve the efficiency of a spill response in the event of a major spill. A large number of animals could be exposed to a spill and associated spill response actions, particularly during a large or prolonged event. However, the resiliency of the sea otter is demonstrated by their recovery following over-harvest during the fur trade of the 19th century and their gradual recovery from the EVOS spill. Given the current population size, the relatively small numbers needed to sustain a viable population, and their widespread distribution, it is highly unlikely that a sufficient number of individuals would be affected by the Action to cause population-level impacts.

Short-tailed Albatross

This wide-ranging, pelagic species may be susceptible to the effects of spill response activities in and outside of the dispersant-use preauthorization area. Direct exposure to dispersed oil or residual contamination following *in situ* burning may affect individuals present in the affected area or adults may carry contaminants back to breeding areas where chicks may be harmed. Potential impacts from spill response may include: impaired breathing or lung damage from the aspiration of dispersants, dispersed oil, or smoke inhalation following burning; degradation of the insulating properties of feathers following exposure to dispersants, resulting in hypothermia; and potential changes in abundance and composition of prey affected by oil and dispersant toxicity.

Molting birds may be particularly vulnerable to wetting of feathers (Stephenson 1997), while at the same time their energy demands may be elevated due to the cost of feather synthesis. Short-tailed albatrosses may molt in the Aleutian passes or the canyons of the outer continental shelf break where they may be at greatest risk of exposure due to relatively high numbers in these areas at certain times of the year.

Despite these potential risks, spill response actions are not likely to adversely many individuals. The scale of impacts from a hypothetical worst-case scenario analysis, which employed assumptions that likely overestimated impacts to albatrosses, suggest only an event 8.7 times larger than EVOS, and with adverse impacts specifically attributable to spill response actions would appreciably reduce the probability of survival and recovery of the short-tailed albatross. The likelihood of a spill of that size occurring is extremely low.

Polar Bear

Individual polar bears may be adversely affected during implementation of the Unified Plan. Impacts may arise from disturbance from aircraft or vessels, harassment during deterrence, direct exposure to dispersed oil, inhalation of smoke from *in situ* burning, and exposure to dispersed oil from feeding on scavenged carcasses. The severity of exposure will depend on any number of factors, not necessarily limited to the response activities: location and size of the spill; accessibility of the spill site; spill trajectory; time of year; weather conditions (i.e., wind, temperature, precipitation); environmental conditions (i.e., presence of ice); effectiveness of spill responses will influence impacts to polar bears.

Several factors related to their life history increase the level of risk to polar bears from spill response activities. The polar bear's curious nature may lead bears to approach spill response vessels and shore-based responders, causing safety concerns and resulting in deterrence efforts to prevent human/bear encounters. Bears may ingest dispersed oil while feeding on the scavenged carcasses of oiled seals or other animals. They may also encounter contaminated material at landfills, disposal sites, or other opportunistic foraging areas if waste materials are comingled with municipal wastes or disposed of in other inappropriate ways. The geographic distribution of polar bears overlap with significant oil and gas development in the Action Area, where spills are most likely to occur. On the North Slope, bears traverse areas of oil and gas development in the fall and during the ice-covered season when coming ashore to feed, den, or travel. Den

emergence may be a time of particular vulnerability, as bears may be dehydrated, undernourished, or accompanied by a cub.

In rare circumstances, a large number of bears may be exposed to spill response activities. This could occur due to treatment of a large or prolonged spill with dispersants, resulting in a large spatial area affected. A prolonged spill response effort may also increase exposure as bears move through the affected area with changes in seasonal habitat use. Spill response near a high-density area, such as a village bone pile, could likewise increase the numbers exposed at certain times of the year. The largest level of exposure during a hypothetical worst-case scenario was estimated to be approximately 5.5% of the minimum global polar bear population size, thus the Action alone is not likely to cause population-level impacts.

Chronic exposure to contaminants is a concern for polar bears. Currently, the use of spill response techniques that contribute contaminants to the environment is extremely infrequent and does not raise concerns for cumulative exposures. Should dispersants be used repeatedly in one location, or their use generally become more common in the future, polar bears may be at greater risk of adverse effects. Chronic effects from extremely rare large scale events are possible. Spill response efforts involving collecting and removing oiled carcasses may reduce this risk. Chronic effects from small spills are unlikely due to the large home ranges and frequent movements of individual bears, as documented, for example by Pagano et al. (2012).

The current status of the polar bear in the Action Area is concerning, however. Declining survival rates, recruitment, body size, and recent low growth rate estimates for the SBS population suggest the population is declining. The A-C population status is uncertain, but may currently be faring better in the face of habitat loss from changes in sea-ice than the SBS population. With small population sizes and low reproductive rates, any loss of large numbers of polar bears (especially adult females) or prey species could exacerbate that decline. However, given the low likelihood of occurrence of large spills, the advancements in industry standards and regulatory oversight for blow-out prevention developed after DHS, and the differences in depth and pressures between the Gulf of Mexico and the southern Beaufort and Chukchi seas, the likelihood of significant impacts to the population from the Action is extremely low.

Pacific Walrus

Walruses exposed to direct, indirect, acute and chronic effects of spill response actions will respond variably, depending on the type of response action encountered. Exposure to dispersed oil, smoke, or residues from *in situ* burning may cause severe physiological impacts including neurotoxicity or reduced pulmonary and cardiovascular function. Acute exposure is likely to occur through inhalation of volatilized substances at the water surface. Chronic exposure may occur through the food chain. Walruses feed primarily on immobile benthic invertebrates, which may be affected by use of non-mechanical countermeasures; dispersed oil or *in situ* burn residues may smother or contaminate benthic invertebrates, causing loss of food resources, reduction in food quality, and bioaccumulation of contaminants. Acute adverse effects from spill response activities may arise from disturbances at haulouts. Large haulouts may contain tens of thousands of animals. Disturbances from aircraft, vessels, and onshore activities may cause a stampede, resulting in injury or death of hundreds of animals.

The walrus' tendency to congregate in large concentrations increases the potential for exposure to spill response activities occurring nearby. Large groups have been documented in the shallow waters of Hanna Shoal and in haulouts near Point Lay during summer, especially in recent years with low ice coverage. These areas are near the Chukchi Sea outer continental shelf oil and gas exploration area, and walruses may be exposed to spill response actions during oil exploration work. North Slope oil and gas development poses little risk to Pacific walruses, as they do not normally range into the Beaufort Sea, although individuals and small groups have occasionally been reported. Large groups have been observed in the southwestern Chukchi Sea along the coast of northern Chukotka during autumn (Jay et al. 2012). Although there are no existing oil and gas development or production activities in the Russian sector of Chukchi Sea, the region is thought to contain significant oil and gas reserves. In 2006, 3,700 km of seismic surveys were conducted in Russia's North and South Chukchi basins to explore for economically viable oil and gas reserves. Preliminary results were described as "very encouraging" (Frantzen 2007). Walruses using haulouts along the Bering Strait may be at greater risk in the future due to expanded Arctic shipping, but currently, the likelihood of spills in these areas is very low.

The number of walruses at risk from implementation of the Unified Plan depends on the scale of spill response, which is determined by the scale of the spill. Our evaluation of the consequences of the hypothetical worst-case scenario suggests spill response activities associated with a large-scale event must occur on a scale nearly 40% larger than the DHS to potentially jeopardize the species. Given the improbability of large spills, the high probability that most spill response actions will decrease the scale of impacts, and the low likelihood that if effects will be worsened by spill response (i.e., dispersant use), implementation of the Unified Plan is highly unlikely to cause population level impacts to walruses.

Measures identified in the Unified Plan and its Wildlife Protection Guidelines (ARRT 2012) will help to minimize risks to walruses during spill response. These include limitations on approach distances to haulouts for vessels and aircraft, guidance for use of deterrence techniques, and BMPs for avoiding use of dispersants near shore and near concentrations of wildlife. The recommendations developed during incident-specific consultation with Service biologists per the Interagency MOA (USCG et al. 2001) will be particularly valuable for reducing level of take during spill response.

Steller's Eiders

Exposure at the scale of a hypothetical, worst-case scenario could significantly affect the listed Steller's eiders population, as concluded in the Exposure Analysis, above. The potential for harm to individuals from spill response actions also exists, as described in the Response Analysis. Risk to Steller's eiders is mainly due to their small population size and higher exposure potential in some habitat areas at certain times of year. Due to the already low numbers, take of relatively low numbers of birds may have proportionally large effects on the population and this makes them vulnerable to stochastic events. Factors reducing risks to eiders include low probabilities of a spill where they congregate to molt, a dispersed population during times they do occupy areas with higher vessel traffic, a land-based nesting strategy, and a staged occupation of marine areas on the North Slope.

Apparent use of the KSCHU by a relatively large proportion of the listed Steller's eider population during molt increases the population-level risk. Though sample size is minimal, the best available evidence suggests that between one half and two thirds of the listed population uses this area during the flightless molting period. Three factors reduce risk in the KSCHU: low levels of current vessel traffic, a lack of current oil and gas development, and low human population sizes in this area. There are relatively few communities on the Y-K Delta, which limits vessel traffic. As described in the baseline section, low vessel traffic translates into low spill probability. Moreover, not all of the listed Steller's eider population molts in the KSCHU. The low likelihood of a large spill in this region combined with protective measures specified in the Unified Plan result in a low risk of harm to Steller's eiders in this CHU. However this low level of risk could change in the future, due to proposed development of a large-scale gold mine. Project proponents have identified transportation of large amounts of fuel and other hazardous materials via the Kuskokwim River as a possible project alternative (Donlin Gold 2015).

During winter, Alaska-breeding Steller's eiders inhabit harbors with significant levels of vessel traffic and industry, especially near Unalaska (Dutch Harbor), Akutan, Cook Inlet, and Kodiak. Baseline probability of spills is higher in and around these harbor areas. Nonetheless, the tendency of the listed Steller's eider population to disperse to different areas (rather than congregating in one area) during the winter reduces the probability of population level exposure from any one spill event. This tendency results in a low probability that Steller's eiders will experience substantial population-level exposure to spills and spill responses during winter. Their proximity to shipping corridors and population centers may further reduce risk by making spill response activities easier to implement (compared with more remote regions). As described above, many spill response activities are predicted to reduce rather than increase the risk of harm.

During the breeding season, Steller's eiders congregate in flocks in the near shore environment off the coast of northern Alaska where oil and gas exploration is ongoing. A factor reducing this risk is Steller's eiders occupancy of marine habitat is staged in time, such that the entire population does not occupy it at once (see Status of The Species section). This timing of occupancy limits the population level exposure potential. In order to harm a large fraction of the population, a large and long duration spill, such as a well blowout spill, would have to occur. This type of spill currently has an exceedingly low probability of occurrence.

Steller's eiders breed on land, which also reduces the probability of population level exposure during this life stage. Spills on land tend to be smaller than spills in the water, due to the lack of dilution in water or dispersion by currents. Due to the relatively small spatial extent of most land based spills, nesting Steller's eiders are likely to be much more widespread in space in comparison. Therefore, although oil spills on land may affect individuals during the nesting season, such an event is exceedingly unlikely to harm or take more than a few individuals of Steller's eiders.

The critical habitat analysis examines the relationship between population size for the listed Steller's eider populations, the size of existing CHUs, and carrying capacity. Steller's eider and sea otters eat many of the same food resources. Please refer to the Sea Otter Risk Analysis

section above for a discussion of effects of spill response on food resources including marine invertebrates.

Population sizes of listed Steller's eiders on the breeding grounds have declined (based on historic estimates) which led to their ESA designation (see status of the species section). The population size is determined, in part, by the quality and quantity of physical habitat and available food resources. Factors like frequency and intensity of adverse conditions and the abundance of predators and competitors influence an area's carrying capacity. When we apply the "Destruction or Adverse Modification" standard, we think in terms of the ecological function or "ecological carrying capacity" of the designated area. We ask whether direct or indirect effects of the proposed Action are likely to reduce the "carrying capacity", where the "carrying capacity" of the entire designation is the sum of the carrying capacities of the various sub-units. Ecological carrying capacity is defined as the population size an area can indefinitely sustain or as the environment's maximal load (Hui 2006). We considered if the activities in the Unified Plan would substantially reduce the quality and quantity of Steller's eider critical habitat such that it would reduce carrying capacity.

A reduction in the ability of the critical habitat to support the population, i.e., a reduction in carrying capacity, could be an indicator of adverse modification of the habitat. The small population sizes of breeding Steller's eiders in Alaska suggest that their populations are highly unlikely to be close to the carrying capacity of the relatively large critical habitat areas designated for their use. Moreover, these areas are in relatively pristine ecological condition. By this logic, a relatively large proportion of the critical habitat area would need to undergo substantial degradation from its present condition to reduce the ecological carrying capacity, e.g., the function of the critical habitat as a whole and the conservation role that it provides for Steller's eiders. This is highly unlikely, given the current depressed population status and the large availability of these ecologically intact habitat units.

Spectacled Eiders

Spectacled eiders experience higher risks than other listed species due to higher exposure potential for the entire listed species while wintering in the CHU south of St. Lawrence Island. Spectacled eiders from all three breeding populations— the entire known global population of spectacled eiders—winter in open water leads in the pack ice in the Bering Sea between St. Lawrence and St. Mathews Islands. The probability of spills and associated response actions in the wintering area in the polynyas and lead complexes south/southwest of St. Lawrence Island is minimal, because most ships cannot or do not transit through the pack ice during winter. Currently, there is no planned oil or gas development in the area and limited shipping in winter due to extensive sea-ice. A main factor reducing the risk of population-level exposure for spectacled eiders is that the probability of spills in areas they frequent is low, making them highly unlikely to be exposed to a spill or the response action.

We also considered the risk that the Action could destroy or adversely modify the CHUs for spectacled eiders. Spill responses occurring during any time of year could affect the spectacled eider wintering CHU in the Bering Sea between St. Lawrence and St. Matthew Island. The PCEs here include all marine waters that are 75 m (246.1 ft) or less in depth, along with

associated marine aquatic flora and fauna in the water column and the underlying marine benthic community. Spill responses reducing quality or abundance of benthic invertebrates will result in a reduced quality of the critical habitat for the eiders. The frequency of vessel traffic through the area is higher than in summer, particularly by fishing vessels, but there are no important shipping routes, large urban centers, large industrial facilities, or oil development. Thus, the likelihood of a very large spill response action occurring in the area is very low and incapable of significantly reducing the forage value in the CHU.

Offshore oil and gas development in the Southern Beaufort and Chukchi seas increases the probability of spectacled eiders exposure to spill response actions near North Slope habitats in the summer. Birds stage near offshore oil and gas development before and after the breeding season. Probability of exposure varies with the amount of time spent in the area and the locations used. Males are less likely to spend time in this staging area than females, and when they do stage here, males use areas closer to shore. Land-based oil development on the North Slope increases the probability of exposure of nesting birds to spills in this region. Oil development is gradually spreading westwards across the North Slope from the original hub at Prudhoe Bay; expansion of industrial development is likely to continue. As with Steller's eiders, spills on the terrestrial nesting habitat may affect individuals, but will generally have a limited ability to spread beyond the immediate spill area and are not likely to be increased in size due to response activities, and thus have very low likelihood of affecting many nesting birds.

A substantial portion of the Ledyard Bay Critical Habitat Unit (LBCHU), designated for molting spectacled eiders overlaps with the Chukchi Sea oil and gas exploration area. Spill response activities, especially dispersant use in the Chukchi Planning Area could reach the molting spectacled eiders and potentially affect the physical and biological features of this CHU. Factors associated with the low risk are that most spills projected to occur from oil and gas development are expected to be of low volume. Small spills would have to occur directly adjacent to or within the LBCHU to affect the habitat or the eiders. Currents would generally push spills or dispersed oil in this area northward. As such, risks of impacts from spill response actions in the LBCHU are minimal.

The Y-K Delta breeding population molts and stages in eastern Norton Sound. Currently, there is no oil and gas development and limited vessel traffic in the Y–K delta region or in Norton Sound. Similar to Steller's eiders, the population declines on the breeding grounds suggest that the relatively large and ecologically intact critical habitat areas are likely to have a much higher carrying capacity than the population they support at present. For this reason, a relatively large proportion of the critical habitat area would need to undergo substantial degradation from its present condition to reduce ecological carrying capacities of these areas. Low probabilities of spills in these areas lead us to the conclusion that activities in the Unified Plan are not likely to reduce the quality and quantity of spectacled eider critical molting and breeding habitat.

These factors combine to make the risk of the Action to spectacled eiders exceedingly low. A low probability of exposure (due to low vessel traffic and low spill probability), coupled with a high probability of harm (where the entire population to be exposed) still results only in moderate risk. At this point, we must also consider the possible responses to spill response

activities. To determine that the Action would jeopardize the population, there must be evidence to suggest that activities associated with a response to a worst-case scenario spill would result in population level impacts above and beyond the spill itself. Our review of the best available science in the response analysis does not lead us to this conclusion.

Risk Characterization Conclusions

The probability that Alaska's listed species could be exposed to spill response actions at a spatial or temporal scale capable of affecting a sufficient number of individuals to have consequences for entire populations is extremely low. Steller's and spectacled eiders have greater potential for exposure levels of consequence to the listed populations due to their concentrations on the wintering or breeding habitats and because of their small population size to begin with (Steller's eiders). However, because most spills are small, exposure to impacts of the Action will most often be temporary and localized, occurring near the spill site, and affecting only a few individuals—far fewer than necessary for population-level effects. However, our review of the risks to listed species and critical habitat has revealed various geographic areas or time periods at which species may be particularly sensitive to effects of spill response. These are shown in Table 10. For example, we identified potential impacts from a short-term, yet massive spill with use of dispersants to sea otters in the Kodiak, Kamishak, and Alaska Peninsula CHU to be concerning, because this may be the most stable portion of the listed population and provides a buffer against impacts to the rest of the population. Because such an event is extremely unlikely, the resulting risk would be considered low to moderate. Risks for other species are likewise described.

Spill response activities may have adverse impacts to individuals ranging from loss of food resources (an indirect effect) to stress from capture and handling (a direct effect). Spill response actions may also be beneficial, particularly the actions conducted under the Unified Plan which prevent spills and reduce their size. Most of the actions implemented under the Unified Plan, given the situations most likely to trigger those actions, are intended to improve environmental protection, including protection of listed species and critical habitat.

Various factors, including logistical constraints, environmental factors, decision-making processes, BMPs and impact avoidance measures, all influence the risk of adverse effects by either altering the probability of exposure or the species' response. The Service recognizes the considerable benefits of the Unified Plan, but acknowledges that adverse effects to individuals of listed populations are likely to occur as a result of the activities proposed. However, we conclude, based on the baseline and the status of the species, there are no likely situations in which implementation of the Unified Plan (apart from and in addition to any impacts of a spill) could result in severe and widespread exposure to harmful activities sufficient to threaten the continued existence of a species.

Table 10. Risk summary table. This table highlights potential situations of concern for listed species and critical habitat.

Species	Sensitive Habitat Area	Event	Location	Frequency of event(s) needed to generate Risk	Scale of event(s) needed to generate Risk	Duration of event(s) needed for Risk	Severity of risk given frequency, scale, duration	Likely-hood of occur-rence	Explanation
Sea Otter	Kodiak, Kamishak Alaska Peninsula Critical Habitat Unit	Massive spill response with dispersants	South-central Alaska	Infrequent	Extreme	Short	Low/Moderate	Extremely unlikely	Otters in the Kodiak, Kamishak, and Alaska Peninsula Critical Habitat Unit are the most stable portion of the listed population. They may be of particular importance as a buffer against baseline stressors
Short-tailed albatross	Aleutian Passes	Medium Spills response with dispersants	Aleutian Islands	Repeated	Moderate	Short	Low/Moderate	Moderate	Short-tailed albatross molting in the passes may experience additional mortality due to accumulation of toxins if exposed repeatedly over time
Spectacled eider	Norton Sound, Ledyard Bay	Medium Spills response with dispersants	Chukchi, Bering Sea	Infrequent	Large	Short	Moderate	Unlikely	Large numbers of spectacled eiders congregate in the molting areas
Spectacled eider	Winter Habitat S. of St. Lawrence	Large Spill response with dispersant, in-situ burning	Bering Sea	Infrequent	Large	Medium	High	Unlikely	The entire population of spectacled eiders overwinter in this area and if exposed to large-scale, high intensity or repeated spill response events may suffer severe impacts
Steller's eider	North slope nesting habitat	Large spill response	North Slope	Repeated	Moderate	Short, during nesting	Moderate	Moderate	Spill response activities during nesting could cause nest failures, which may have population-level effects if repeated
Steller's eider	Kusko-kwim shoals	Large Spill response with dispersants	Bering Sea	Infrequent	Moderate	Short, during staging or migration	Moderate	Unlikely	High concentrations of listed Steller's eiders are present in this Critical Habitat Unit
Steller's eider	Barrow nearshore	Medium spill response with dispersants	North Slope	Repeated	Moderate	Long	Moderate	Unlikely	Spill response activities in staging areas following the breeding season could affect a high proportion of the population if events are repeated or occur over an extended time period.
Pacific walrus	Hanna Shoal, Point Lay	Large Spill response with dispersants	Beaufort Sea	Repeated	Large	Short or long	Moderate	Moderate	Walrus in this area may accumulate toxins, particularly if large scale spill response is repeated periodically, resulting in impacts to multiple generations.
Pacific walrus	NE Chukotka Peninsula	Large Spill response with dispersants	Southern Chukchi Sea	Infrequent	Large	Short or long	Low/Moderate	Unlikely	Walrus aggregate as the ice begins to move south, increasing vulnerability of the species
Polar bear	Coastal Alaska Denning habitat, sea ice	Massive Spill response with dispersants	Chukchi Sea, Bering Sea	Infrequent	Extreme	Long	Low/Moderate	Unlikely	Polar bears may be at risk when exposed to extreme widespread dispersed oil

5.4 Effects Analysis Conclusions

The literature on the effects of spill response activities indicates there are tradeoffs in the environmental impacts of spill response. Under some scenarios, including dispersant use, spill response may be worse than the spill itself. In other scenarios, spill response actions have demonstrably improved the outcome from that of an unmitigated oil spill. The best available information leads us to conclude that effects of the proposed actions in the Unified Plan are of low population-level risk to all listed species considered (Table 11).

Table 11. Effects Analysis Conclusions Table.

Listed Species/ Critical Habitat	Exposure Analysis	Response Analysis	Risk Characterization	Conclusion
Sea Otter	Worst-case scenario insufficient to cause concerns for survival and recovery of species	Spill response actions may cause take	Moderate risk of effects to individuals, extremely low likelihood of impacts to listed species	The Action is not likely to Jeopardize listed species
Sea Otter Critical Habitat	Worst-case scenario insufficient to cause significant decline in conservation value of critical habitat	Spill response actions may reduce physical and biological habitat features important to the species	Moderate risk of effects to local habitat areas, extremely low likelihood of impacts to critical habitat as a whole	The Action is not likely to adversely modify critical habitat
Short-tailed albatross	Worst-case scenario insufficient to cause concerns for survival and recovery of species	Spill response actions may cause take	Moderate risk of effects to individuals, extremely low likelihood of impacts to listed species	The Action is not likely to Jeopardize listed species
Polar bear	Worst-case scenario insufficient to cause concerns for survival and recovery of species	Spill response actions may cause take	Moderate risk of effects to individuals, extremely low likelihood of impacts to listed species	The Action is not likely to Jeopardize listed species
Pacific walrus	Worst-case scenario insufficient to cause concerns for survival and recovery of species	Spill response actions may cause take	Moderate risk of effects to individuals, low likelihood of impacts to listed species	The Action is not likely to Jeopardize listed species
Spectacled eider	Worst-case scenario could cause jeopardy	Spill response actions may cause take	Moderately high risk of effects to individuals, low likelihood of impacts to listed species as a whole	The Action is not likely to Jeopardize listed species
Spectacled eider Critical Habitat	Worst-case scenario could degrade conservation value of habitat	Spill response actions may reduce physical and biological habitat features important to the species	Low risk of effects to local habitat areas, extremely low likelihood of impacts to critical habitat as a whole	The Action is not likely to adversely modify critical habitat
Steller's eider	Worst-case scenario could cause jeopardy	Spill response actions may cause take	Moderately high risk of effects to individuals, low likelihood of impacts to listed species as a whole	The Action is not likely to Jeopardize listed species
Steller's eider Critical Habitat	Worst-case scenario could degrade conservation value of habitat	Spill response actions may reduce physical and biological habitat features important to the species	Moderately high risk of effects to local habitat areas, low likelihood of impacts to critical habitat as a whole	The Action is not likely to adversely modify critical habitat

[Top]

6.0 CUMULATIVE EFFECTS

Cumulative effects are the effects of future State, tribal, local or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered in this section if they require separate consultation pursuant to section 7 of the ESA.

6.1 Further Oil and Gas Development

Further oil and gas development, including a proposed natural gas line, whether in Federal or State waters or in the terrestrial environment on State, private, Native-owned, or Federal lands, would require Federal permits (such as section 404 of the Clean Water Act authorization from the U.S. Army Corps of Engineers (COE), and National Pollution Discharge Elimination System permits from the Environmental Protection Agency) and, therefore, are not considered cumulative impacts under the ESA.

6.2 Community Growth

Community growth is anticipated to continue in many places statewide (U.S. Census Bureau 2013). The spatial footprint and population sizes of many cities and villages will likely increase, along with associated infrastructure such as roads, power lines, communication towers, landfills, and gravel pits. These activities may impact listed species. The scale of impacts will depend not only on the amount of growth, but the location in relation to habitat of listed species. As the human population grows, so does the probability of impacts to listed species and critical habitat. Community growth may be most important to the listed Steller's eiders given the proximity of important habitat areas to existing communities. Many of the activities that may affect these habitats require Federal permits and are not considered cumulative impacts, but other activities may cause disturbance or impact the quality of habitat.

6.3 Commercial Fishing

Reduction in the extent and duration of sea-ice may increase the potential for commercial fishing, but the likelihood and magnitude of these activities are unknown at this time. Under the Arctic Fisheries Management Plan, NMFS currently has prohibited all commercial fishing in the Arctic. Commercial fishing is an important industry in the Bering Sea. Commercial fisheries in the Action Area are managed by the North Pacific Fisheries Management Council and the NMFS, and the issuance of regulations require section 7 consultations. These activities, therefore, are not considered cumulative effects.

6.4 Increased Marine Traffic

Increased marine traffic could impact listed species through disturbance, collisions, and more significantly from accidental fuel spills. In the Chukchi and Beaufort seas, decline in the extent of Arctic sea-ice in the summer and increase in the length of the ice-free season has prompted interest in shipping within and through Arctic waters via the Northwest Passage (Brigham and Ellis 2004). Ships operating, or that could operate in the area, include military vessels, pleasure craft, cruise ships, barges, scientific research vessels, and vessels related to oil, gas, or mineral development. The potential increase in the number of vessels operating in Arctic waters has

been matched by an increase in USCG activities. The USCG conducted a number of major exercises in Arctic waters in recent years for which section 7 consultations were conducted.

Shipping through the Northwest Passage could involve routes through the Bering Sea as well as Arctic waters. However, we have no data on the number of vessels that may operate in these waters, the routes that may be selected, or the magnitude of potential risk they pose. In addition, all international commercial shipping currently taking place utilizes the Northern Sea Route in Russian waters, not the Northwest Passage that includes U.S. waters. As more information becomes available, we will consider these impacts in future section 7 consultations.

Thousands of vessels transit the Great Circle Route through the Aleutians each year and the level of use is expected to double into the next several decades (Nuka 2005). DNV and ERM (2010) conducted an evaluation of existing and future spill risk through the Aleutians. Using models incorporating the frequency of use, the occurrence and consequences of spills, and projected future conditions, they estimated the amount of material spilled to increase by 48–83% by 2034 and frequency of accidents to increase by 11%. However, the average amount of material spilled per accident is expected to decline due to increasing numbers of vessels with double hulled protection (required for new tankers) (DNV and ERM 2010b). Increased spill risk in the Aleutians will increase baseline risk of contaminant exposure for listed species. New and improved risk reduction measures have been proposed and would benefit listed species (Nuka 2005; See Recommendations Section).

6.5 Increased Scientific Research

Interest in scientific research across the Action Area is increasing as concerns about effects of climate change grow. While research is often conducted by universities and private institutions, many activities are funded by the National Science Foundation or operate from U.S. Coast Guard vessels and are therefore considered in other section 7 consultations.

6.6 Subsistence Harvest

Subsistence harvest of polar bears, sea otters, and walruses are expected to continue in the Action Area in the future. The Service will continue to work with Native groups and others nationally and internationally to participate in the management of subsistence harvest in order to minimize potential for these impacts to alter the probability of continued survival of the species.

7.0 CONCLUSIONS

Section 7(a)(2) of the ESA requires Federal agencies to ensure that their activities are not likely to: (1) jeopardize the continued existence of listed species; or (2) result in the destruction or adverse modification of designated critical habitat. In addition, the lead Federal agencies have requested conference for the Pacific walrus, a candidate species. We have evaluated the effects of the Action on sea otters, short-tailed albatrosses, spectacled and Steller's eiders, polar bears, and Pacific walruses to ensure that their continued existence will not be jeopardized. A conclusion of "jeopardy" for an action means that the action could reasonably be expected to reduce appreciably the likelihood of both the survival and recovery of the species. A conclusion

of "adverse modification" means that the action could reasonably be expected to appreciably diminish the value of critical habitat for the survival and recovery of this species.

This programmatic consultation, evaluates the decision-making processes incorporated into the Unified Plan; we determine if they are sufficient to identify and prevent individual spill response actions likely to increase the extinction risks of endangered or threatened species or reduce the value of designated critical habitat for the conservation of those species. To do this, we considered the impacts of typical spill response actions, and assessed the impacts relating to the scale of exposure during a spill response by considering a hypothetical worst-case scenario oil spill. We also considered the benefits of BMPs, preventative measures, incident-specific consultation during a spill response, and other risk-reducing factors. Our conclusion is based on the comprehensive consideration of direct and indirect effects of the Action, interdependent and interrelated actions, and cumulative effects considered against the environmental baseline and status of the species. We concluded that the effects of the Action alone are largely beneficial to listed species, although not wholly beneficial; incidental take of individuals from listed species is likely to occur on an incident-specific basis. Our rationale for each listed species follows:

7.1 Sea otter

It is the biological opinion of the Service that **the proposed action will not jeopardize the southwest DPS of northern sea otters and will not result in adverse modification of designated critical habitat**. This opinion is based on the following evidence:

- Because of the current population size, widespread distribution, and recent stabilizing population trends of some portions of the listed entity, an extremely large spill response event would have to occur before enough animals could be affected to impact the listed species as a whole.
- The expanse of designated critical habitat makes it unlikely that actions implemented under the Unified Plan would reduce the value that the critical habitat as a whole provides to the conservation of the species.
- The hypothetical worst-case scenario spill, combined with the spill response activities likely to be conducted for an event of that scale would not impact a sufficient portion of the listed population to lower the probability of survival or recovery of the species.
- Typical spill response actions will be relatively small in scale. These events will have only localized impacts to the PCEs of habitat (including food resources, shallow nearshore areas, and kelp beds) and will affect a limited number of animals.
- The likelihood of large spill response actions, which may have extensive impacts to large numbers of otters and areas of habitat, is extremely low.
- During a large spill response event, the initiation of section 7 consultation per the Interagency MOA will trigger incident-specific involvement from the Service. Any necessary and feasible actions to prevent spill response activities from jeopardizing the sea otter or adversely modifying critical habitat will be implemented at that time.
- Critical habitat for the sea otter is not within the preauthorization zone for use of dispersants. The Service will provide additional review and recommendations prior to use of dispersants which may affect otters, thereby reducing risks to this species.

- The beneficial effects of spill prevention and response actions specified in the Unified Plan are likely to have an impact on large numbers of sea otters.

7.2 Short-tailed Albatross

It is the Service's biological opinion that **the implementation of the Unified Plan will not jeopardize the survival and recovery of the short-tailed albatross in the wild**. No critical habitat has been designated for this species; therefore, none will be affected. This opinion is based on the following evidence:

- Because of the current population size, increasing population trend, and widespread distribution of this species, an extremely large spill response event would have to occur before enough animals could be affected to impact the listed species as a whole.
- The hypothetical worst-case scenario spill and the spill response activities likely to be conducted for an event of that scale would not impact a sufficient portion of the listed population to lower the probability of survival or recovery of the species.
- Typical spill response actions will be relatively small in scale. These events will have only localized impacts to a limited number of animals.
- The likelihood of large spill response actions, which may have extensive impacts to large numbers of animals, is extremely low.
- During a large spill response event, the initiation of section 7 consultation per the Interagency MOA will initiate incident-specific involvement from the Service. Any necessary and feasible actions to prevent spill response activities from jeopardizing the species or adversely modifying critical habitat will be implemented at that time.
- Areas frequently used by the short-tailed albatross have been excluded from the dispersant use preauthorization zone (see Appendix D). The Service will provide additional review and recommendations prior to use of dispersants during most spills, thereby reducing risks to the albatross.
- The beneficial effects of spill prevention and response actions specified in the Unified Plan are likely to have an impact on large numbers of short-tailed albatross.

7.3 Spectacled Eider

It is the Service's biological opinion **that the Action, as proposed, is not likely to jeopardize the continued existence of the spectacled eider or adversely modify spectacled eider critical habitat**. This conclusion is based on the following factors:

- Because of the current population size, stable population trends, and widespread distribution of this species outside of the wintering area, there is a very low likelihood that impacts from spill response activities would affect enough animals to impact the listed species as a whole.
- The likelihood of spills and associated spill response actions in the wintering area is extremely low due to its geographic location away from shipping lanes, urban and industrial centers, and oil and gas development.
- Typical spill response actions will be relatively small in scale. These events will have only localized impacts to a limited number of animals.
- Typical spill response actions will be small in scale and will have only localized, temporary impacts affecting the PCEs of critical habitat (which include open water and

adjacent vegetated habitats used for nesting, and marine waters with invertebrate food resources). Thus, it is unlikely that actions implemented under the Unified Plan would reduce the value that the critical habitat as a whole provides to the conservation of the species.

- The likelihood of large spill response actions, which may have extensive impacts to large numbers of animals and large areas of critical habitat, is very low.
- If spill response activities are to occur within the range of spectacled eiders, initiation of section 7 consultation per the Interagency MOA will trigger incident-specific involvement from the Service. Any necessary and feasible actions to prevent spill response activities from jeopardizing the species or adversely modifying critical habitat will be implemented at that time.
- Critical habitat and other important habitat areas for the spectacled eider are not within the preauthorization zone for use of dispersants. The Service will provide additional review and recommendations prior to nearly all uses of dispersants which may affect eiders, thereby reducing risks of negative impacts.
- The beneficial effects of spill prevention and response actions specified in the Unified Plan are likely to have an impact on large numbers of spectacled eiders.

7.4 Steller's eider

It is the biological opinion of the Service that **the proposed action will not jeopardize the Steller's eider and will not result in adverse modification of designated critical habitat**. The following points summarize our evaluation:

- Because of the widespread winter distribution of this species, it is very unlikely that impacts from spill response in those wintering areas would affect enough animals to impact the listed species as a whole.
- The tendency for Steller's eiders to stage near North Slope oil and gas development areas in phases rather than all together makes it unlikely that all but a large or ongoing spill response effort may affect more than a few individuals.
- The existing low level of development and transportation in staging and molting areas in the Kuskokwim Shoals CHU makes it unlikely that spill response actions in this area will affect more than a few individuals, and therefore will likely have negligible population-level effects.
- Typical spill response actions will be relatively small in scale. These events will have only localized impacts to the PCEs of critical habitat (including small lakes, ponds, and pools and nearby nesting habitats, and shallow marine waters with invertebrate food resources and/or eelgrass beds) making it unlikely that actions implemented under the Unified Plan would reduce the value that the critical habitat as a whole provides to the conservation of the species.
- Typical spill response actions will be small, with the potential to affect only a limited number of animals, and would not impact a large enough portion of the listed population to lower the probability of survival or recovery of the species.
- The likelihood of large spill response actions, which may have extensive impacts to large numbers of animals and large areas of critical habitat, is extremely low.

- During any spill response event that may affect the species, initiation of section 7 consultation per the Interagency MOA will trigger incident-specific involvement from the Service. Any necessary and feasible actions to prevent spill response activities from jeopardizing the species or adversely modifying critical habitat will be implemented at that time.
- Critical habitat and other important habitat areas for the Steller's eider are not within the preauthorization zone for use of dispersants. The Service will provide additional review and recommendations prior to nearly all uses of dispersants which may affect eiders, thereby reducing risks of negative impacts.
- The beneficial effects of spill prevention and response actions specified in the Unified Plan are likely to have an impact on large numbers of Steller's eiders.

7.5 Pacific Walrus

The Service's biological opinion regarding the implementation of the Unified Plan is that it will not jeopardize the survival and recovery of the Pacific walrus. No critical habitat has been designated for this species; therefore, none will be affected. This opinion is based on the following evidence:

- Because of the current population size and widespread distribution of this species, an extremely large spill response event would have to occur before enough animals could be affected to impact the Pacific walrus as a whole.
- The hypothetical worst-case scenario spill, combined with the spill response activities likely to be conducted for an event of that scale would not impact a sufficient portion of the population to lower the probability of survival or recovery of the species.
- Typical spill response actions will be relatively small in scale. These events will have only localized impacts to a limited number of animals.
- The likelihood of large spill response actions, which may have extensive impacts to large numbers of animals and result in population-level consequences, is extremely low.
- During a large spill response event, the initiation of section 7 consultation per the Interagency MOA will trigger incident-specific involvement from the Service. Any necessary and feasible actions to prevent spill response activities from jeopardizing the species or adversely modifying critical habitat will be implemented at that time.
- Important habitat areas such as haulouts and foraging area are not within the preauthorization zone for use of dispersants. The Service will provide additional review and recommendations prior to use of dispersants which may affect walruses, thereby reducing risks to this species.
- The beneficial effects of spill prevention and response actions specified in the Unified Plan are likely to have an impact on large numbers of Pacific walrus.

7.6 Polar Bear

The Service concludes that the Action, as proposed, is not likely to jeopardize the continued existence of the polar bear. No critical habitat for this species is designated at this time; therefore, none will be affected. This conclusion is based on the following factors:

- Based on the current population size and widespread distribution of this species, an extremely large spill response event would have to occur before enough animals could be affected to impact the species as a whole.
- The hypothetical worst-case scenario spill, combined with the spill response activities likely to be conducted for an event of that scale would not impact a sufficient portion of the population to lower the probability of survival or recovery of the species.
- Typical spill response actions will be relatively small in scale. These events will have only localized impacts to a limited number of animals.
- The likelihood of large spill response actions, which may have extensive impacts to large numbers of animals, is extremely low.
- During a large spill response event, the initiation of section 7 consultation per the Interagency MOA will trigger incident-specific involvement from the Service. Any necessary and feasible actions to prevent spill response activities from jeopardizing the species or adversely modifying critical habitat will be implemented at that time.
- The dispersant use preauthorizatioin areas do not overalap with the range of the polar bear. Therefore the Service will provide additional review and recommendations prior to use of dispersants which may affect polar bears, thereby reducing risks to this species.
- The beneficial effects of spill prevention and response actions specified in the Unified Plan are likely to have an impact on large numbers of polar bears.

Although the Service concludes the Action is not likely to jeopardize the continued existence of listed species and is not likely to destroy or adversely modify critical habitat, considerable uncertainty exists regarding the type, location, and magnitude of activities that may result from the Action. Our conclusion assumes: 1) the hypothetical worst-case scenarios developed for this analysis do not underestimate the level of impact that could actually occur because of spill response activities; 2) the BMPs and impact avoidance and minimization measures within the Unified Plan are fully implemented; and 3) other assumptions used for the analysis in this BO are valid. If changing conditions prove these assumptions wrong and suggest impacts to listed species or critical habitat have been underestimated, it may be necessary to reinitiate section 7 consultation in accordance with 50 CFR 402.16.

[Top]

8.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service provides the following conservation recommendations:

1. This section 7 consultation has highlighted the need for cross-agency staff training and expertise in oil spill response. Lack of staff resources could limit the information readily available during a spill, and hinder the FOSC's ability to make informed decisions

regarding threatened and endangered species. We recommend that the EPA and USCG work with the Service to identify and develop additional means for increasing the Service's capacity to respond during a spill.

2. Annual meetings of the ARRT should assess the previous year's spill response activities, consider avoided and realized impacts to listed species and critical habitat, evaluate effectiveness of incident-specific and emergency consultation processes, and review progress in addressing conservation recommendations in this BO. A summary report of findings should be provided to the Service.
3. When operating marine vessels during spill response, all operators should abide by "Boat Operation Guidance to Avoid Disturbing Sea Otters," included in Appendix B.
4. The ARRT should develop site-specific Ecological Risk Assessments (Aurand et al. 2000) for threatened and endangered species and sensitive habitat areas listed on Table 10 (Sensitive Habitat Areas in Effects Section). The Service should be involved in the preparation of the Risk Assessments that would inform the development of strategies to minimize impacts. Risk Assessments should be incorporated into SCPs and the Service should be notified of their completion.
5. The following recommendations are considerations to improve the use and availability of decision-making tools when dispersants are being considered
    a. Information on toxicity and effectiveness of dispersant formulations should be incorporated into SCPs or the Dispersant Use Plan to provide decision makers with the best available science on which to base incident-specific decisions. This information should include: effects on the range of organisms and habitats likely to be impacted by dispersants in specific regions; effects from real-world quantities and application methods; environmental effects not captured in acute toxicity studies, such as sublethal, synergistic, and long-term effects; and specific application instructions or regional use restrictions.
    b. Information should be updated regularly to address changes to the EPA's dispersant schedule, new scientific literature, and other sources of new information.
    c. Information incorporated into SCPs or the Dispersant Use Plan should include sufficient information on the dispersants to determine whether the combination of dispersant and oil (or other hazardous product) will increase or decrease the persistence, bioaccumulation potential or toxicity relative to the dispersant alone. Data should also be sufficient to determine the potential for dispersants to persist or accumulate, or to contribute to short- and long-term adverse effects in the region of use.
    d. Data incorporated into SCPs or the Dispersant Use Plan should help the team to determine whether and under what circumstances use of the dispersant will cause less harm to wildlife and the environment than responding to the oil spill without use of the dispersant.
    e. EPA and USCG should recommend the use of only the most effective, least toxic dispersants available when threatened and endangered species may be affected.
6. Due to the large numbers of walruses that could be encountered in the Hanna Shoal area from July through September, additional mitigation measures, such as seasonal restrictions, reduced vessel traffic, or rerouting vessels, may be appropriate for activities

within this area. Service biologists should be consulted prior to use of dispersants in these areas. We recommend EPA and USCG continue coordinating and planning with the Service on this issue.

7. Important areas for short-tailed albatrosses have been identified outside of the preauthorization zone, particularly along the continental shelf edge in the Gulf of Alaska and Bering Sea, and on both sides of the Aleutian Archipelago. Specific areas of concentration include the great canyons of the western Bering shelf, especially Zhemchug and St. Matthews canyons, Ingenstrem Rocks (Buldir Pass) in the western Aleutians, near Seguam Pass in the central Aleutians, Near Strait, Samalga Pass, and the shelf-edge south of Umnak/Unalaska islands (Piatt et al. 2006). Service biologists should be consulted prior to use of dispersants in these areas.
8. Potential effects of oil spill preparedness drills and other pre-spill activities on listed species and critical habitat should be evaluated through section 7 consultation.
9. Service biologists should be consulted prior to use of dispersants in important molting and wintering areas. Service biologists should be contacted to identify these areas when a spill occurs. The Service's Information, Planning, and Conservation (IPaC) IPaC decision support system (https://ecos.fws.gov/ipac/) can be a helpful tool to identify important habitat locations if a Service biologist is not immediately available.
10. A no transit zone for vessel traffic should be established in winter in spectacled eider critical habitat south/southwest of St. Lawrence Island similar to the voluntary no traverse zone in eastern Norton Sound during molt.
11. To better document initiation and conclusion of emergency section 7 consultation during and after an incident, we recommend including the standardized emergency consultation form, which was developed by the Services, as an appendix to the Unified Plan.
12. We recommend working with the Service to clarify State and Federal authorizations and requirements required for response organizations to conduct hazing and capture during a spill. This information could be used to update Annex G, Wildlife Protection Guidelines.
13. Calculate/estimate the carbon footprint of a spill activity and add to the factors considered when determining go or no go on an action.

9.0 INCIDENTAL TAKE

Take of endangered or threatened species may occur when a site-specific response or action is undertaken in compliance with requirements of the Unified Plan. These site specific actions will be subject to additional section 7 consultation and incidental take statements, as appropriate, during and following a spill event, as per the Interagency MOA outlining procedures to streamline ESA compliance before, after, and during spill response (USCG et al. 2001).

Although we have evaluated the general nature of the effects of the Unified Plan on listed species, we cannot fully assess the potential effects of specific future actions under the Unified Plan because information on the location, timing, design, and other aspects of these actions are not available at this time. Consequently, we cannot provide an exemption from the prohibitions against take, as described in section 9 of the Act, for the incidental take that may result from these future actions that require separate review and authorization by USCG and EPA. We will

review the effects of those actions, and through emergency section 7(a)(2) consultation, issue incidental take statements in the future, if appropriate, when formal consultation is requested on specific discretionary actions. It is appropriate to defer incidental take in the context of a consultation that evaluates a broad program that sets bounds on future site-specific activities.

Spill drills and other preparedness activities are the only actions conducted under the Unified Plan that are not eligible for emergency consultation and therefore must be consulted on separately if they may affect listed species. Contact the Service for consultation on these actions. In the event the action agencies propose any other site-specific action under the Unified Plan that is likely to cause take of a listed species, but is not eligible for incident-specific emergency consultation, consultation on the Unified Plan should be reinitiated.

10.0 REINITIATION STATEMENT

This concludes consultation on the proposed action. As provided in 50 CFR §402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) new information reveals effects of the action that may affect listed species or critical habitat in a matter or to an extent not considered here; (2) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this evaluation; or (3) a new species not covered here is listed or critical habitat designated that may be affected by this action.

Modifications listed below would constitute changes to the proposed action that may cause impacts not considered in this BO and trigger reinitiation. This is not intended to be a comprehensive list of all modifications that could warrant reinitiation, additional triggers are possible:

1. Changes in the dispersant formulations approved for use in Alaska.
2. Changes to the area designated as preauthorized for dispersant use other than the approval of avoidance areas for the protection of listed species.

Consultation should be reinitiated when the Unified Plan is updated or every five years, whichever occurs first, unless no substantial changes in the status of listed species, existing and baseline, proposed action, or potential effects have occurred. This period is intended to match the normal 5-year schedule for updates to the Unified Plan.

[Top]

11.0 LITERATURE CITED

The Service has done our best to ensure this list is complete, but please contact us in the case of missing references.

Aars J, NJ Lunn, AE Derocher (eds.). 2006. Polar Bears: Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 20–24 June 2005, Seattle, Washington, USA. IUCN, Gland, Switzerland and Cambridge, UK.

Adams, Julie, Michael Sweezey, and Peter V. Hodson. "Oil and oil dispersant do not cause synergistic toxicity to fish embryos." Environmental Toxicology and Chemistry 33.1 (2014): 107-114.

Albers, PH. 1979. Effects of Corexit 9527 on the Hatchability of Mallard Eggs. Bull. Environ. Contain. Toxicol. 23,661-668.

Albers PH 2003. Petroleum and individual polycyclic aromatic hydrocarbons. Pp. 341-372 in: Hoffman, DJ, BA Rattner, GA Burton, Jr., and J. Cairns, Jr. (eds). Handbook of Ecotoxicology, 2nd Edition. Lewis Publishers, Boca Raton, FL.

Albers, Peter H., and Martha L. Gay. "Effects of a chemical dispersant and crude oil on breeding ducks." Bulletin of environmental contamination and toxicology 29.4 (1982): 404-411.

[ADEC and EPA] Alaska Department of Environmental Conservation and the Environmental Protection Agency. 2010. Kodiak Subarea contingency plan for oil and hazardous substance discharges/releases. July 1998, Change Two- March 2010. Kodiak, Alaska. Alaska Regional Response Team. Available: http://dec.alaska.gov/spar/perp/plans/scp_ki.htm (January 2015).

[ADEC, USCG and EPA] Alaska Department of Environmental Conservation USCG, and the Environmental Protection Agency. 2010. Cook Inlet Subarea Contingency Plan. July 1997, Change 1, May 2004; Administrative Update, 2011. Kodiak, Alaska. Alaska Regional Response Team. Available: http://dec.alaska.gov/spar/perp/plans/scp_ci.htm (January 2015).

[ADEC USCG and EPA] Alaska Department of Environmental Conservation USCG, and the Environmental Protection Agency,. 2010. Cook Inlet Subarea Contingency Plan. July 1997, Change 1, May 2004; Administrative Update, 2011. Kodiak, Alaska. Alaska Regional Response Team. Available: http://dec.alaska.gov/spar/perp/plans/scp_ci.htm (January 2015).

[ADEC] Alaska Department of Environmental Conservation. 2007. 10-Year Statewide Summary Oil and Hazardous Substance Spill Data (July 1, 1995 - June 30, 2005). Anchorage, Alaska. Alaska Department of Environmental Conservation.

[ADEC] Alaska Department of Environmental Conservation. 2008. In situ burn guidelines for Alaska Revision 1 August 2008. Available: http://dec.alaska.gov/spar/perp/docs/ISB-Rev1(Final-August%202008).pdf (January 2015).

[ADEC] Alaska Department of Environmental Conservation. 2014. Oil and Hazardous Substance Spill Data Summaries. ADEC, Spill Prevention and Response. Available: http://dec.alaska.gov/spar/perp/data.htm (January 2015).

Allen, A.A. 1990. Contained Controlled Burning of Spilled Oil During the Exxon Valdez Oil Spill. Proc. Thirteenth Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Ottawa. pp. 305-313.

Allen, Alan A., and Ronald J. Ferek. "Advantages and disadvantages of burning spilled oil." International Oil Spill Conference. Vol. 1993. No. 1. American Petroleum Institute, 1993.

[ACS] Alaska Clean Seas. 1999. ACS Technical Manual, Volume 1 Tactics Descriptions. Alaska Clean Seas, Prudhoe Bay, Alaska.

[ACS] Alaska Clean Seas. 2012. Alaska Clean Seas Technical Memo, Volume 1, Tactics Descriptions. Prudhoe Bay, AK. 186 p. Available at: http://alaskacleanseas.org/wp-content/uploads/2010/12/ACS_Tech_Manual_Rev9_Vol1-TACTICS.pdf. Prudhoe Bay, AK. Available at: http://alaskacleanseas.org/wp-Almeda R, Bona S, Foster CR, Buskey EJ. 2014. Dispersant corexit 9500A and chemically dispersed crude oil decreases the

growth rates of meroplanktonic barnacle nauplii (amphibalanus improvisus) and tornaria larvae (schizocardium sp.). Mar Environ Res 99:212-7.

Amstrup SC, GM Durner, TL McDonald, WR Johnson. 2006. Estimating Potential Effects of Hypothetical Oil Spills on Polar Bears. Anchorage, Alaska. U.S. Geological Survey, Alaska Science Center.

Amstrup SC, I Stirling, JW Lentfer. 1986. Past and present status of polar bears in Alaska. Wildlife Society Bulletin 14:241-254.

Amstrup SC. 1995. Movements, distribution, and population dynamics of polar bears in the Beaufort Sea. PhD. Fairbanks, Alaska: University of Alaska Fairbanks.

Anderson, B.A., R.J. Ritchie, A.A. Stickney, and J.E. Shook. 2007. Avian studies in the Kuparuk Oilfield, Alaska, 2006. Data Summary Report prepared for ConocoPhillips Alaska, Inc. and the Kuparuk River Unit, Anchorage, Alaska. 36pp.

Arctic Council. 2011. Agreement on cooperation on aeronautical and maritime search and rescue in the arctic. April 21, 2011. The Government of Canada, the Government of the Kingdom of Denmark, the Government of the Republic of Finland, the Government of Iceland, the Government of the Kingdom of Norway, the Government of the Russian Federation, the Government of the Kingdom of Sweden, and the Government of the United States of America. Available: http://library.arcticportal.org/1474/1/Arctic_SAR_Agreement_EN_FINAL_for_signature_21-Apr-2011.pdf (January 2015).

Arctic Council. 2013. Agreement on Cooperation on Marine Oil Pollution, Preparedness and Response in the Arctic 2013. The Government of Canada, the Government of the Kingdom of Denmark, the Government of the Republic of Finland, the Government of Iceland, the Government of the Kingdom of Norway, the Government of the Russian Federation, the Government of the Kingdom of Sweden, and the Government of the United States of America. Available:http://www.arctic-council.org/eppr/agreement-on-cooperation-on-marine-oil-pollution-preparedness-and-response-in-the-arctic/ (January 2015).

[ARRT] Alaska Regional Response Team. 2010. The Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases; Unified Plan. Change 3-January 2010. Anchorage Alaska. The Alaska Department of Environmental Conservation, U.S. Coast Guard, Seventeenth District, and U.S. Environmental Protection Agency, Region 10. Available: http://dec.alaska.gov/spar/perp/plans/uc.htm (January 2015).

[ARRT] Alaska Regional Response Team. 2012. Annex G: Wildlife Protection Guidelines. In editor. The Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases; Unified Plan. Anchorage: The Alaska Department of Environmental Conservation, U.S. Coast Guard, Seventeenth District, and U.S. Environmental Protection Agency, Region 10. Available: http://dec.alaska.gov/spar/perp/plans/uc.htm. (January 2015).

[ARRT] Alaska Regional Response Team. 2014. Annex F, Appendix I: Alaska Regional Response Team Dispersant Use Plan For Alaska, DRAFT - Revised 4-3-14. Anchorage, Alaska. The Alaska Department of Environmental Conservation, U.S. Coast Guard, Seventeenth District, and U.S. Environmental Protection Agency, Region 10.

ASRC Energy Services. 2012. Petition for Incidental Take Regulations for Oil and Gas Activities in the Chukchi Sea and Adjacent Lands in 2013-2018. Anchorage, AK. Alaska Oil and Gas Association. Available: http://www.fws.gov/alaska/fisheries/mmm/itr.htm (January 2015).

Aurand D, L Walko, R Pond. 2000. Developing Consensus Ecological Risk Assessments: Environmental Protection In Oil Spill Response Planning A Guidebook. Washington, D.C. United States Coast Guard. Available: http://www.fws.gov/contaminants/FWS_OSCP_05/fwscontingencyappendices/N-Manuals-Response-Assessment/CG-EcolRiskatOilSpills.pdf (January 2015).

Aurell, Johanna, and Brian K. Gullett. "Aerostat sampling of PCDD/PCDF emissions from the Gulf oil spill in situ burns." Environmental science & technology 44.24 (2010): 9431-9437.

Austin OLJ. 1949. The Status of Steller's Albatross. Pacific Science 3(October):283-295.

Baillie SR, H Milne. 1982. The influence of female age on breeding in the Eider Somateria mollissima. Bird Study 29(1):55-66. Available: http://dx.doi.org/10.1080/00063658209476738 (January 2015).

Ballachey BE, JL Bodkin, AR DeGange. 1994. An overview of sea otter studies. In Marine mammals and the Exxon Valdez. (Ed) T.R. Loughlin. Academic Press, San Diego, A. pp. 47-60.

Ballachey BE, CS Gorbics AM Doroff. 2002. Sea otter mortality in Orca Inlet, Prince William Sound, Alaska, winter 1995-1996. USFWS Technical Report MMM 02-1. Marine Mammals Management, Fish and Wildlife Service Region 7, Alaska. U.S. Department of the Interior.

Ballachey BE, JL Bodkin, S Howlin, AM Doroff, and A Rebar. 2003. Correlates to survival of juvenile sea otters in Prince William Sound, Alaska. Canadian J. Zoology 81:1494- 1510.

Ballachey BE, DH Monson, GG Esslinger, K Kloecker, J Bodkin, L Bowen, AK Miles. 2014. 2013 update on sea otter studies to assess recovery from the 1989 Exxon Valdez oil spill, Prince William Sound, Alaska. Reston, Virginia:. U.S. Geological Survey http://pubs.usgs.gov/of/2014/1030/ (January 4, 2015).

Barnea, Nir. "Health and safety aspects of in-situ burning of oil." Report to National Oceanic and Atmospheric Administration, Seattle, WA (1995).

Barron, Mace G., et al. "Photoenhanced toxicity of aqueous phase and chemically dispersed weathered Alaska North Slope crude oil to Pacific herring eggs and larvae." Environmental Toxicology and Chemistry 22.3 (2003): 650-660.

BBC 2003. China protests Japan Islands lease. BBC News, World Edition, Asia-Pacific, Sunday, January 5, 2003. http://news.bbc.co.uk/2/hi/asia-pacific/2628641.stm).

Belovsky GE. 1987. Extinction models and mammalian persistence. In Soule M, editor. Viable Populations for Conservation. Cambridge, MA: Cambridge University Press. Available: http://dx.doi.org/10.1017/CBO9780511623400.004

Benner, BA Jr., NP Bryner, SA Wise, GW Mulholland, RC Lao, MF Fingas. 1990. Polycyclic aromatic hydrocarbon emissions from the combustion of crude oil on water. Environ. Sci. Technol. 24(0):1418-1427 [BLM] Bureau of Land Management. 2012a. Draft National Petroleum Reserve – Alaska Integrated Activity Plan Environmental Impact Statement. March 2012. 5 volumes + Appendices.

Blenkinsopp, S. A., Sergy, G., Doe, K., Wohlgeschaffen, G., Li, K., & Fingas, M. (1996). Toxicity of the weathered crude oil used at the Newfoundland offshore burn experiment (NOBE) and the resultant burn residue. Spill Science & Technology Bulletin, 3(4), 277-280.

[BLM] Bureau of Land Management. 2012b. Biological assessment for the National Petroleum Reserve – Alaska Integrated Activity Plan. September 2012.

Bodkin JL, MS Udevitz. 1994. An intersection model for estimating sea otter mortality along the Kenai Peninsula. In T. R. Loughlin, editor. Marine Mammals and the Exxon Valdez. San Diego, California: Academic Press.

Bodkin JL, BE Ballachey TA Dean, AK Fukuyama, SC Jewett, L McDonald, DH Monson, CE O'Clair and GR VanBlaricom. 2002. Sea otter population status and the process of recovery from the 1989 'Exxon Valdez' oil spill. Marine Ecology Progress Series. 241: 237-253.

Bodkin JL, BE Ballachey, GG Esslinger. 2011. Trends in sea otter population abundance in western Prince William Sound, Alaska: Progress toward recovery following the 1989 Exxon Valdez oil spill Scientific Investigations Report 2011–5213. Reston, Virginia U.S. Geological Survey. Available: http://pubs.usgs.gov/sir/2011/5213/pdf/sir20115213.pdf (January 2015).

Boehm PD, PJ Mankiewicz, R Hartung, JM Neff, DS Page, ES Gilfillan, JE O'Reilly, KR Parker. 1996. Characterizing of Mussel Beds with Residual Oil and the Risk to Foraging Wildlife 4 Years After the Exxon Valdez Oil Spill. Environmental Toxicology and Chemistry 15(8):1289–1303.

[BOEM] Bureau of Ocean Energy Management. 2011. Alaska Outer Continental Shelf Chukchi Sea Planning Area Oil and Gas Lease Sale 193 In the Chukchi Sea, Alaska Final Supplemental Environmental Impact Statement OCS EIS/EA BOEMRE 2011-041 Anchorage. Bureau of Ocean Energy ManagementRegulation, and Enforcement, Alaska OCS Region

[BOEM] Bureau of Ocean Energy Management. 2011b. Biological Evaluation for Oil and Gas Activities on the Beaufort and Chukchi Sea Planning Areas. OCS EIS/EA BOEMRE 2011. Anchorage, AK: USDOI, BOEMRE, Alaska OCS Region. 406 pp.

[BOEM] Bureau of Ocean Energy Management. 2014. Chukchi Sea Planning Area Oil and Gas Lease Sale 193 In the Chukchi Sea, Alaska Draft Supplemental Environmental Impact Statement Volume 1. Chapters 1 – 6. Anchorage, Alaska. Alaska OCS Region. Available: http://www.boem.gov/ak-consultations/ (January 2015).

Born, E. W., et al. "Underwater observations of foraging free-living Atlantic walruses (Odobenus rosmarus rosmarus) and estimates of their food consumption." Polar Biology 26.5 (2003): 348-357.

Braune, BM, PM Outridge, AT Fisk, DCG Muir, PA Helm, K Hobbs, PF Hoekstra, ZA Kuzyk, M Kwan, RJ Letcher, et al. 2005. Persistent organic pollutants and mercury in marine biota of the Canadian Arctic: an overview of spatial and temporal trends. The Science of the Total Environment 351–352:4–56.

Brigham L, B Ellis, eds. 2004. Arctic Marine Transport Workshop. 28–30 September 2004, Scott Polar Research Institute, Cambridge University, United Kingdom. 34 p.

Brueggeman, J.J., C.I. Malmoe, R.A. Grotefendt, D.P. Volsen, J.J. Burns, D.G. Chapman, D.K. Ljungblad, and G.A. Green. 1990. 1989 Walrus Monitoring Program: The

Klondike, Burger, and Popcorn Prospects in the Chukchi Sea. Report from Ebasco Environmental, Bellevue, WA, for Shell Western E&P, Inc. Houston, TX. 62 pp.

Buist, I. and K. Trudel. 1995. Laboratory studies of the properties of in-situ burn residues. Technical Report Series 95-010, Marine Spill Response Corporation, Washington, D.C., 110 pp.

Buist, I.A., S.L. Ross, B.K. Trudel, E. Taylor, T.G. Campbell, P.A. Westphal, M.R. Myers, G.S. Ronzio, A.A. Allen, and A. B. Nordvik. 1994. The Science, Technology and Effects of Controlled Burning of Oil Spills at Sea. Marine Spill Response Corporation, Washington, DC. MSRC Technical Report Series 94-013. 388 pp.

Buist, I.A., 1999. Window of opportunity for in situ burning. Pp. 21-30 in: Walton, W. Douglas, and Nora H. Jason. In Situ Burning of Oil Spills Workshop Proceedings: New Orleans, Louisiana, November 2-4, 1998. US Department of Commerce, Building and Fire Research Laboratory, National Institute of Standards and Technology, 1999.

Burn DM. 1994. Boat-based population surveys of sea otters in Prince William Sound. In T. R. Loughlin, editor. Marine Mammals and the Exxon Valdez. San Diego, California: Academic Press.

Burns JJ. 1965. The walrus in Alaska: its ecology and management. Juneau, Alaska. Alaska Department of Fish and Game.

Bustnes JO, GH Systad. 2001. Comparative feeding ecology of Steller's Eider and long-tailed ducks in winter. Waterbirds 24(3):407-412. <Go to ISI>://000172510400012

Butler, R. G., et al. "Impact of sublethal oil and emulsion exposure on the reproductive success of Leach's storm-petrels: short and long-term effects." Journal of applied ecology (1988): 125-143.

Cameron, Michael Foley, et al. Status Review of the Bearded Seal(Erignathus barbatus). 2010.Carls MG, PM Harris, SD Rice. 2004. Restoration of oiled mussel beds in Prince William Sound, Alaska. Marine Environmental Research 57(5):359-376. Available: http://www.sciencedirect.com/science/article/pii/S0141113603001090 (January 2015).

Carey, A.G. 1991. Ecology of North American Arctic continental shelf benthos: A review. Continental Shelf Research 11:865-883.

Chen S, E Firing. 2006. Currents in the Aleutian Basin and subarctic North Pacific near the dateline in summer 1993. Journal of Geophysical Research: Oceans 111(C3):C03001. http://dx.doi.org/10.1029/2005JC003064

Christman, C., M. Ferguson, G. Friedrichsen, B. Rone, and J. Clarke. 2010. Pacific Walrus Sightings Documented by COMIDA Aerial Surveys of the Northeastern Chukchi Sea in 2009. Abstract of Poster Presented at 2010 Alaska Marine Science Symposium, Anchorage, Alaska, January 18-22, 2010.

Clarke JT, CL Christman, AA Brower, MC Ferguson. 2011. Distribution and Relative Abundance of Marine Mammals in the Alaskan Chukchi and Beaufort Seas, 2011. Annual Report, OCS Study BOEM 2012-009. Seattle, WA. National Marine Mammal Laboratory (NMML), Alaska Fisheries Science Center, NMFS, NOAA. Available: http://www.afsc.noaa.gov/nmml/PDF/COMIDA-2011-Report.pdf (January 2015).

Clarke JT., Ferguson, M.C., Christman, C.L., Grassia, S.L., Brower, A.A. and Morse, L.J. 2011. Chukchi Offshore Monitoring in Drilling Area (COMIDA) Distribution and Relative Abundance of Marine Mammals: Aerial Surveys. Final Report, OCS Study BOEMRE

2011-06. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AKC3, Seattle, WA 98115-6349.

Couillard, Catherine M., et al. "Effect of dispersant on the composition of the water-accommodated fraction of crude oil and its toxicity to larval marine fish." Environmental toxicology and chemistry 24.6 (2005): 1496-1504.

Cross WE, CM Martin, DH Thomson. 1987. Effects of experimental releases of oil and dispersed oil on arctic nearshore macrobenthos. II. Epibenthos. Arctic 40 (Supp. 1):201-210.

Curland, JM. 1997. Effects of disturbance on sea otters (Enhydra lutris) near Monterey, California (Master's thesis). Available from ProQuest Dissertations and Theses database. (UMI No. 1384680).

Dau, C.P., and S.A. Kistchinski. 1977. Seasonal movements and distribution of the spectacled eider. Wildfowl. 28:65–75.

Davis RW, TM Williams, F Awbrey. 1988. Sea otter oil spill avoidance study. U.S. Department of the Interior, Minerals Management Service.

Davis, R. A., & Malme, C. I. (1997). Potential effects on ringed seals of ice-breaking ore carriers associated with the Voisey's Bay Nickel Project. LGL Limited.

Daykin, M., Tang, A., Sergy, G., & Aurand, D. (1994). Aquatic toxicity resulting from in situ burning of oil- on-water. In arctic and marine oilspill program technical seminar (pp. 1165-1165). Ministry of Supply And Services, Canada.

Day RH. 1998. Predator populations and predation intensity on tundra-nesting birds in relation to human development. Report prepared by ABR Inc., for Northern Alaska Ecological Services, U.S. Fish and Wildlife Service, Fairbanks, Alaska. 106 pp.

Day RH, AE Gall, TC Morgan, JR Rose, JH Plissner, PM Sanzenbacher, JD Fenneman, KJ Kuletz, and B. A. Watts. 2013. Seabirds new to the Chukchi and Beaufort seas, Alaska: response to a changing climate? Western Birds 44:174–182.

de Villiers MS, J Cooper, PG Ryan. 2005. Individual variability of behavioural responses by Wandering Albatrosses (Diomedea exulans) to human disturbance. Polar Biology 28(4):255-260. Avialable: http://search.ebscohost.com/login.aspx?direct=true&db=eih&AN=16342457&site=ehost-live (January 2015).

Dean TA, JL Bodkin, SC Jewett, DH Monson, D Jung. 2000. Changes in sea urchins and kelp following a reduction in sea otter density as a result of the Exxon Valdez oil spill. Marine Ecology Progress Series 199:281-291.

DeBruyn, TD, TJ Evans, C Hamilton, S Miller, CJ Perham, C Putnam, E Regehr, K Rode, J Wilder. 2010. Report to Inupiat of the North Slope, Alaska, and the Inuvialuit of the Northwest Territories, Canada Polar Bear Management in the Southern Beaufort Sea, 2008-2009. Tuktoyaktuk, Northwest Territories, Canada. July 28-31, 2010. U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK, USA.

DeBruyn, T. D., Evans, T. J., Miller, S., Perham, C., Regehr, E., Rode, K., ... & Lierheimer, L. J. (2010, June). Polar bear conservation in the United States, 2005–2009. In M. E. Obbard, G. W. Thiemann, E. Peacock, & T. D. DeBruyn (Eds.), Proceedings of the 15th Working Meeting of the Polar Bear Specialist Group (eds. ME Obbard, GW Thiemann, E. Peacock & T. DeBruyn), IUCN, Gland, Switzerland.

Degange AR, AM Dorff, DH Monson. 1994. Experimental recovery of sea otter carcasses at Kodiak Island, Alaska, following the Exxon Valdez oil spill. Marine Mammal Science 10(4):492-496. <Go to ISI>://A1994PP91200014 (January 2015).

DeGange AR, DC Douglas, DH Monson, CM Robbins. 1995. Surveys of Sea Otters in the Gulf of Alaska in Response to the Exxon Valdez Oil Spill. Anchorage, Alaska. U.S. Fish and Wildlife Service.

[DNV and ERM] Det Norske Veritas and ERM-West Inc. 2010a. Task 1: Semi-quantitative Traffic Study Report. Report no. / DNV ref no: EP007543. Aleutian Islands Risk Assessment Phase A – Preliminary Risk Assessment. Available: http://www.aleutiansriskassessment.com/documents/2010.09.03_FinalEP007543AIRAPhaseATask1eReport.pdf (January 2015).

[DNV and ERM] Det Norske Veritas and ERM-West Inc. 2010b. Task 2A marine spill frequency and size report. Report no. / DNV ref no: EP007543-1. Aleutian Islands Risk Assessment Phase A. Available: http://www.aleutiansriskassessment.com/documents/2010.09.03_FinalTask2AMarineRiskAssessmentResultseReport.pdf (January 2015).

[DNV and ERM] Det Norske Veritas and ERM-West Inc. 2011. Task 3 and 4 Consequences Analysis Report. Project No. 0105563. Aleutian Islands Risk Assessment Phase A. Available: file:///C:/Users/kimberlyklein/Downloads/2011_7_7_AIRAPhaseACAReportFINALwCovLtr.pdf (January 2015).

Donlin Gold. 2015. Donlin Gold. Anchorage, AK. Donlin Gold LLC. Available: http://www.donlingold.com/our-plan

Duerr, Rebecca S., et al. "Physical Effects of Prudhoe Bay Crude Oil Water Accommodated Fractions (WAF) and Corexit 9500 Chemically Enhanced Water Accommodated Fractions (CEWAF) on Common Murre Feathers and California Sea Otter Hair." International Oil Spill Conference Proceedings (IOSC). Vol. 2011. No. 1. American Petroleum Institute, 2011.

Dunton, K, C. Ashjian, R. Campbell, L. Cooper, J. Grebmeier, R. Harvey, B. Konar, D. Maidment, S. Schonberg, J. Trefry, and T.Weingartner. 2013. An Integrated Ecosystem Field Study of Hanna Shoal, Northern Chukchi Sea, Alaska. Alaska Marine Science Symposium, 21-25 January; http://www.alaskamarinescience.org/documents/AMSS_Book_of_Abstracts_2013.pdf

Durner GM, SC Amstrup, R Nielson, T McDonald. 2004. Using discrete choice modeling to generate resource selection functions for female polar bears in the Beaufort Sea. In S. Huzurbazar, editor. Resource Selection Methods and Applications: Proceedings of the 1st International Conference on Resource Selection, 13-15 January 2003. Laramie, WY:

Durner GM, DC Douglas, RM Nielson, SC Amstrup, TL McDonald, I Stirling, M Mauritzen, EW Born, O Wiig, E DeWeaver, et al. 2009. Predicting 21st-century polar bear habitat distribution from global climate models. Ecological Monographs 79: 25–58.

Durner GM, DC Douglas, RM Nielson, SC Amstrup, TL McDonald. 2007. Predicting the Future Distribution of Polar Bear Habitat in the Polar Basin from Resource Selection Functions Applied to 21st Century General Circulation Model Projections of Sea-ice. Administrative Report U.S. Department of the Interior U.S. Geological Survey Reston, Virginia. Available:

http://www.usgs.gov/newsroom/special/polar_bears/docs/USGS_PolarBear_Durner_Habitat_highres.pdf (January 2015).

Durner, G. M. (2010). A Fischbach, S Amstrup, D Douglas. 2010. Catalogue of polar bear (Ursus maritimus) maternal den locations in the Beaufort Sea and neighboring regions, Alaska, 2010. Joint monitoring program in the Chukchi and Beaufort Seas, open water seasons, 2006. LGL Alaska Research Associates, 2010.

Dussauze M, Camus L, Le Floch S, Pichavant-Rafini K, Geraudie P, Coquillé N, Amérand A, Lemaire P, Theron M. 2014. Impact of dispersed fuel oil on cardiac mitochondrial function in polar cod boreogadus saida. Environ Sci Pollut Res Int 21(24):13779-88.

Eberhardt LE, RA Garrott, WC Hanson. 1983. Winter movements of Arctic foxes, Alopex lagopus, in a Petroleum Development Area. The Canadian Field Naturalist 97:66–70.

Ely, C.R., C.P. Dau, and C.A. Babcock. 1994. Decline in population of Spectacled Eiders nesting on the Yukon-Kuskokwim Delta, Alaska. Northwestern Naturalist 75:81–87.

Engelhardt, F. R. "Limitations and innovations in the control of environmental impacts from petroleum industry activities in the Arctic." Marine Pollution Bulletin 29.6 (1994): 334-341.

[EPA] U.S. Environmental Protection Agency. 2000. Science Policy Council Handbook. Risk Characterization Handbook http://www.epa.gov/spc/pdfs/rchandbk.pdf February 2015.

[EPA] Environmental Protection Agency. 2013. Questions and Answers on Dispersants. February 14, 2013. U.S. Environmental Protection Agency. Available: http://www.epa.gov/bpspill/dispersants-qanda.html#q5 (January 2015).

[EPA and USCG] U.S. Environmental Protection Agency and U.S. Coast Guard. 2015. Discussion Paper Clarifying Inclusion Of Atypical Dispersant Use In Formal Consultation On The Alaska Unified Plan. Anchorage. United States Coast Guard, Seventeenth Coast Guard District, and United States Environmental Protection Agency, Region 10 Alaska.

Epstein N, RPM Bak, B Rinkevich. 2000. Toxicity of Third Generation Dispersants and Dispersed Egyptian Crude Oil on Red Sea Coral Larvae. Marine Pollution Bulletin 40(6):497-503. http://www.sciencedirect.com/science/article/pii/S0025326X99002325

ESRI. 2012. Kernal Density (Spatial Analyst). ArcGIS Resources. http://resources.arcgis.com/en/help/main/10.1/index.html#/Kernel_Density/009z0000000s000000/ (January 2015).

[EVOS] Exxon Valdez Oil Spill Restoration Team. 1993. Exxon Valdez Spill Boundary. Anchorage, Alaska. Information Resource Management, Alaska Department of Natural Resources. http://www.esri.com/metadata/esriprof80.html (December 2014).

[EVOS] Exxon Valdez Oil Spill Trustee Council. 2009. Questions and Answers, History of the Spill. Anchorage, Alaska. Available: http://www.evostc.state.ak.us/index.cfm?FA=facts.QA (January 2015).

Fay, Francis H. "Ecology and biology of the Pacific walrus, Odobenus rosmarus divergens Illiger." North American Fauna (1982): 1-279.

Fay, F. H., and J. J. Burns. "Maximal feeding depths of walruses." Arctic 41.3 (1988): 239-240.

Fay F, BP Kelly, PH Gehnrich, JL Sease, AA Hoover. 1984. Modern Populations, Migrations, Demography, Trophics, and Historical Status of the Pacific Walrus. Fairbanks, AK. Institute of Marine Science, University of Alaska.

Fay FH, CG Ray, AA Kibal'chich. 1984. Time and Location of Mating and Associated Behavior of the Pacific Walrus, Odobenus rosmarus divergens Illiger. 1.

Fay FH, LL Eberhardt, BP Kelly, JJ Burns, LT Quakenbush. 1997. Status of the Pacific walrus population, 1950-1989. Marine Mammal Science 13(4):537-565. <Go to ISI>://A1997YA66000001

Fay FH. 1982. Ecology and biology of the Pacific walrus, Odobenus rosmarus divergens illiger. North American Fauna. Washington, D. C.: U.S. Fish and Wildlife Service.

Finch, Bryson E., Kimberly J. Wooten, and Philip N. Smith. "Embryotoxicity of weathered crude oil from the Gulf of Mexico in mallard ducks (Anas platyrhynchos)." Environmental Toxicology and Chemistry 30.8 (2011): 1885-1891.

Fingas, M.F., Li, K., Ackerman, F., Pare, J., Bissonette, M.C., Campagna, P.R., Turpin, R.D., Soleki, M.F., Getty, S.J., & Trespalacios, M.J. (1993). Emissions from mesoscale in-situ oil fires: The Mobile 1991 and 1992 tests (EC/TDTS--94-02286-Vol1-2). Proceedings of the sixteenth Arctic and Marine Oil Spill Program (AMOP) technical seminar.

Fingas M, Ackerman F, Li K, Lambert P, Wang Z, Bissonette M, Campagna P, Boileau P, Laroche N, Jokuty P, Nelson R, et al. 1994. The Newfoundland Offshore Burn Experiment: NOBE preliminary results of emissions measurement. Proceedings of the Seventeenth Arctic and Marine Oil Spill Program Technical Seminar. pp. 1099-1164

Fingas, Merv. "A review of literature related to oil spill dispersants 1997-2008." Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska (2008).

Finkelstein M, S Wolf, M Goldman, D Doak. 2007. A Stochastic Population-based Model for the Short-tailed Albatross (Phoebastria albatrus). Santa Cruz. Ecology and Evoutionary Biology Department, University of California.

Finkelstein ME, S Wolf, M Goldman, DF Doak, PR Sievert, G Balogh, H Hasegawa. 2010. The anatomy of a (potential) disaster: Volcanoes, behavior, and population viability of the short-tailed albatross (Phoebastria albatrus). Biological Conservation 143:321-331.

Fischbach AS, DH Monson, CV Jay. 2009. Enumeration of Pacific walrus carcasses on beaches of the Chukchi Sea in Alaska following a mortality event, September 2009. Reston, VA. U.S. Geological Survey.

Fischer, J.B., R.A. Stehn, and G. Walters. 2011. Nest population size and potential production of geese and spectacled eiders on the Yukon–Kuskokwim Delta, Alaska, 1985–2011. Unpublished Report. U.S. Fish and Wildlife. Service, Anchorage, Alaska. 43 pp.

Fischman J. 2014. Sonar Spots Invisible Arctic Oil Spills. May 7, 2014. Scientific American. Available: http://www.scientificamerican.com/article/sonar-spots-invisible-arctic-oil-spills/ (January 2015).

Fitch K, PJ Johnson. 1977. Human Life Sciences. New York, New York: Rinehart and Winston, Inc.

Fox AD, C Mitchell. 1997. Spring Habitat Use and Feeding Behaviour of Steller's Eider, Polysticta stelleri, in Varangerfiord, Norway. IBIS 139:542-548.

Franklin IR. 1980. Evolutionary change in small populations. In Soule ME and B. A. Wilcox, editor. Conservation biology: An evolutionary-ecological perspective. Sunderland: Sinauer Associates.

Frantzen E. 2007. From Russia with love. Hart Energy Publishing, LP, Houston, Texas. Available: http://www.epmag.com/archives/features/405.htm (January 2015).

Frid A, L Dill. 2002. Human-caused disturbance stimuli as a form of predation risk. Conservation Ecology 6(1):11. http://www.consecol.org/vol6/iss1/art11

Gall, AE, RH Day, TC Morgan. 2013. Distribution and Abundance of Seabirds in the Northeastern Chukchi Sea, 2008–2012, Final Report. Prepared by ABR, Inc. - Environmental Research & Services, Fairbanks, Alaska for ConocoPhillips Company, Shell Exploration & Production Company and Statoil USA E & P, Inc, Anchorage, Alaska. 88 pp.

Garlich-Miller J, JG MacCracken, J Snyder, R Meehan, M Myers, L E., A Matz. 2011. Status review of the Pacific walrus (Odobenus rosmarus divergens). Anchorage, Alaska. U.S. Fish and Wildlife Service, Marine Mammals Management.

Gardiner, William W., et al. "The acute toxicity of chemically and physically dispersed crude oil to key arctic species under arctic conditions during the open water season." Environmental Toxicology and Chemistry 32.10 (2013): 2284-2300.

Garner GW, SE Belikov, MS Stishov, VG Barnes, Jr., SM Arthur. 1994. Dispersal patterns of maternal polar bears from the denning concentration on Wrangel Island. Ninth International Conference on Bear Research and Management; Missoula, Montana, USA: International Association for Bear Research and Management.

Garner GW, ST Knick, DC Douglas. 1990. Seasonal Movements of Adult Female Polar Bears in the Bering and Chukchi Seas. Bears: Their Biology and Management 8(A Selection of Papers from the Eighth International Conference on Bear Research and Management, Victoria, British Columbia, Canada, February 1989):219-226. http://www.jstor.org/stable/3872922

Garrott RA, LL Eberhardt, DM Burn. 1993. Mortality of sea otters in Prince William Sound following the Exxon Valdez oil spill. Marine Mammal Science 9(4):343-359. <Go to ISI>://A1993MH88700001

Garshelis DL, CB Johnson. 2001. Sea otter population dynamics and the Exxon Valdez oil spill: disentangling the confounding effects. Journal of Applied Ecology 38(1):19. http://search.ebscohost.com/login.aspx?direct=true&db=fzh&AN=5674664&site=ehost-live

Garshelis DL, JA Garshelis. 1984. Movements and Management of Sea Otters in Alaska. The Journal of Wildlife Management 48(3):665-678. http://www.jstor.org/stable/3801414<Go to ISI>://A1984TP34300001 (2/05/2008).

Garshelis DL. 1997. Sea otter mortality estimated from carcasses collected after the Exxon Valdez oil spill. Conservation Biology 11(4):905-916.

Ghoul A, C Reichmuth. 2012a. Aerial hearing sensitivity in a southern sea otter (Enhydra lutris nereis). Journal of the Acoustical Society of America 132(3 part 2):2008.

Ghoul A, C Reichmuth. 2012b. Sound Production and Reception in Southern Sea Otters (Enhydra lutris nereis). In A. N. Popper and A. Hawkins, editor. The effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology Springer Science+Business Media. .

Gill, RE Jr., MR Petersen, PD Jorgensen. 1981. Birds of the northcentral Alaska Peninsula, 1976-1980. Arctic, 34:286-306.

Gong, Yanyan, et al. "A review of oil, dispersed oil and sediment interactions in the aquatic environment: Influence on the fate, transport and remediation of oil spills." Marine

pollution bulletin 79.1 (2014): 16-33.
Götmark, Frank, and Matti Åhlund. "Do field observers attract nest predators and influence nesting success of common eiders?." The Journal of wildlife management (1984): 381-387.
Goudie RI, IL Jones. 2004. Dose-response relationships of harlequin duck behaviour to noise from low-level military jet over-flights in central Labrador Environmental Conservation 31(4):289-298.
Grebmeier, J.M., L.W. Cooper, H.M. Feder and B.I. Sirenko. 2006a. Ecosystem dynamics of the Pacific-influenced Northern Bering and Chukchi Seas in the Amerasian Arctic. Progress in Oceanography 71:331-361.
Grebmeier, Jacqueline M., et al. "A major ecosystem shift in the northern Bering Sea." Science 311.5766 (2006): 1461-1464.
Gulec, I., & Holdway, D. A. (1999). The Toxicity of Laboratory Burned Oil to the Amphipod Allorchestes compressa and the Snail Polinicesconicus. Spill Science & Technology Bulletin, 5(2), 135-139.
Guy, TJ, SL Jennings, RM Suryan, EF Melvin, MA Bellman, LT Ballance, BA Blackie, DA Croll, T Deguchi, TO Geernaert, et al. 2013. Overlap of North Pacific albatrosses with the U.S. west coast groundfish and shrimp fisheries. Fisheries Research. 147:222-234.
Hansen BH, Altin D, Olsen AJ, Nordtug T. 2012. Acute toxicity of naturally and chemically dispersed oil on the filter-feeding copepod calanus finmarchicus. Ecotoxicol Environ Saf 86:38-46.
Harms CA, WJ Fleming, MK Stoskopf. 1997. A Technique For Dorsal Subcutaneous Implantation of Heart Rate Bioelemetry Transmitters in Black Ducks: Application in an Aircraft Noise Response Study. The Condor 99:231-237.
Harwell MA, JH Gentile. 2014. Assessing risks to sea otters and the Exxon Valdez oil spill: New scenarios, attributable risk, and recovery. Human and Ecological Risk Assessment 20(4):889-916. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3935186/pdf/bher20_889.pdf
Hoffman R. 2007. A birdwatcher at Peggy's Cove, Nova Scotia, reports seeing a species presumed extinct: an Eskimo Curlew: How a stroll along the rocky coastline of Nova Scotia turned into a once-in-a-lifetime encounter with one of the planet's rarest birds. Birders World Magazine August 24, 2007.
Holmes WN. 1984. Petroleum pollutants in the marine environment and their possible effects on seabirds. In Reviews in Environmental Toxicology L ed. E. Hodgson. Elsevier Science Publishers, Amsterdam, The Netherlands, pp. 251-317. Hui C. 2006. Carrying capacity, population equilibrium, and environment's maximal load. Ecological Modelling 192(1–2):317-320. http://www.sciencedirect.com/science/article/pii/S0304380005003339 (January 2015).
Holmes WN, Cronshaw J. Gorsline J. 1978b. Some effects of ingested petroleum on seawater-adapted ducks (Anas platyrhynchos). Environ. Res., 17, 177-90.
Holmes WN, Gorsline J, Cronshaw J. 1979. Effects of mild cold stress on the survival of seawater-adapted Mallard ducks (*Anas platyrhynchos*) maintained on food contaminated with petroleum. Environ. Res., 20, 425-44.

Hunter CM, H Caswell, M Runge, C., SC Amstrup, EV Regehr, I Stirling. 2007. Polar Bears in the Southern Beaufort Sea II: Demography and Population Growth in Relation to Sea Ice Conditions. Anchorage, Alaksa. U. S. G. Survey. USGS Alaska Science Center.

Hyrenbach KD, P Fernandez, DJ Anderson. 2002. Oceanographic habitats of two sympatric North Pacific albatrosses during the breeding season. In editor.:

[IMO] International Maritime Organization. 2014. Construction Requirements for Oil Tankers. http://www.imo.org/. Available: http://www.imo.org/OurWork/Environment/PollutionPrevention/OilPollution/Pages/constructionrequirements.aspx (January 2015).

Irvine GV, DH Mann, JW Short. 2006. Persistence of 10-year old Exxon Valdez oil on Gulf of Alaska beaches: The importance of boulder-armoring. Marine Pollution Bulletin 52(9):1011-1022. Available: http://www.sciencedirect.com/science/article/pii/S0025326X06000129 (January 2015).

[IUCN/SSC PBSG] International Union for Conservation of Nature/Species Survival Commission Polar Bear Specialist Group. 2009. Distribution and current trend of polar bear subpopulations throughout the circumpolar Arctic. January 1, 2009. Conservation of Arctic Flora and Fauna. Available: http://www.abds.is/ (January 2015).

[IUCN/SSC PBSG] International Union for Conservation of Nature/Species Survival Commission Polar Bear Specialist Group. 2015. Southern Beaufort Sea (SB). January 24, 2015. Available: http://pbsg.npolar.no/en/status/populations/southern-beaufort-sea.html (January 2015).

[IUCN/PBSG] International Union for Conservation of Nature/Polar Bear Specialist Group. 2015. Summary of polar bear population status per 2014. January 2015 Accessed January 28, 2015. http://pbsg.npolar.no/export/sites/pbsg/en/docs/status-table-2014.pdf.

Jay, Chadwick V., Sean D. Farley, and Gerald W. Garner. "Summer diving behavior of male walruses in Bristol Bay, Alaska." Marine Mammal Science 17.3 (2001): 617-631.

Jay CV, BG Marcot, DC Douglas. 2010. Projected status of the Pacific walrus (Obodenus rosmarus divergens) in the 21st century. Anchorage, AK. U.S. Department of Interior, U.S. Gological Survey.

Jay C, A Fischbach, A Kochnev. 2012. Walrus areas of use in the Chukchi Sea during sparse sea ice cover. Marine Ecology Progress Series 468:1-13. http://www.int-res.com/abstracts/meps/v468/p1-13/

Jenssen, BM. 1994. Review Article: Effects of Oil Pollution, Chemically Treated Oil, And Cleaning On The Thermal Balance Of Birds. Environmental Pollution 86:207-215.

Jenssen BM, M Ekker. 1991. Dose dependent effects of plumage-oiling on thermoregulation of Common Eiders Somateria mollissima residing in water. Polar Research, 10, 579-84.

Jenssen, Bjørn Munro, and Morten Ekker. "Effects of plumage contamination with crude oil dispersant mixtures on thermoregulation in common eiders and mallards." Archives of environmental contamination and toxicology 20.3 (1991): 398-403.

Jewett SC, TA Dean, BR Woodin, MK Hoberg, JJ Stegeman. 2002. Exposure to hydrocarbons 10 years after the Exxon Valdez oil spill: evidence from cytochrome P4501A expression and biliary FACs in nearshore demersal fishes. Marine Environmental Research 54(1):21-48. Available: http://www.sciencedirect.com/science/article/pii/S0141113602000934 (January 2015).

Joling D. 2014. Corps of Engineers advances Arctic port study. January 6, 2014. JuneauEmpire.com. Available: http://juneauempire.com/state/2014-01-06/corps-engineers-advances-arctic-port-study (January 2015).

Jung JH, Yim UH, Han GM, Shim WJ. 2009. Biochemical changes in rockfish, sebastes schlegeli, exposed to disperse crude oil. Comparative Biochemistry and Physiology.Toxicology & Pharmacology : CBP 150(2):218-23.

Kavry VI, AN Boltunov, VV Nikiforov. 2008. New coastal haulouts of walruses (Odobenus rosmarus) – response to the climate changes. In editor. Collection of Scientific Papers from the Marine Mammals of the Holarctic V conference,14-18 October 2008. Odessa, Ukraine:

Kochnev AA. 1999. Pacific Walrus In Coastal Waters Of Wrangell Island (1991-1994). News of the Pacific Fisheries Research Center 126:1-16.

Kochnev AA. 2004. Warming of eastern arctic and present status of the Pacific walrus (Odobenus rosmarus divergens) population. Papers of the Third International Conference on Marine Mammals of the Holarctic; October 11-17, 2004; Koktebel, Crimea, Ukraine.

Kochnev AA. 2006. Research on polar bears autumn aggregations on Chukotka, 1989-2004. Proceedings of he 14th working meeting of the IUCN/SSC polar bear specialist group; Seattle, WA: International Union for the Conservation of Nature.

Kroeker KJ, RL Kordas, RN Crim, GG Singh. 2009. Meta-analysis reveals negative yet variable effects of ocean acidification on marine organisms. Ecol. Lett. 13:1419–34.

Lambert G, DB Peakall, BJR Philogene, FR Engelhardt. 1982. Effect of oil and oil dispersant mixtures on the basal metabolic rate of ducks. Bulletin of Environmental Contamination and Toxicology 29:520-524.

Lance, Ellen W., et al. "Petroleum hydrocarbon contamination in Nelson Lagoon, Alaska, sampling three different matrices." Marine pollution bulletin 64.10 (2012): 2129-2134.

Larned WW, T Tiplady. 1996. Distribution and Abundance of Sea Ducks in Kuskokwim Bay, Alaska, September 1996. unpublished:12p.

Larned WW. 2000. Aerial Surveys of Steller's Eiders and Other Waterbirds and Marine Mammals in Southwest Alaska Areas Proposed for Navigation Improvements by the U.S. Army Corps of Engineers. unpublished:51p.

Larned WW, Karen S. Bollinger 2011. Steller's Eider Spring Migration Surveys Southwest Alaska 2010. Anchorage. U.S. Fish and Wildlife Service.

Larned WW, R Stehn, and R Platte. 2011. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska, 2010. Unpublished report. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska. 52 pp.

Larned, W., K. Bollinger, and R. Stehn. 2012. Late winter population and distribution of spectacled eiders (Somateria fischeri) in the Bering Sea, 2009 and 2010. USFWS. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska. January 12, 2012. 23 pp.

Lessard RR, G Demarco. 2000. The significance of oil spill dispersants. Spill Science & Technology Bulletin 6(1):59-68.

Leighton FA, Peakall DB. Butler, RG. 1983. Heinz-body hemolytic anemia from the ingestion of crude oil: A primary toxic effect in marine birds. Science, 220, 871-3.

Leighton, Frederick A. "Oil Pollution in the Aquatic Environment: Effects on Birds and Mammals." Annual Conference-American Association Of Zoo Veterinarians. American

Association Of Zoo Veterinarians, 1995.
Lichti NI, RK Swihart. 2011. Estimating utilization distributions with kernel versus local convex hull methods. The Journal of Wildlife Management 75(2):413-422. Availabel: http://dx.doi.org/10.1002/jwmg.48 (January 2015).
Lie, E, A Bernhoft, F Riget, SE Belikov, AN Boltunov, GW Garner, Ø Wiig, and JU Skaare. 2003. Geographical distribution of organochlorine pesticides (OCPs) in polar bears (Ursus maritimus) in the Norwegian and Russian Arctic. The Science of the Total Environment 306:159–170.
Lin CY, Anderson BS, Phillips BM, Peng AC, Clark S, Voorhees J, Wu HI, Martin MJ, McCall J, Todd CR, et al. 2009. Characterization of the metabolic actions of crude versus dispersed oil in salmon smolts via NMR-based metabolomics. Aquat Toxicol 95(3):230-8.
Livezey, Bradley C. "Effects of selected observer-related factors on fates of duck nests." Wildlife Society Bulletin (1980): 123-128.
Lunn, N.J. and I. Stirling. 1985. The significance of supplemental food to polar bears during the ice-free period of Hudson Bay. Canadian Journal of Zoology 63:2291–97.
MacCracken, J.G. 2012. Pacific walrus and climate change: observations and predictions. Ecology and Evolution 2:2072-2090.
Major, Richard E. "The effect of human observers on the intensity of nest predation." Ibis 132.4 (1990): 608-612.
Marcot BG, JD Steventon, GD Sutherland, RK McCann. 2006. Guidelines for developing and updating Bayesian belief networks applied to ecological modeling and conservation. Canadian Journal of Forest Research 36:3063-3074.
Martin P. 2001. Memorandum: Steller's Eider Telemetry Update - 29 November 2001. Anchorage. U.S. Fish and Wildlife Service.
Martin, Jonathan D., et al. "Chronic toxicity of heavy fuel oils to fish embryos using multiple exposure scenarios." Environmental Toxicology and Chemistry 33.3 (2014): 677-687.
Martinez-Abrian A, A Velando, D Oro, M Genovart, C Gerique, MA Bartolome, E Villuendas, B Sarzo. 2006. Sex-specific mortality of European shags after the Prestige oil spill: demographic implications for the recovery of colonies. Marine Ecology Progress Series 318:271-276. Available: http://www.int-res.com/abstracts/meps/v318/p271-276/ (January 2015).
McEachern KL. 2014. Toxicity of oil from BP deepwater horizon blowout on the early life stage of red drum, sciaenops ocellatus. Ann Arbor: Florida Gulf Coast University.
McFarlin, Kelly M., et al. "Biodegradation of dispersed oil in arctic seawater at-1 C." PloS one 9.1 (2014): e84297.
McGowan CP, MR Ryan. 2010. Arguments for using population models in incidental take assessments for endangered species. Journal of Fish and Wildlife Management 1(2):183-188.
McKnight A, KM Sullivan, DB Irons, SW Stephensen, S Howlin. 2006. Marine Bird and Sea Otter Population Abundance of Prince William Sound, Alaska: Trends following the T/V Exxon Valdez Oil Spill, 1989-2005 Anchorage, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management.

Melvin, E.F., J. Parrish, K.S. Dietrich, and O.S. Hamel. 2001. Solutions to seabird bycatch in Alaska's demersal longline fisheries. Washington Sea Grant Program. Project A/FP-7. 53 pp. Available at: http://www.wsg.washington.edu/pubs/seabirds/seabirdpaper.html

Melvin EF, K.S. Dietrich, S. Fitzgerald, and T. Cardoso. 2011. Reducing seabird strikes with trawl cables in the pollock catcher-processor fleet in the eastern Bering Sea. Polar Biology 34:215–226.

[MMS] Minerals Management Service. 2010. Arctic oil spill response research and development program: a decade of achievement. Minerals Management Service, U.S. Department of the Interior. Western Gray Whale Advisory Panel, 9th Meeting. 30 p.

Moore, S.E., R.R. Reeves, B.L. Southall, T.J. Ragen, R.S. Suydam, and C.W. Clark. 2012. A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing arctic. BioScience 62: 289-295.

Morris WH, DF Doak. 2002. Quantitative Conservation Biology: Theory and Practice of Population Viability Analysis. Sunderland: Sinauer Associates.

Mu, Jingli, et al. "Comparative effects of biological and chemical dispersants on the bioavailability and toxicity of crude oil to early life stages of marine medaka (Oryzias melastigma)." Environmental Toxicology and Chemistry 33.11 (2014): 2576-2583.

Murphy SM, RH Day, JA Wiens, KR Parker. 1997. Effects of the Exxon Valdez Oil Spill on Birds: Comparisons of Pre- and Post-Spill Surveys in Prince William Sound, Alaska. The Condor 99(2):299-313. Available: http://www.jstor.org/stable/1369936 (January 2015).

[NMFS] National Marine Fisheries Service. 2007. Annual Report on Seabird Interactions and Mitigation Efforts in the Hawaii Longline fishery for 2006. Pacific Islands Regional Office, April 2007.

[NMML] National Marine Mammal Laboratory. 2010. Annual Report for Activities Conducted by the National Marine Mammal Laboratory under the Federal Fish and Wildlife Permit MA212570-0 in Calendar Year 2009.

[NMML] National Marine Mammal Laboratory. 2011. Annual Report for Activities Conducted by the National Marine Mammal Laboratory under the Federal Fish and Wildlife Permit MA212570-0 in Calendar Year 2010.

[NMML] National Marine Mammal Laboratory. 2012. Annual Report for Activities Conducted by the National Marine Mammal Laboratory under the Federal Fish and Wildlife Permit MA212570-0 in Calendar Year 2011.

[NMML] National Marine Mammal Laboratory. 2013. Annual Report for Activities Conducted by the National Marine Mammal Laboratory under the Federal Fish and Wildlife Permit MA212570-0 in Calendar Year 2012.

[NOAA] National Oceanic and Atmospheric Administration. 2010. Characteristics of response strategies: a guide for spill response planning in marine environments. Seattle, Washington. 76.

[NOAA Fisheries] National Oceanic and Atmosheric Administration Fisheries. 2011. Press Release: December 20, 2011 Deaths Of Ringed Seals In Alaska Declared An Unusual Mortality Event; Walrus Pending. Anchorage. National Marine Fisheries Service, Alaska Regional Office. Available: http://www.fws.gov/alaska/fisheries/mmm/walrus/disease_investigation.htm (January 2015).

[NOAA Fisheries] National Oceanic and Atmosheric Administration Fisheries. 2015. Residues from In Situ Burning of Oil on Water. February 17, 2015. National Oceanic and Atmospheric Administration. Available: http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/residues-in-situ-burning-oil-water.html (February 2015).

[NOAA and UNH] National Oceanic and Atmospheric Administration and University of New Hampshire. 2015. Cumulative TCNNA SAR Composite in: Environmental Response Management Application (ERMA). NOAA's Office of Response and Restoration, the University of New Hampshire's Coastal Response Research Center and the U.S. Environmental Protection Agency. http://gomex.erma.noaa.gov/erma.html#x=-89.37870&y=29.14486&z=6&layers=6770+12782+15753+15879 (January 2015).

Norse EA, J Amos. 2010. Impacts, Perception, and Policy Implications of the BP/Deepwater Horizon Oil and Gas Disaster. The Environmental Law Reporter 40(11):058. http://www.eli.org (January, 2015).

[NRC] National Research Council. Spills of Nonfloating Oil: Risk and Response. National Academies Press, Washington, D.C. 75 pp.

[NRC] National Research Council. 2003. Cumulative environmental effects of oil and gas activities on Alaska's north slope. Washington, D.C.: The National Academies Press.

[NRC] National Research Council. 2005. Oil Spill Dispersants: Efficacy and Effects. Washington, D.C.: The National Academies Press. http://www.nap.edu/openbook.php?record_id=11283

Neff, J. M., P. D. Boehm & W. E. Haensly. 1985. Petroleum contamination and biochemical alterations in oysters (Crassostrea gigas) and plaice (Pleuronectes platessa) from bays impacted by the Amoco Cadiz crude oil spill. Mar. Environ. Res. 17:281–283.

[Nuka] Nuka Research & Planning Group LaCI, Inc. 2005. Vessel Traffic in the Aleutians Subarea. Seldovia, Alaska. prepared for the Alaska Department of Environmental Conservation.

[Nuka] Nuka Research and Planning Group. 2006. Spill tactics for responders. Prepared for the Alaska Department of Environmental Conservation. 274 p. Available at http://dec.alaska.gov/spar/perp/star/final/NORS_STAR_vMarch2014.pdf. Nuka Research and Planning Group, LLC. Seldovia, AK. 274.

[Nuka] Nuka Research and Planning Group LLC. 2014. Aleutian Island Risk Assessment Project, Recommending an Optimal Response System for the Aleutian Islands: Draft Summary Report. Prepared for: The Aleutian Islands Risk Assessment Team. http://www.aleutiansriskassessment.com/documents/110826AIRA_ (January 2015).

O'Hara, Patrick D., and Lora A. Morandin. "Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds." Marine Pollution Bulletin 60.5 (2010): 672-678.

Obbard, M.E., G.W. Thiemann, E. Peacock, and T.D. DeBruyn, eds. 2010. Polar Bears: Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009. Gland, Switzerland and Cambridge, UK: IUCN. vii + 235 pp.

Obritschkewitsch T, P Martin, R Suydam. 2001. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1999-2000. Northern Ecological Services, U.S. Fish and Wildlife Service, Technical Report NAES-TR-01-04, Fairbanks, Alaska 113 pp.

Ovsyanikov NG, IE Menyushina, AV Bezrukov. 2007. Unusual walrus mortality at Wrangel Island in 2007. Marine Mammals of the Holarctic. Odessa:413-416. Available: http://www.polarbearsinternational.org/sites/default/files/ovsyanikov_unusual_walrus_mortality_en.pdf (January 2015).

Ovsyanikov NG. 2012. Occurrence of family groups and litters size of polar bears on Wrangel Island in the autumns of 2004-2010 as an indication of population status. In: Marine Mammals of the Holarctic, Suzdal, 2012.

Pagano AM, GM Durner, SC Amstrup, KS Simac, GS York. 2012. Long-distance swimming by polar bears (Ursus maritimus) of the southern Beaufort Sea during years of extensive open water. Canadian Journal of Zoology 90(5):663-676.

Payne JR, GD McNabb, JR Clayton. 1991. Oil-weathering behavior in Arctic environments. Polar Research 10(2):631-662. http://dx.doi.org/10.1111/j.1751-8369.1991.tb00681.x http://www.polarresearch.net/index.php/polar/article/view/6774

Petersen MR. 1981. Populations, feeding ecology and molt of Steller's eiders. Condor 83:256–262

Petersen MR, Larned WW, Douglas DC. 1999. At-sea distribution of spectacled eiders: a 120-year-old mystery resolved. Auk 116:1009–1020.

Petersen MR, Grand JB, Dau CP. 2000. Spectacled eider (Somateria fischeri). In: Poole A, Gill F (eds) The birds of North America, no. 547. The Birds of North America, Philadelphia,Pa.

Peterson CH, SD Rice, JW Short, D. Esler, JL Bodkin, BE Ballachey and DB Irons. 2003. Long-Term Ecosystem Response to the Exxon Valdez Oil Spill. Science. Vol 302 pp 2082-2086.

Piatt JF, CJ Lensink, W Butler, M Kendziorek, DR Nysewander. 1990. Immediate Impact of the 'Exxon Valdez' Oil Spill on Marine Birds. The Auk 107(2):387-397. Available: http://www.jstor.org/stable/4087623 (January 2015).

Piatt JF, J Wetzel, K Bell, AR DeGange, GR Balogh, GS Drew, T Geernaert, C Ladd, GV Byrd. 2006. Predictable hotspots and foraging habitat of the endangered short-tailed albatross (Phoebastria albatrus) in the North Pacific: Implications for conservation. Deep-Sea Research Part II, Topical Studies in Oceanography 53(3/4):387-398. 10.1016/j.dsr2.2006.01.008 Available: http://search.ebscohost.com/login.aspx?direct=true&db=fzh&AN=21262780&site=ehost-live

Platte RM, RA Stehn. 2011. Abundance and trend of waterbirds on Alaska's Yukon–Kuskokwim Delta coast based on 1988 to 2010 aerial surveys. Unpublished report, U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska. April 29, 2011. 43 pp.

Pörtner HO. 2010. Oxygen and capacity limitation of thermal tolerance: a matrix for integrating climate related stressors in marine ecosystems. Journal of Experimental Biology 213:881–93.

Powell AN, S Backensto. 2009. Common ravens (Corvus corax) nesting on Alaska's North Slope Oil Fields. Final Report to CMI, Minerals Management Service OCS Study 2009-007, Alaska. 41pp.

Prestrud P, I Sterling. 1994. The international polar bear agreement and the current status of polar bear conservation. Aquatic Mammals 20(3):113-124.

Proshutinsky, A.Y. and M. Johnson. 2001. Two regimes of Arctic's circulation from ocean models with ice and contaminants. Marine Pollution Bulletin 43:61–70.

Quinlan R, MV Douglas, and JP Smol. 2005. Food web changes in arctic ecosystems related to climate warming. Global Change Biology 11:1381–1386.

Reed DH, JJ O'Grady, BW Brook, JD Ballou, R Frankham. 2003. Estimates of minimum viable population sizes for vertebrates and factors influencing those estimates. Biological Conservation 113(1):23. Available: http://search.ebscohost.com/login.aspx?direct=true&db=fzh&AN=9341212&site=ehost-live (January 2015).

Reddy, Christopher M., et al. "The West Falmouth oil spill after thirty years: The persistence of petroleum hydrocarbons in marsh sediments." Environmental science & technology 36.22 (2002): 4754-4760.

Reddy, Christopher M., et al. "Composition and fate of gas and oil released to the water column during the Deepwater Horizon oil spill." Proceedings of the National Academy of Sciences 109.50 (2012): 20229-20234.

Regehr EV, SC Amstrup, I Stirling. 2006. Polar bear population status in the southern Beaufort Sea. Open-File Report 2006-1337. Reston, Virginia. U.S. Geological Survey. http://alaska.usgs.gov/science/biology/polar_bears/size.html#pop_assess (January 2015).

Regehr, E. V., C. M. Hunter, H. Caswell, S. C. Amstrup, and I. Stirling. 2009. Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea-ice. Journal of Animal Ecology 79: 117-127.

Regehr EV, CM Hunter, H Caswell, SC Amstrup, I Stirling. 2010. Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea-ice. Journal of Animal Ecology 79(1):117-127.

Reichmuth C, A Ghoul. 2012. Auditory Sensitivity in Sea Otters (Enhydra lutris). Santa Cruz, California. University of California Santa Cruz. This report is available for downloading at the Environmental Studies Program Information System (ESPIS) by referencing OCS Study BOEM 2012-103.

Riedman ML. 1983. Studies of the effects of experimentally produced noise associated with oil and gas exploration and development on sea otters in California. Final report.

Riedman ML. 1984. Effects of sounds associated with petroleum industry activities on the behavior of sea otters in California. pp. D–1 to D–12 In: Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack, and J.E. Bird, Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior/Phase II: January 1984 migration. BBN Rep. 5586. Rep. by Bolt Beranek & Newman Inc., Cambridge, MA, for MMS. Anchorage, AK. NTIS PB86–218377.

Ritchie LA, DA Gill. 2008. The Selendang Ayu Shipwreck and Oil Spill: Considering Threats and Fears of a Worst-Case Scenario. Sociological Inquiry 78(2):184-206. Available: http://dx.doi.org/10.1111/j.1475-682X.2008.00234.x (January 2015).

Rocke, T. E., T. M. Yuill, and R. D. Hinsdill. "Oil and related toxicant effects on mallard immune defenses." Environmental research 33.2 (1984): 343-352.

Rode, K. 2010. Annual Report for Activities Conducted Under Permit MA046081-3 for Calendar Year 2009. U.S. Fish and Wildlife Service. Marine Mammals Management, Anchorage, Alaska.

Rode KD, EV Regehr, DC Douglas, G Durner, AE Derocher, GW Thiemann, SM Budge. 2014. Variation in the response of an Arctic top predator experiencing habitat loss: feeding and reproductive ecology of two polar bear populations. Global Change Biology 20(1):76-88. http://dx.doi.org/10.1111/gcb.12339

Rojek NA. 2008. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 2007. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. Technical Report. 44 pp.

Rosenberg DH, MJ Petrula, D Zwiefelhofer, T Holmen, DD Hill, JL Schamber. 2011. Seasonal Movements and Distribution of Pacific Steller's Eiders (Polysticta stelleri). Anchorage, Alaska. Alaska Department of Fish and Game.

Roth, E.H, J.A. Hildebrand, S.M. Wiggins, and D. Ross. 2012. Journal of Acoustical Society of America. 131: 104-110.

Rothrock DA, Y Yu, and GA Maykut. 1999. Thinning of the Arctic sea-ice cover, Geophysical Research Letters 26: 3469-3472.

Runge J. 2004. Population Viability Analysis for Alaska Breeding and Pacific Populations of Steller's Eider. University of Montana.

Ryerson TB, R Camilli, JD Kessler, EB Kujawinski, CM Reddy, DL Valentine, E Atlas, DR Blake, J de Gouw, S Meinardi, DD Parrish, J Peischl, JS Seewald, C Warneke. 2012. Chemical data quantify Deepwater Horizon hydrocarbon flow rate and environmental distribution. Proceedings of the National Academy of Sciences 109(50):20246-20253. http://www.pnas.org/content/109/50/20246.abstract

Safine DE. 2011. Breeding ecology of Steller's and spectacled eiders nesting near Barrow, Alaska, 2008–2010. U. S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. Technical Report. 66 pp.

Salwasser H, SP Mealey, K Johnson. 1984. Wildlife population viability: A question of risk. Transactions of the North American Wildlife and Natural Resources Conference 49:421-439.

Sammarco, Paul W., et al. "Distribution and concentrations of petroleum hydrocarbons associated with the BP/Deepwater Horizon Oil Spill, Gulf of Mexico." Marine pollution bulletin 73.1 (2013): 129-143.

Schmidt CW. 2012. Offshore Exploration in the Arctic: Can Shell's Oil-Spill Response Plans Keep Up? Environmental Health Perspectives 120: a194-a199. http: //dx.doi.org/10.1289/ehp.120-a194 (January 2015).

Scholz, D., S.R. Warren Jr., A.H. Walker, and J. Michel. 2004. In-situ burning: The fate of burned oil. American Petroleum Institute Publication 4735. American Petroleum Institute, Washington, DC. 40 pp.

Schwacke LH, CR Smith, FI Townsend, RS Wells, LB Hart, BC Balmer, TK Collier, S De Guise, MM Fry, LJ Guillette, SV Lamb, SM Lane, WE McFee, NJ Place, MC Tumlin, GM Ylitalo, ES Zolman, TK Rowles. 2013. Health of Common Bottlenose Dolphins (Tursiops truncatus) in Barataria Bay, Louisiana, Following the Deepwater Horizon Oil Spill. Environmental Science & Technology 48(1):93-103. http://dx.doi.org/10.1021/es403610f (January 2015).

Seyle H. 1956. The Stress of Life. New York, New York: McGraw-Hill Book Company.

Shaffer ML. 1981. Minimum Population Sizes for Species Conservation. BioScience 31(2):131-134. http://bioscience.oxfordjournals.org/content/31/2/131.abstract

Sheffield, Gay, and Jacqueline M. Grebmeier. "Pacific walrus (Odobenus rosmarus divergens): differential prey digestion and diet." Marine Mammal Science 25.4 (2009): 761-777.

Silverman BW. 1986. Density Estimation for Statistics and Data Analysis. New York: Publisher Chapman and Hall.

Singer, M. M., S. George, and R. S. Tjeerdema. "Relationship of some physical properties of oil dispersants and their toxicity to marine organisms." Archives of Environmental Contamination and Toxicology 29.1 (1995): 33-38.

SkyTruth. 2010. BP/Gulf Oil Spill-68,000 Square Miles of Direct Impact July 27, 2010. Available: http://blog.skytruth.org/2010/07/bp-gulf-oil-spill-68000-square-miles-of.html (January 2015).

Sonsthagen S, K Fales, C Jay, G Sage, S Talbot. 2014. Spatial variation and low diversity in the major histocompatibility complex in walrus (Odobenus rosmarus). Polar Biology 37(4):497-506. Available: http://dx.doi.org/10.1007/s00300-014-1450-9 (January 2015).

Sørstrøm, Stein Erik, et al. Joint industry program on oil spill contingency for Arctic and ice-covered waters: Summary report. SINTEF, 2010.

Soule ME. 1980. Thresholds for survival: Maintaining fitness and evolutionary potential. In Soule ME and B. A. Wilcox, editor. Conservation biology: An evolutionary-ecological perspective. Sunderland: Sinauer Associates.

Soule ME. 1987. Where do we go from here? In Soule ME, editor. Viable populations for conservation. Cambridge: Cambridge University Press.

Speckman SG, VI Chernook, DM Burn, MS Udevitz, AA Kochnev, A Vasilev, CV Jay, A Lisovsky, AS Fischbach, RB Benter. 2011. Results and evaluation of a survey to estimate Pacific walrus population size, 20061. Marine Mammal Science 27(3):514-553. http://dx.doi.org/10.1111/j.1748-7692.2010.00419.x

Stehn R, R Platte. 2000. Exposure of birds to assumed oil spills at the Liberty Project. Anchorage, Alaska. U.S. Fish & Wildlife Service, Migratory Bird Management.

Stehn R, R Platte. 2009. Steller's Eider Distribution, Abundance, and Trend on the Arctic Coastal Plain, Alaska, 1989-2008. Anchorage. Migratory Bird Management, Waterfowl Management Branch, U.S. Fish and Wildlife Service.

Stehn, R., C. Dau, B. Conant, and W. Butler. 1993. Decline of spectacled eiders nesting in western Alaska. Arctic 46: 264–277.

Stehn, R., W. Larned, R. Platte, J. Fischer, and T. Bowman. 2006. Spectacled eider status and trend in Alaska. U.S. Fish and Wildlife Service, Anchorage, Alaska. Unpublished Report. 17 pp.

Stephenson, Richard. "Effects of oil and other surface-active organic pollutants on aquatic birds." Environmental Conservation 24.02 (1997): 121-129.

Stephenson, Richard, and Catherine A. Andrews. "The effect of water surface tension on feather wettability in aquatic birds." Canadian journal of zoology 75.2 (1997): 288-294.

Stevens L, D Aurand. 2008. Criteria for evaluating oil spill planning and response operations. A Report to IUCN. Technical Report 07-02. Ecosystem Management & Associates, Inc. Lusby, MD. 20657.

Stubblefield, William A., et al. "Effects of naturally weathered Exxon Valdez crude oil on mallard reproduction." Environmental Toxicology and Chemistry 14.11 (1995): 1951-1960.

Swem T, A Matz. 2008. Analysis of the current status of the Alaska-breeding population of the Steller's Eider. Report of the Steller's Eider Recovery Team workshop, January, 2008. Fairbanks. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office.

Taylor RL, MS Udevitz. 2015. Demography of the Pacific walrus (Odobenus rosmarus divergens): 1974–2006. Marine Mammal Science 31(1):231-254. Available: http://dx.doi.org/10.1111/mms.12156 (January 2015).

Tempel DJ, RJ Gutierrez. 2003. Fecal corticosterone levels in California spotted owls exposed to low-intensity chainsaw sound. 31(3):698-702.

[TERA] Troy Ecological Research Associates. 2002. Spectacled eider movements in the Beaufort Sea: Distribution and timing of use. Report for BP Alaska Inc., Anchorage, Alaska and Bureau of Land Management, Fairbanks, Alaska. 17 pp.

Thomas, T.A., W.R. Koski, D.S. Ireland, D.W. Funk, M. Laurinolli and A.M. Macrander. 2009. Pacific walrus movements and use of terrestrial haul-out sites along the Alaskan Chukchi Sea coast in 2007. Poster, society for Marine Mammalogy annual meeting, Quebec City, Quebec, Canada.

Thompson GG. 1991. Determining Minimum Viable Populations under the Endangered Species Act. Seattle, WA. Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration. Available:

Traill LW, CJA Bradshaw, BW Brook. 2007. Minimum viable population size: a meta-analysisof 30 years of published estimates. Biological Conservation 139:159-166.

Tuomi, P. 2001. Sea Otters (In) CRC Handbook of Marine Mammal Medicine 2nd edition. (eds) L. A. Dierauf and F. M. D. Gulland. Boca Raton, London, New York Washington, DC. Pp. 961- 979.

Udevitz, Mark S., et al. "Modeling haul-out behavior of walruses in Bering Sea ice." Canadian Journal of Zoology 87.12 (2009): 1111-1128.

Udevitz MS, JL Bodkin, DP Costa. 1995. Detection of sea otters in boat-based surveys of Prince William Sound, Alaska. Marine Mammal Science 11(1):59. http://search.ebscohost.com/login.aspx?direct=true&db=eih&AN=8432435&site=ehost-live

[USCG et al.] U.S. Coast Guard, U.S. Environmental Protection Agency, Department of the Interior Office of Environmental Policy and Compliance, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration's National Marine Fisheries Service and National Ocean Service. 2001. Inter-agency Memorandum of Agreement Regarding Oil Spill Planning and Response Activities Under the Federal Water Pollution Control Act's National Oil and Hazardous Substances Pollution Contingency Plan and the Endangered Species Act. 1-22.

[USCG] U.S. Coast Guard. 2011. On Scene Coordinator Report Deepwater Horizon Oil Spill. Submitted to the National Respons Team September 2011. Available: http://www.uscg.mil/foia/docs/dwh/fosc_dwh_report.pdf (January 2015).

U.S. Census Bureau. 2013. State and County QuickFacts. Data derived from Population Estimates, American Community Survey, Census of Population and Housing, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits Last Revised: Thursday, 05-Feb-2015 Available: http://quickfacts.census.gov/qfd/states/02/02185.html (February 2015)

[USFWS] U.S. Fish and Wildlife Service. 1996. Spectacled Eider Recovery Plan. Prepared for Region 7 - U.S. Fish and Wildlife Service, Anchorage, Alaska. 100pp + Appendices.

[USFWS] U.S. Fish and Wildlife Service. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Alaska-Breeding Population of the Steller's Eider. Federal Register. 66 (23):8850.

[USFWS] U.S. Fish and Wildlife Service Steller's Eider Recovery Team. 2002. Steller's Eider Recovery Plan. Fairbanks. U.S. Fish and Wildlife Service.

[USFWS] U.S. Fish and Wildlife Service. 2005. FWS National Oil Spill Contingency Plan. Final Updated Revision, June, 2005. Environmental Qualtiy, Ecological Services. Washington, D.C. Available: http://www.fws.gov/Contaminants/FWS_OSCP_05/FWSContingencyTOC.htm (January 2015).

[USFWS] U.S. Fish and Wildlife Service. 2010. Southwest Alaska Distinct Population Segment of the Northern Sea Otter (Enhydra lutris kenyoni) Draft Recovery Plan. Anchorage. Marine Mammals Management Office, Region 7.

[USFWS] U.S. Fish and Wildlife Service. 2011a. Eskimo curlew (Numenius borealis) 5-year review: summary and evaluation. Fairbanks Fish and Wildlife Field Office, US Fish and Wildlife Service, Fairbanks, AK.

[USFWS] U.S. Fish and Wildlife Service. 2011b. Biological Opinion For Approval of the State of Alaska's Mixing Zones Regulation Section of the Alaska Water Quality Standards, Consultation with the U.S. Environmental Protection Agency Seattle, Washington. U.S. Fish and Wildlife Service Anchorage Fish and Wildlife Field Office. Anchorage, Alaska.

[USFWS] U.S. Fish and Wildlife Service. 2011. Letters of authorization to take marine mammals." 76 FR 47010

[USFWS] U.S. Fish and Wildlife Service. 2012. Biological Opinion and Conference Opinion for Oil and Gas Activities in the Beaufort and Chukchi Sea Planning Areas on Polar Bears (Ursus maritimus), Polar Bear Critical Habitat, Spectacled Eiders (Somateria fischeri), Spectacled Eider Critical Habitat, Steller's Eiders (Polysticta stelleri), Kittlitz's Murrelets (Brachyramphus brevirostris), and Yellow-billed Loons (Gavia adamsii). Fairbanks, Alaska. Fairbanks Fish and Wildlife Field Office. . Available: http://www.boem.gov/ak-consultations/ (January 2015).

[USFWS] U.S. Fish and Wildlife Service. 2013a. Biological Opinion for the National Petroleum Reserve – Alaska Integrated Activity Plan 2013. Fairbanks, Alaska. Fairbanks Fish and Wildlife Field Office.

[USFWS] U.S. Fish and Wildlife Service. 2013b. Marine Mammals; Incidental Take During Specified Activities; Final Rule Federal Register. 78 (113, Part II):35364-35427. http://www.fws.gov/alaska/fisheries/mmm/polarbear/pdf/78_FR_35364_%20June_12_2013.pdf (January 2014).

[USFWS] U.S. Fish and Wildlife Service. 2014a. 5-Year Review: Summary and Evaluation Short-tailed Albatross (Phoebastria albatrus). Anchorage. Anchorage Fish and Wildlife Field Office.

[USFWS] U.S. Fish and Wildlife Service. 2014b. Intra-Service Biological Opinion For Hunting Regulations for the 2015 Spring/Summer Harvest. Fairbanks, Alaska. Fairbanks Fish and Wildlife Field Office. Available: http://www.fws.gov/alaska/fisheries/endangered/bio_opinion.htm (January 2015).

[USFWS] U.S. Fish and Wildlife Service. 2014b. Revised Northern Sea Otter (Enhydra lutris kenyoni): Southwest Alaska Stock Assessment Report. Anchorage, Alaska. Department of the Interior, Marine Mammals Management. Available: http://www.fws.gov/alaska/fisheries/mmm/stock/stock.htm (January 9, 2015).

[USFWS] U.S. Fish and Wildlife Service. 2014c. Revised Northern Sea Otter (*Enhydra lutris kenyoni*): Southwest Alaska Stock Assessment Report. Anchorage, Alaska. Department of the Interior, Marine Mammals Management. Available: http://www.fws.gov/alaska/fisheries/mmm/stock/stock.htm (January 9, 2015).

[USFWS] U.S. Fish and Wildlife Service. 2015. Draft oil spill response plan for polar bears in Alaska. Marine Mammals Management. Anchorage, Alaska.

[USFWS and USGS] U.S. Fish and Wildlife Service and U.S. Geologic Survey. 2015. IPaC - Information, Planning, and Conservation System Environmental Conservation Online System. http://ecos.fws.gov/ipac/ (January 9, 2015).

Van Polanen Petel TD, JM Terhune, MA Hindell, MA Giese. 2006. An assessment of the audibility of sound from human transport by breeding Weddell seals (Leptonychotes weddellii). Wildlife Research 33(4):275-291.

Van Vleet, Edward S., and George G. Pauly. "Characterization of oil residues scraped from stranded sea turtles from the Gulf of Mexico." (1987).

Wadhams P, NR Davis. 2000. Further evidence of ice thinning in the Arctic Ocean. Geophysical Research letters 27(24): 3973-3975.

Warnock, N. and D. Troy. 1992. Distribution and abundance of spectacled eiders at Prudhoe Bay, Alaska: 1991. Unpublished report prepared for BP Exploration (Alaska) Inc., Environmental and Regulatory Affairs Department, Anchorage, Alaska, by Troy Ecological Research Associates (TERA), Anchorage, Alaska. 20 pp.

Weingartner T, K Aagaard, R Woodgate, S Danielson, Y Sasaki, D Cavalieri. 2005. Circulation on the north central Chukchi Sea shelf. Deep Sea Research Part II: Topical Studies in Oceanography 52(24–26):3150-3174. http://www.sciencedirect.com/science/article/pii/S0967064505002158

White HK, SL Lyons, SJ Harrison, DM Findley, Y Liu, EB Kujawinski. 2014. Long-Term Persistence of Dispersants following the Deepwater Horizon Oil Spill. Environmental Science & Technology Letters 1(7):295-299. http://dx.doi.org/10.1021/ez500168r (2014/09/02).

Whitney J. 2000. The Aleutian Islands and Lower Alaska Peninsula: Oceangraphic Conditions and NOAA's Oil SPill Response History during 1981-1999.98.

Williams, T.M, R.A. Kastelein, R.W. Davis, and J.A. Thomas. 1988. The effects of oil contamination and cleaning on sea otters (Enhydra lutris). I. Thermoregulatory implications based on pelt studies. Canadian Journal of Zoology 66:2776- 2781.

[Windward] Windward Environmental LLC and ERM. 2014. The Biological Assessment of the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases (Unified Plan) Final, 23 January 2014. Anchorage. Prepared for: United States Coast Guard, Seventeenth Coast Guard District, and United States Environmental Protection Agency, Region 10 Alaska. 1-820.

Woodgate R, K Aagaard, T Weingartner. 2014. Circulation And Outflows Of The Chukchi Sea. University of Washington, Seattle, WA. Polar Science center, Applied Physics

Laboratory, High Latutude Dynamics Unit. http://psc.apl.washington.edu/HLD/Chukchi/Chukchi.html (January 2015).

Woodgate RA, K Aagaard, TJ Weingartner. 2005. A year in the physical oceanography of the Chukchi Sea: Moored measurements from autumn 1990–1991. Deep Sea Research Part II: Topical Studies in Oceanography 52(24–26):3116-3149.

Wu, Dongmei, et al. "Comparative toxicity of four chemically dispersed and undispersed crude oils to rainbow trout embryos." Environmental Toxicology and Chemistry 31.4 (2012): 754-765.

Yamada, Mihoko, et al. "Study on the fate of petroleum-derived polycyclic aromatic hydrocarbons (PAHs) and the effect of chemical dispersant using an enclosed ecosystem, mesocosm." Marine Pollution Bulletin 47.1 (2003): 105-113.

[Top]

APPENDIX A. STATUS OF THE SPECIES

Northern sea otter

Species Description

The southwestern Alaska Distinct Population Segment (DPS) of the northern sea otter was listed as threatened on August 9, 2005 due to population declines documented in the 1980s and 1990s (70 FR 46366). The sea otter is a mammal in the family Mustelidae and it is the only species in the genus *Enhydra.* Three subspecies are recognized: 1) the Asian northern sea otter (*E. l. lutris*), which occurs west of the Aleutian Islands; 2) the southern sea otter (*E. l. nereis*), which occurs off the coast of California and Oregon; and 3) the Alaskan northern sea otter (*E. l. kenyoni*), which occurs from the west end of the Aleutian Islands to the coast of the State of Washington (Wilson et al. 1991). Adult males average 130 cm (4.3 ft) in length and 30 kg (66 lb) in weight; adult females average 120 cm (3.9 ft) in length and 20 kg (44 lb) in weight (Kenyon 1969). Sea otters lack blubber and depend entirely upon their fur for insulation (Riedman and Estes 1990). They molt gradually throughout the year (Kenyon 1969).

Status and Distribution

Distribution and Population Structure

The northern sea otter has a range that extends from the Aleutian Islands in southwestern Alaska to the coast of the State of Washington. Three stocks of sea otters are recognized in Alaska: southwest, southcentral and southeast (Figure A-20). The southwest Alaska stock ranges from Attu Island at the western end of the Near Islands in the Aleutians, east to Kamishak Bay on the western side of lower Cook Inlet, and includes waters adjacent to the Aleutian Islands, the Alaska Peninsula, the Kodiak archipelago, and the Barren Islands (USFWS 2005) and is currently estimated to contain about 55,000 animals (USFWS 2014b).

Within the range of northern sea otters (*E. l. kenyoni*), there may be physical barriers to movement across the upper and the lower portions of Cook Inlet, and there are morphological and some genetic differences between sea otters that correspond to the southwest and south-central Alaska stocks (USFWS 2005). Genetic analyses show some similarities between sea otters in the Commander Islands, Russia, and Alaska (Cronin et al. 1996), which indicates that movements between these areas has occurred, at least over evolutionary time scales. All existing sea otter populations have experienced at least one genetic bottleneck caused by the commercial fur harvests from 1741 - 1911. As part of efforts to re-establish sea otters in portions of their historical range, otters from Amchitka Island (part of the Aleutian Islands) and Prince William Sound were translocated to other areas outside the range of what we now recognize as the southwest Alaska distinct population segment, but within the range of *E. l. kenyoni* (Jameson 2002).

Sea otters generally occur in shallow water areas near the shoreline. They are most commonly observed within the 40 m (131 ft) depth contour (USFWS 2008a), although they can be found in waters up to 100 m (328 ft) deep. Most foraging dives take place in waters less than 30 m (98 ft) deep (Bodkin et al. 2004). As water depth is generally correlated with distance to shore, sea

otters typically inhabit waters within 1-2 km (0.62–1.24 miles) of shore (Riedman and Estes 1990). Much of the marine habitat of the sea otter in southwest Alaska is characterized by a rocky substrate. In these areas, sea otters typically are concentrated between the shoreline and the outer limit of the kelp canopy (Riedman and Estes 1990), but they also occur further seaward. Sea otters also inhabit marine environments that have soft sediment substrates, such as areas in Bristol Bay and the Kodiak archipelago. As communities of benthic invertebrates differ between rocky and soft sediment substrate areas, so do sea otter diets.

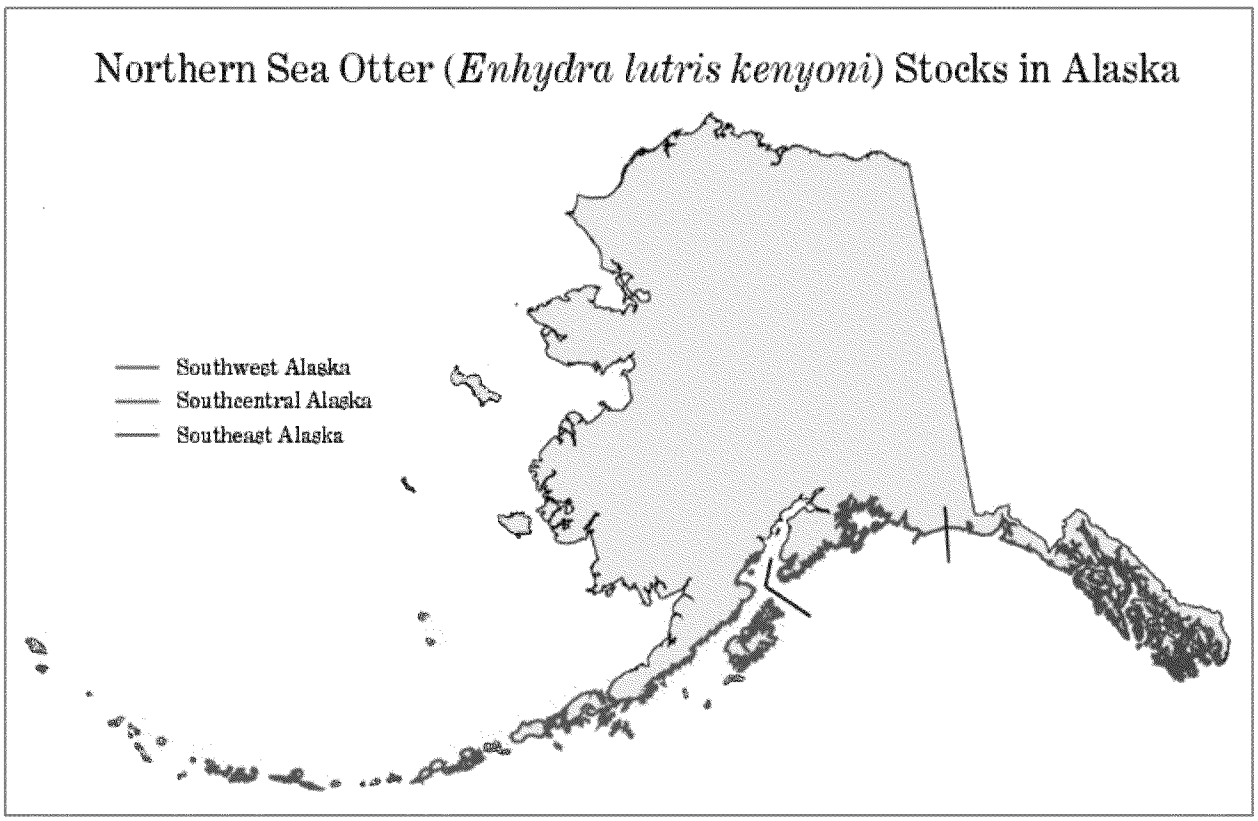


Figure A-20. Northern sea otter stocks in Alaska. [Top]

Population Trends

Historically, sea otters occurred throughout the coastal waters of the North Pacific Ocean from the northern Japanese archipelago around the North Pacific Rim to central Baja California. Between 1741 and 1911, sea otters were hunted to the brink of extinction by Russian and American fur hunters. Prior to commercial exploitation, the worldwide population of sea otters was estimated at 150,000 - 300,000 animals (Kenyon 1969; Johnson 1982).

Sea otters were protected from further commercial harvests under the International Fur Seal Treaty of 1911. At that time, only 13 small remnant populations were believed to have persisted. The total worldwide population may have been only 1,000 - 2,000 animals. Two of these remnant populations (Queen Charlotte Island and San Benito islands) declined to extinction (Kenyon 1969; Estes 1980). The remaining 11 populations began to grow in number, and

expanded to recolonize much of the former range. Six of these remnant populations (Rat Islands, Delarof Islands, False Pass, Sandman Reefs, Shumagin Islands, and Kodiak Island) were located within the bounds of the southwest Alaska DPS. Because of the remote, pristine nature of southwest Alaska, these remnant populations grew rapidly during the first 50 years following protection from further commercial hunting. The population in southwest Alaska had grown in numbers and re-colonized much of the former range by the mid- to late-1980s. At that time, numbers were believed to be around 92,800 - 126,900 in southwest Alaska.

Aleutian Islands

From the mid-1960s to the mid-1980s, otters expanded their range, and presumably their numbers as well, until they had recolonized all the major island groups in the Aleutians. Although the maximum size reached by the sea otter population is unknown, a habitat-based computer model estimates that the population in the late 1980s may have numbered approximately 74,000 individuals in the Aleutians (Burn et al. 2003). But in a 1992 aerial survey of the entire Aleutian archipelago, only 8,048 otters were counted (Evans et al. 1997); approximately 19% fewer than the total reported for a 1965 survey Kenyon (1969). In April 2000, 2,442 sea otters were counted; a 70% decline from the count eight years previous (Doroff et al. 2003). Along the more than 5,000 km (3,107 miles) of shoreline surveyed, sea otter density was at a uniformly low level, which clearly indicated that sea otter abundance had declined throughout the archipelago. Doroff et al. (2003) calculated that the decline occurred at an average rate of 17.5% per year throughout the Aleutians.

Alaska Peninsula

Remnant colonies along the Alaska Peninsula expanded through the 1950s and early 1960s, (Kenyon 1969). Schneider (1976) estimated 17,000 sea otters on the north side of the Alaska Peninsula in 1976 (Burn and Doroff 2005), which he believed to have been within the carrying capacity for that area. In 1986, an estimated 6,474–9,215 sea otters occupied this area (Burn and Doroff 2005). By May 2000, estimates had dropped 27–49% from 1986 (Burn and Doroff 2005). Declines were also occurring along the south side of the Alaska Peninsula between the mid-1960s and early 2000s (Kenyon 1969; Brueggeman et al. 1988; DeGange et al. 1995). Rates of decline as high as 93% were documented in some areas (Burn and Doroff 2005). Overall, the combined counts for the entire Alaska Peninsula have declined by 65–72% since the mid-1980s. The estimated number of sea otters along the Alaska Peninsula was 9,658 as of 2014.

Kamishak Bay, the Kodiak Archipelago and Cook Inlet

The eastern extent of the population decline of the1960s-1990s appears to occur at about Castle Cape. Populations around Kodiak, Katmai, Kamishak, and lower Cook Inlet are stable or increasing (Coletti et al. 2009, Estes et al. 2010). In 2002, Bodkin (2003) found sea otters to be relatively abundant within Kamishak Bay (6,918 otters). In 1994, there were an estimated 9,817 otters in the Kodiak archipelago (USFWS, unpublished data). An aerial survey of the Kodiak Archipelago conducted in 2004 resulted in an estimate of 11,005 sea otters (CV = 0.19; USFWS unpublished data).

Population trends in southwest Alaska changed during the period 2003 - 2011. Declines leveled off and average growth rates approached zero. Some variation was evident but the overall trends

were consistent among islands. These results suggest that population declines may have recently stabilized in the western Aleutian Islands, although there is still no evidence of recovery (USGS unpublished data, USFWS unpublished data).

Life History

Breeding Biology

There is variation in age of first reproduction, but generally, male sea otters appear to reach sexual maturity at 5–6 years of age and females reach sexual maturity at 3–4 years (Garshelis et al. 1984; von Biela et al. 2007). The interval between pups is typically one year. The presence of pups and fetuses at different stages of development throughout the year suggests that reproduction occurs at all times of the year. Most areas that have been studied show evidence of one or more seasonal peaks in pupping (Rotterman and Simon-Jackson 1988). Similar to other mustelids, sea otters can have delayed implantation of the blastocyst (developing embryo) (Sinha et al. 1966). As a result, pregnancy can have two phases: from fertilization to implantation, and from implantation to birth (Rotterman and Simon-Jackson 1988). The average time between copulation and birth is 6–7 months. Female sea otters typically will not mate while accompanied by a pup (Lensink 1962; Kenyon 1969; Garshelis et al. 1984).

Estimating the rate of recruitment of sea otters into a population is difficult primarily because of asynchronous pupping and an inability to reliably distinguish males from females and juveniles from adults externally. For long-lived species, we expect that survivorship of offspring is related to maternal age and experience, and that recruitment rate is more sensitive than survival rate to environmental fluctuations (Eberhardt 1977). The maximum life span of a wild sea otter is believed to be 23 years (Nowak 1999).

Movement Patterns

Sea otters in Alaska are non-migratory and generally do not disperse over long distances (USFWS 2008a). They usually remain within a few kilometers of their established feeding grounds (Kenyon, 1981); however they are capable of long distance travel. Translocated populations are known to shift and expand their distribution in favorable habitats, sometimes traversing distances up to 350 km (217 mi) over a relatively short period (Ralls et al. 1992; Jameson 2002). Juvenile males (1–2 years of age) are known to disperse up to 120 km (75 mi) from their natal (birth) area; young females traveled up to 38 km (23.6 mi) (Garshelis and Garshelis 1984; Monnett and Rotterman 1988; Riedman and Estes 1990). Routine movements between feeding and resting areas as large as 35 - 60 miles (57 - 97 km) have also been observed by VanBlaricom et al. (2001).

Once a population has become established and has reached equilibrium density within the habitat, the home ranges of sea otters are relatively small. Home range and movement patterns vary depending on the gender and breeding status. In the Aleutian Islands, breeding males remain for all or part of the year within the bounds of their breeding territory, which constitutes a length of coastline anywhere from 100 m (328 ft) to approximately 1 km (0.62 miles). Sexually mature females have home ranges of approximately 8–16 km (5–10 miles), which may include one or more male territories. Male sea otters that do not hold territories may move greater

distances between resting and foraging areas than territorial males (Lensink 1962; Kenyon 1969; Riedman and Estes 1990; Estes and Tinker 1996). Typical daily movement distances may exceed 3 km at rates of speed up to 5.5 km per hour (Garshelis and Garshelis 1984).

Sea otter movements are also influenced by local climatic conditions such as storm events, prevailing winds, and in some areas, tidal states. Sea otters tend to move to protected or sheltered waters (bays, inlets, or lees) during storm events or high winds. In calm weather conditions, sea otters may be encountered further from shore (Lensink 1962; Kenyon 1969). In the Commander Islands, Russia, weather, season, time of day, and human disturbance have been cited as factors that induce sea otter movement (Barabash-Nikiforov 1947; Barabash-Nikiforov et al. 1968).

Threats

Predation

Available information suggests that predation by killer whales (*Orcinus orca*) may be the most likely cause of the sea otter decline in the Aleutian Islands (Estes et al. 1998). Data that support this hypothesis include: 1) a significant increase in the number of killer whale attacks on sea otters during the 1990s (Hatfield et al. 1998); 2) the number of observed attacks fits expectations from computer models of killer whale energetics; 3) the scarcity of beach cast otter carcasses that would be expected if disease or starvation were occurring; 4) markedly lower mortality rates for sea otters in a sheltered lagoon (where killer whales cannot go) than for those in an adjacent exposed bay; and 5) documentation of elevated mortality rate as the cause of decline, rather than reduced fertility or redistribution (Laidre et al. 2006).

The hypothesis that killer whales may be the principal cause of the sea otter decline suggests that there may have been significant changes in predator-prey relationships in the Bering Sea ecosystem (Estes et al. 1998; Springer et al. 2003). For the past several decades, harbor seals (*Phoca vitulina*) and Steller sea lions *(Eumetopias jubatus)*, the preferred prey species of transient, marine mammal eating killer whales, have been in decline throughout the western North Pacific. In 1990, Steller sea lions were listed as threatened under the ESA (55 FR 49204). Estes et al. (1998) hypothesized that killer whales may have responded to declines in their preferred prey species, harbor seals and Steller sea lions, by broadening their prey base to include sea otters. Springer et al. (2003) suggest that modern industrial whaling led to declines in great whale populations in the North Pacific, which in turn resulted in killer whales "fishing down" the marine food web; first harbor seals, then fur seals (*Callorhinus ursinus*), sea lions, and finally sea otters in succession as preferred prey were depleted.

Subsistence Harvest

Subsistence harvest has reportedly removed fewer than 1,400 sea otters from the southwest Alaska DPS between 1989 and 2011 (average from 2006 - 2010 = 76 per year; range = 30 - 122 per year; USFWS unpublished data; USFWS 2014b). The majority of the subsistence harvest in southwest Alaska occurs in the Kodiak archipelago. Given the estimated population growth rate of 10% per year estimated for the Kodiak archipelago by Bodkin et al. (1999), we would expect that these harvest levels by themselves would not cause a population decline. Some of the largest

observed sea otter declines have occurred in areas where subsistence harvest is either nonexistent or extremely low. The best available scientific information does not indicate that subsistence harvest by Alaska Natives has had a major impact on the southwest Alaska DPS of the northern sea otter.

Interaction with Commercial Fisheries

Sea otters are sometimes taken incidentally in commercial set net, trawl, and finfish pot fisheries fishing operations (76 FR 73912). Entanglements of single animals have been reported from the Bering Sea, Bristol Bay, and PWS. In 1992, a total of eight sea otters were observed caught in the Pacific cod pot fishery in the Aleutian Islands (Perez 2006, 2007). In 2002, four incidents of entanglement with no mortality or serious injury were recorded in the Kodiak salmon set net fishery (Manly et al. 2003). Based on Kodiak fisheries data, coupled with self-reporting records from the Bering Sea and Aleutian Island ground fish trawl fishery, it is estimated that fewer than 10 sea otters per year might be killed or seriously injured as a result of entanglement with fishing gear (USFWS 2008b).

Development

Habitat destruction or modification is not known to be a major factor in the decline of the southwest Alaska DPS of the northern sea otter. Development of harbors and channels by dredging may affect sea otter habitat on a local scale by disturbing the sea floor and affecting benthic invertebrates that sea otters eat. As harbor and dredging projects typically impact an area of 50 hectares or less, the overall impact of these projects on sea otter habitat is considered to be negligible (USFWS 2008c). However, the cumulative effect of incremental, small losses of critical habitat may affect the population by removing or reducing the availability of PCEs. Between 2002 and 2014, section 7 consultation documented an estimated 20.24 hectares of habitat impacted (including both temporary and permanent impacts) and take by disturbance of 36 otters.

Research

Scientific research on sea otters occurs primarily as annual aerial and skiff surveys. When they occur, they last for very short durations of time. Other research includes capture and handling of individuals. During the 1990s, 198 otters were captured and released as part of health monitoring and radio telemetry studies at Adak and Amchitka. In the 2000s, 98 sea otters from the southwest Alaska DPS were live-captured and released as part of a multi-agency health monitoring study (USFWS 2005, 2008b). Accidental capture-related deaths have been rare, with research activities carefully monitored by the Division of Management Authority (DMA).

Disease

Parasitic infection was identified as a cause of increased mortality of sea otters at Amchitka Island in 1951 (Rausch 1953). These highly pathogenic infestations were apparently the result of sea otters foraging on fish, combined with a weakened body condition brought about by nutritional stress. More recently, sea otters have been impacted by parasitic infections resulting from the consumption of fish waste. Necropsies of carcasses recovered in Orca Inlet, Prince William Sound, revealed that some otters in these areas had developed parasitic infections and fish bone impactions that contributed to their deaths (Ballachey et al. 2002). Valvular

endocarditis and septicemia have been isolated as a major, proximate cause of sea otter deaths in Alaska (Goldstein et al. 2009). The majority of these deaths are ultimately related to exposure to and infection from *Streptococcus* bacteria.

Oil Spills

The effects of oil on sea otters include short-term acute oiling of fur, resulting in death from hypothermia, smothering, drowning, or ingestion of toxics during preening. While these acute effects are not disputed, a growing body of evidence suggests that oil also affects sea otters over the long term, with interactions between natural environmental stressors and the compromised health of animals exposed to oil lingering well beyond the acute mortality phase (Peterson et al. 2003). The myriad studies that have been undertaken since EVOS provide the most comprehensive data by which to evaluate the effects to wild populations of sea otters to long-term, low-level exposure to hydrocarbons (Bodkin et al. 2002; Stephensen et al. 2001), but documenting chronic effects of EVOS on sea otters has been difficult due to lack of appropriate controls combined with the natural variability among affected resources. Without experimental controls, correlation analysis is the best available inferential tool in assessing the impacts of unpredictable environmental perturbations.

Sublethal exposure compromises health, reproduction, and survival across generations (Bodkin et al. 2002). Sea otters consuming prey in habitats contaminated by residual oil have a high likelihood of encountering subsurface oil while excavating prey from sediments (Bodkin et al. 2002). Unlike vertebrates, invertebrates do not metabolize hydrocarbons; thus they accumulate hydrocarbon burdens in their tissues (Short and Harris 1996). Sea otters are, therefore, potentially exposed to residual oil through two pathways: physical contact with oil while digging for prey, and ingestion of contaminated prey.

Research has confirmed the persistent exposure of sea otters to residual oil in western PWS. Several authors reported higher levels of a biomarker (P450 1A), which indicates exposure to aromatic hydrocarbons in sea otters sampled from oiled areas of PWS compared to animals sampled from un-oiled areas (Ballachey et al. 2000a; Ballachey et al. 2000b; Bodkin et al. 2002). Chronic, persistent exposure to oil appears to cause reduced productivity and reduced survival of young (Mazet et al. 2001; Ballachey et al. 2003). A comparison of body lengths of sea otters that attained adulthood prior to the spill, relative to post-spill measurements, suggests that food resources were approximately equivalent before and after. These results imply that factors other than body condition are affecting pup survival in western Prince William Sound (Ballachey et al. 2003).

Trans-generational effects may arise from direct exposure to a mutagen such as petroleum hydrocarbons, and therefore may be realized long after the contaminant exposure has ceased (Bickham and Smolen 1994). Sea otters are long-lived, with relatively low annual reproductive rates and high annual adult survival; factors that result in reduced reproduction, increased mortality, or increased emigration will eventually lead to depressed population growth rates (Riedman and Estes 1990). Finally, exposure to pollutants such as crude oil may affect sea otters at a variety of levels of organization, beginning with somatic or germinal cell mutations and

leading to a cascade of alterations that go beyond the individual or community to threaten the long-term survival of the population (Bickham et al. 2000; Clements 2000).

Short-Tailed Albatross

Species Description

The short-tailed albatross is a large pelagic bird with long narrow wings adapted for soaring just above the water surface. It is classified within the family Diomedeidae, in the order of tube-nosed marine birds (Procellariiformes). Until recently, it had been assigned to the genus *Diomedea.* Following the results of genetic studies by Nunn et al. (1996), the family Diomedeidae was arranged in four genera. The genus *Phoebastria* (North Pacific albatrosses) now includes the short-tailed albatross, the Laysan albatross (*P. immutabilis*), the black-footed albatross (*P. nigripes*), and the waved albatross (*P. irrorata*) (AOU 1998).

Status and Distribution

The short-tailed albatross was federally listed as endangered throughout its range, including the United States, on July 31, 2000 (65 FR 147:46643). At the time of listing, designation of critical habitat was determined to be not prudent (65 FR 147:46651). Historically, the short-tailed albatross was probably the most abundant albatross in the North Pacific, with 14 known breeding colonies (Olson and Hearty 2003). However, from the late 1800's, millions were hunted for feathers, oil, and fertilizer (USFWS 2008), and by 1949 the species was thought to be extinct. The species began to recover during the 1950's and currently occurs throughout the North Pacific Ocean.

Current Population Status

Short-tailed albatross breed on remote islands in the North Pacific Ocean (Figure A-21). Torishima, a Japanese island that is an active volcano, is estimated to contain 80 - 85% of the existing breeding population in two main breeding colonies: Hatsunezaki and Tsubamezaki. The 2013 - 2014 population was 609 breeding pairs (or 1,218 breeding adults) (USFWS 2014). Assuming that 25% of breeding-age adults do not return to breed each year (H. Hasegawa, Toho University, pers. comm. *in* USFWS 2014), this would represent an adult population of 1,624 at Torishima at the start of the 2013 - 2014 nesting season.

The breeding colony in the Senkaku (or Diaoyutai) Islands is in disputed ownership among China, Japan, and Taiwan, and is politically difficult to access. As a result, this breeding population has not been surveyed since 2002. The estimates of the Senkaku population data are extrapolated from the 2002 data under the assumption that factors affecting population growth have remained similar to those observed on Torishima. Under this assumption, the total adult breeding population is estimated to be 220 in 2013 - 2014. Assuming that 25% of the adults do not return to breed each year, we estimate the population of breeding-age adults that potentially nest on the Senkaku Islands to be about 293 at the start of the 2013 - 2014 nesting season. Population estimates are calculated using a deterministic population model (P. Sievert, unpublished data, 2014).

In 2008, 10 chicks were translocated to a former colony site on Mukojima, a non-volcanic island, south of Torishima in the hope of re-establishing a colony on this island. All chicks in this group survived to fledging. From 2009 through 2012, an additional 15 chicks per year have been moved to Mukojima and reared to fledging. All but one of the 70 chicks fledged successfully. The relocation effort may be attracting additional breeding adults to this island; an egg was laid by a pair in 2012 and again in 2013.

In the Northwestern Hawaiian Islands, one pair was breeding at Midway Atoll (having fledged a chick in 2011, 2012, and 2014) and another suspected female-female pair has been attempting to breed at Kure Atoll since 2010. The hatching in 2011 marked the first confirmed hatching of a short-tailed albatross outside of the islands surrounding Japan in recorded history. Prior to that, observations of infertile short-tailed albatross eggs and reports from the 1930's suggested that short-tailed albatross may have nested on Midway Atoll in the past.

As of 2013 - 2014, there were also two breeding sites with one pair each in the Ogasawara (Bonin) Islands and on Nakodo-jima near Mukojima. The total population estimate for breeding age short-tailed albatrosses as of the 2013 - 2014 nesting season is 1,928 individuals. Assuming that adults comprise 50% of the total population of short-tailed albatross (based on the age structure of the Torishima population), we estimate the total population at the end of the 2013 - 2014 breeding season to include 472 fledglings, and 55 chicks for a total population of 4,354 individuals. The population growth rate is determined by annual increases in eggs laid (by breeding pairs) at Torishima. The 3-year running average population growth rate since 2000 is estimated to be 7.5% and ranges from 5.2 - 9.4% (USFWS 2014a).

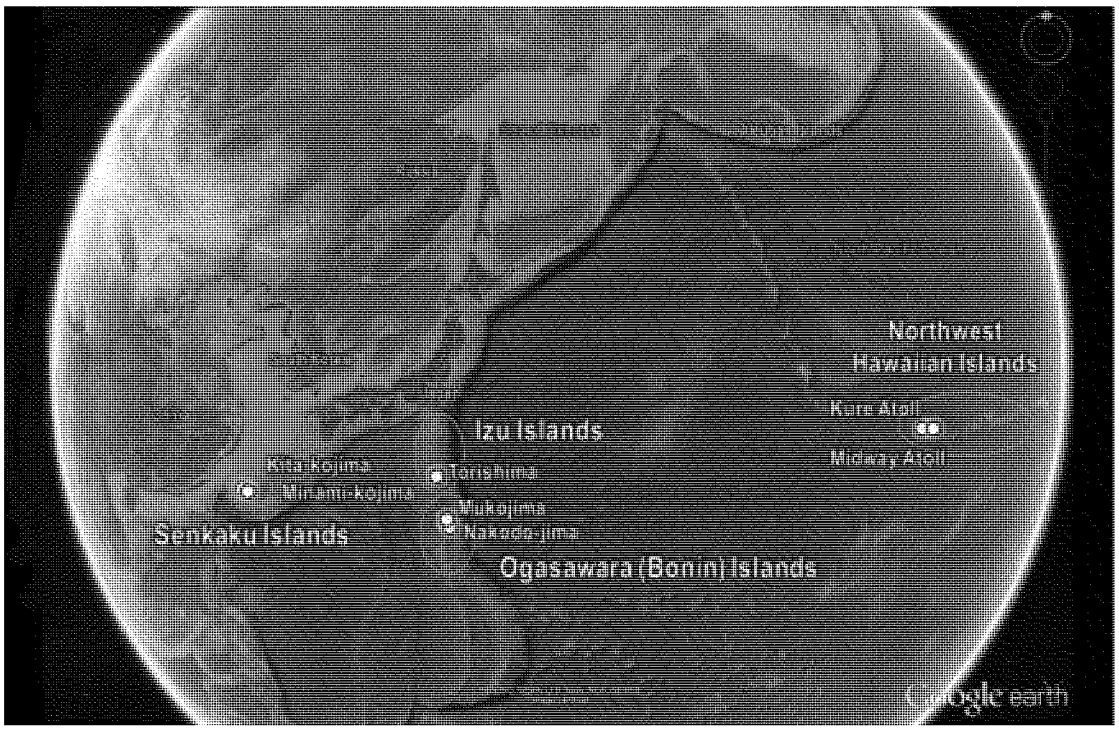


Figure A-21. Short-tailed albatross breeding locations in the North Pacific. Specific islands and their island groups are indicated. [Top]

Distribution

Juveniles and younger sub-adult birds (up to two years old) have a wider range than adults and can be found in the Sea of Okhotsk, a broader region of the Bering Sea, and the west coast of North America (O'Connor 2013; Figure A-22). Sub-adult birds also travel greater daily distances (mean = 191 km/day [119 mi/day] in first year of flight, 181 km/day [112 mi/day] in second year of flight; O'Connor 2013) than adults (133 km/day [83 mi/day]; Suryan et al. 2007). Post-fledging juvenile birds ranged widely throughout the North Pacific rim, and some individuals also spent time in the oceanic waters between Hawaii and Alaska (Deguchi et al. 2014). Although the highest concentrations of short-tailed albatross are found in the Aleutian Islands and Bering Sea (primarily outer shelf) regions of Alaska, subadults appear to be distributed along the west coast of the U.S. more than has been previously reported (Guy et al. 2013).

Life History

The short-tailed albatross is a colonial, annual breeding species; each breeding cycle lasts about eight months. Birds may breed at five years of age, but first year of breeding is more commonly at age six (H. Hasegawa, Toho University, pers. comm. *in* USFWS 2014). Short-tailed albatross are monogamous and highly philopatric to nesting areas (they return to the same breeding site year after year). However, young birds may occasionally disperse from their natal colonies to attempt to breed elsewhere, as evidenced by the appearance of adult birds on Midway Atoll that were banded as chicks on Torishima (Richardson 1994).

Birds arrive on Torishima in October, but as many as 25% of breeding age adults may not return to the colony in a given year (H. Hasegawa, Toho University, pers. comm. *in* USFWS 2014). A single egg is laid in late October to late November, and is not replaced if destroyed (Austin 1949). Bi-parental incubation lasts 64 - 65 days. Parents alternate foraging trips that may last 2 - 3 weeks while taking turns at incubating. When one bird is foraging, the other stays on the nest without eating or drinking for up to 24 days (Fumio Sato, Yamashina Institute, pers. comm. *in* USFWS 2014).

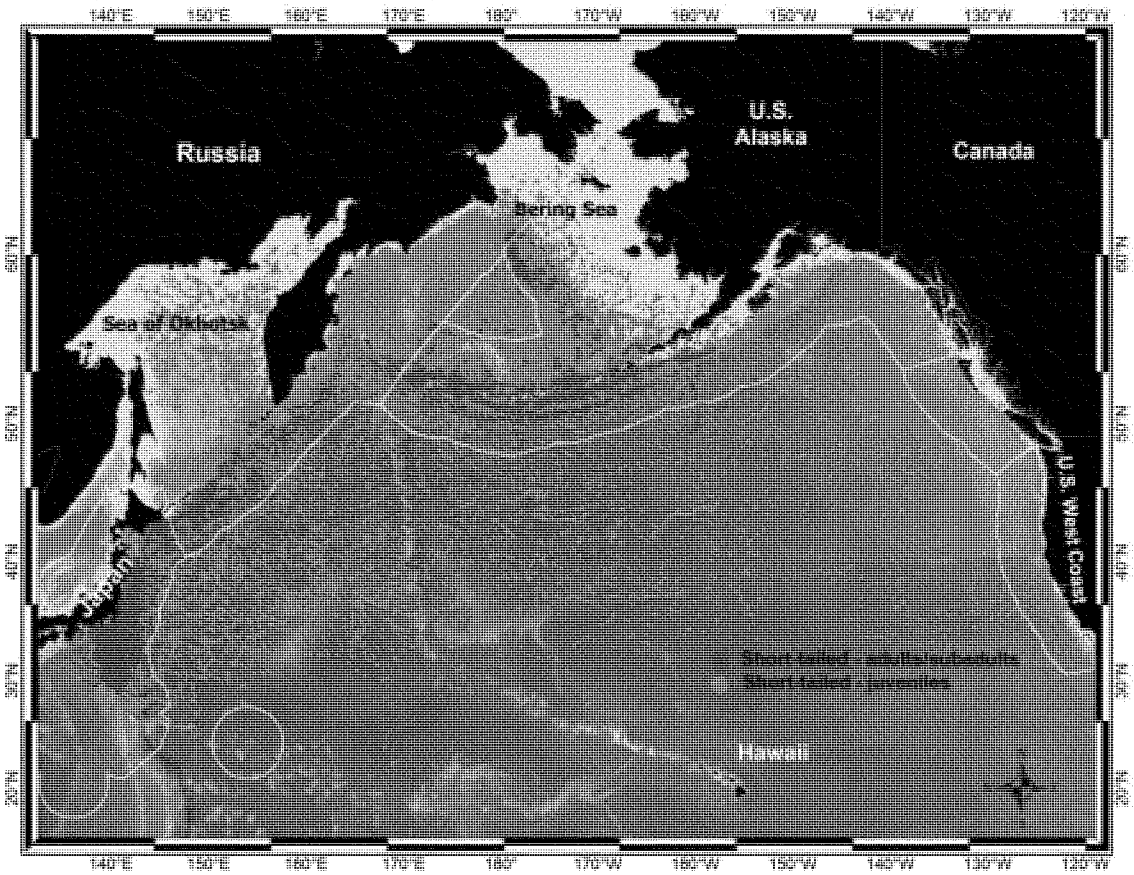


Figure A-22. Locations of 99 short-tailed albatrosses tracked between 2002 - 2012, showing adult and juvenile distributions in the North Pacific (Suryan et al. 2006, 2007, 2008, Suryan and Fischer 2010, Deguchi et al. 2014). White lines represent the exclusive economic zones of countries within the range of short-tailed albatrosses. [Top]

Hatching occurs from late December through January (Hasegawa and DeGange 1982). For the first few days after hatching the chick is fed on stomach oil that is very rich in calories and Vitamin A. This oil also provides a source of water once metabolized, which is important when chicks may be left for several days in high temperatures on dry islands. Soon after hatching, the chicks are fed more solid food, such as squid and flying fish eggs. During the first few weeks after hatching, one adult broods the chick and the other forages at sea. Later, when the chick can regulate its body temperature, both parents leave their chick, while they forage simultaneously. During the brood-rearing period, most foraging bouts are along the eastern coastal waters of Honshu Island, Japan (Suryan et al. 2008).

Chicks begin to fledge in late May into June (Austin 1949). By late May or early June, the chicks are almost fully grown, and the adults begin abandoning the colony site (Hasegawa and DeGange 1982, Suryan et al. 2008). The chicks fledge soon after the adults leave the colony. By mid-July, the breeding colony is empty (Austin 1949). Non-breeders and failed breeders disperse earlier from the breeding colony, during late winter through spring (Hasegawa and DeGange 1982). In summer (the nonbreeding season), short-tailed albatross disperse widely throughout the temperate and subarctic North Pacific Ocean (Sanger 1972; Suryan et al. 2007).

Foraging Ecology and Diet

The diet of short-tailed albatross is not well-known, but observations of food brought to nestlings and of regurgitated material (Austin 1949), as well as at-sea observations during feeding indicate that the diet includes squid, shrimp, fish (including bonitos [*Sarda sp.*], flying fishes [Exocoetidae] and sardines [Clupeidae]), flying fish eggs, and other crustaceans (Tickell 1975; Hasegawa and DeGange 1982; Tickell 2000). This species has also been reported to scavenge discarded marine mammals and blubber from whaling vessels, and they readily scavenge fisheries offal (Hasegawa and Degange 1982). Short-tailed albatross forage diurnally and possibly nocturnally (Hasegawa and Degange 1982), either singly or in groups (occasionally in the 100's) (Piatt et al. 2006) predominantly taking prey by surface-seizing (Piatt et al. 2006; Prince and Morgan 1987; Duke University 2008).

In an analysis of historic and current distribution of North Pacific albatrosses, Kuletz et al. (2014) speculated that the increase in albatrosses (including short-tailed albatross) and changes in their distribution over the last decade was due to possible increases in squid biomass in the Bering Sea/Aleutian Islands region. Overall the much higher abundance of albatrosses in the Aleutians compared to the Bering Sea mirrored the relative density of squid, which is estimated to be approximately seven times higher in the Aleutians (Ormseth 2012).

Threats

Habitat Alteration and Loss

Habitat destruction from volcanic eruption continues to pose a significant threat to short-tailed albatross at the primary breeding colony on Torishima (USFWS 2014). The main colony site, Tsubamezaki, is on a sparsely vegetated steep slope of loose volcanic soil that is subject to severe erosion, particularly during monsoon rains. A landslide at Tsubamezaki buried up to 10 chicks in February 2010 (Yamashina Institute for Ornithology, unpublished data). Future eruptions or landslides could result in a significant loss to the primary nesting area and the population as a whole.

Global Changes

Climate change impacts to short-tailed albatrosses could include changes to nesting habitat or changes to prey abundance or distribution. Fortunately, the nesting habitats on Torishima, the Ogasawara Islands, and the Senkaku Islands are high enough above sea level (above 20 m [70 ft]) to avoid inundation by projected sea level rise. Models for the Northwestern Hawaiian Islands indicate nesting habitat used by short-tailed albatrosses on low-lying Midway and Kure

Atolls is likely to be lost by the end of the century due to sea level rise and increased storm frequency and intensity (Storlazzi et al. 2013).

Sea-ice retreat in the Arctic (see "Habitat or Ecosystem Conditions") may potentially open new foraging habitat or provide a new migration corridor between the Pacific and Atlantic Oceans. A juvenile short-tailed albatross was recently sighted in the Arctic (Chukchi Sea) and evidence from other species (e.g., northern gannet [*Morus bassanus*], ancient murrelet [*Synthliboramphus antiquus*]) indicates some bird species might use ice free portions of the Arctic as a migration or population dispersion route (Gall et al. 2013). The alteration of ice, prey, and seabird distribution is expected to continue, but how these changes will affect short-tailed albatrosses is unknown.

Commercial Fishing

Since 2009, five short-tailed albatross mortalities associated with commercial fisheries have been reported, three in the Alaskan cod fishery one in the Pacific Coast groundfish fishery, and one during bycatch mitigation research in Japan (Table A-12).

Table A-12. Known short-tailed albatross mortalities associated with North Pacific and west coast fishing activities since 1983. Data from USFWS unpublished data and Kiyoaki Ozaki, Yamashina institute, pers. comm. in USFWS 2014).

Date	Fishery	Observer program	Bird age	Location	Source
7/15/1983	Net	No	4 mos	Bering Sea	USFWS (2008)
10/1/1987	Halibut	No	6 mos	Gulf of Alaska	USFWS (2008)
8/28/1995	IFQ sablefish	Yes	1 yr	Aleutian Islands	USFWS (2008)
10/8/1995	IFQ sablefish	Yes	3 yrs	Bering Sea	USFWS (2008)
9/27/1996	Hook-and-line	Yes	5 yrs	Bering Sea	USFWS (2008)
4/23/1998	Russian salmon drift net	n/a	Hatch-yr	Bering Sea, Russia	USFWS (2008)
9/21/1998	Pacific cod hook-and-line	Yes	8 yrs	Bering Sea	USFWS (2008)
9/28/1998	Pacific cod hook-and-line	Yes	Sub-adult	Bering Sea	USFWS (2008)
7/11/2002	Russian, unknown	n/a	3 mos	Sea of Okhotsk, Russia	Yamashina Institute of Ornithology (YIO 2011)
8/29/2003	Russian demersal longline	n/a	3 yrs	Bering Sea, Russia	YIO (2011)
8/31/2006	Russian, unknown	n/a	1 yr	Kuril Islands, Russia	YIO (2011)
8/27/2010	Cod freezer longline	Yes	7-yr old	Bering Sea/Aleutian Islands	NOAA (2010)
9/14/2010	Cod freezer longline	Yes	3-yr old	Bering Sea/Aleutian Islands	NOAA (2010)
4/11/2011	Sablefish demersal longline	Yes	1-yr old	Pacific Ocean/Oregon	USFWS (2012)
10/25/2011	Cod freezer longline	Yes	1-yr old	Bering Sea	NOAA (2011)
5/24/2013	Longline, seabird bycatch mitigation research	No	1-yr old	Pacific Ocean, Japan	YIO (2014)

[Top]

Domestic and international efforts have been ongoing to minimize fisheries impacts on short-tailed albatross. Threats have been reduced in some areas through the establishment or improvement of regulations to minimize seabird bycatch, including within the U.S. Pacific Coast groundfish fishery and in the longline tuna fishery in Japan (USFWS 2012a, Fisheries Agency of Japan 2009). Even with regulatory measures to minimize impacts on short-tailed albatross (including required use of long-line deterrent devices [streamers or tori lines] and implementation of observer programs), bycatch and other injury and mortality associated with

fisheries in the North Pacific remain a concern, and the magnitude of the ongoing impacts is uncertain.

Commercial fishing in Russia
Russian longline cod fisheries implemented experimental use of streamers in 2004 - 2008 (Artukhin et al. 2013). The frequency of reported seabird attacks was 5 - 9 times lower on boats with paired streamers, and total catch of fish was 4 - 12% higher. The study recommended wide application of streamer line in the Far Eastern Seas of Russia. Although consistent funding has been a problem, the World Wildlife Fund has continued to work with Russian partners to educate the Russian commercial fishing communities about the benefits of using streamer lines and promote their use to reduce seabird bycatch and improve fishing success (World Wildlife Fund 2014).

Commercial Fishing in Japan
Japan developed a National Plan of Action for seabird conservation and management (Fisheries Agency of Japan 2004, 2009). In areas where short-tailed albatrosses occur (north of 23°N latitude), vessels must employ two of the following measures, one of which must be from the first four listed, and streamer lines are obligatory within 32 km (20 mi) of Torishima in October through May: side setting with a bird curtain and weighted branch lines, night setting with minimum deck lighting, streamer (tori) lines, weighted branch lines, blue-dyed bait, deep setting line shooter, and/or management of offal discharge. Japan has also implemented an observer program on their longline and purse seine fisheries to observe bycatch of non-target species, including seabirds (Uosaki et al. 2013, 2014). The only observed seabirds incidentally caught north of the 23°N latitude were a black-footed albatross in 2012 and an unidentified petrel in 2013 (Uosaki et al. 2013, 2014). However, only a small percentage of deployed hooks are observed.

Japanese fishermen pioneered the use of streamer (tori) lines to deter seabirds, and researchers have continued to assess their use. Researchers have continued to examine methods to improve the effectiveness of streamer lines, Yokota et al. (2011), Sato et al. (2012) assessed types and lengths of streamers for their effectiveness and found that lighter lines with shorter streamers are as effective as those with long streamers, although the shorter lines are thought to be safer and less likely to tangle. Sato et al. (2013) further examined the use of paired versus single streamer lines and determined that paired lines were more effective than single lines in reducing bait attacks and seabird mortality. The continuing research by Japan has been an important contribution to minimizing longline fisheries bycatch of short-tailed albatrosses.

Driftnet Fishing in the North Pacific
United Nations General Assembly Resolutions 44/225, 45/197, and 46/215 (United Nations 1989, 1990, 1991) called for a global driftnet moratorium on the high seas by June 30, 1992, and the resolution has been re-adopted biennially. NMFS and the State Department work to implement the moratorium for the U.S. According to NMFS (2013), high seas driftnet fishing continues to occur in the North Pacific Ocean. The fishing effort targets species of squid and occurs toward the end of the fishing season. Both of these factors increase the threat to short-

tailed albatrosses. While the numbers of sightings and apprehensions of vessels driftnetting in the North Pacific high seas appear to be decreasing, non-compliance with the moratorium continues to pose a risk of mortality to short-tailed albatrosses entangled in nets.

Canadian fishing Operations
Off Canada's west coast, deployment of seabird avoidance gear has been mandatory for all hook and line groundfish fisheries since 2002 - 2005. Most bycatch monitoring in these fisheries is done by on-board Electronic Monitoring Systems. Following each fishing trip, approximately 10% of the imagery is audited. Although there have been no reported takes of short-tailed albatross bycatch in the groundfish fisheries, in a recent examination of imagery collected between 2006 and 2012, 79 albatrosses were detected; a third of which were identified only as "albatross species". Based on the proportions of sets audited, an estimated 120 albatrosses were predicted to have been caught each year (range 0 - 269). Given the high proportion of albatrosses that are not identified to species and the fact that more than a third of all birds detected during the audits were listed as "unidentified bird", one might expect that one or two short-tailed albatrosses are killed each year in Canadian west coast groundfish longline fisheries (COSEWIC 2014).

Contaminants
Radiation
Approximately 80% of the radiation released from the Fukushima Daiichi Nuclear Plant, which was damaged by a March 11, 2011 earthquake and tsunami, was believed to have entered the Pacific Ocean (Tanabe and Subramanian 2011; Steinhauser et al. 2013, 2014). The area east of the plant is a primary feeding area for nesting short-tailed albatrosses. Although recent analysis has shown no detectable levels of radiation in short-tailed albatross, the impact of these continuing releases on short-tailed albatrosses or their food resources is unknown.

Organochlorines, pesticides and metals
Albatross and other birds may be exposed to organochlorine contaminants such as polychlorinated biphenyls (PCBs) and pesticides, and to toxic metals (e.g., mercury, lead) via atmospheric and oceanic transport. Vo et al. (2011) examined mercury and methylmercury in tissues of black-footed albatross. They compared the levels of mercury and methylmercury in museum specimens (n = 25) from a 120-year collection period (1880 - 2002). They found no temporal trend in mercury concentrations, but measured significantly higher concentrations of methylmercury through time. Finkelstein et al. (2007) found mercury concentrations in black-footed albatross were associated with decreased immune response. Similar effects would be expected for short-tailed albatross.

High concentrations of lead at Midway Atoll are a concern. Taylor et al. (2009) described neurological impacts of lead-based paints on Laysan albatross chicks. Since then, the Service has initiated removal and remediation of lead-based paint and contaminated soils on Sand Island (USFWS 2010). Although only one pair has successfully nested on Midway at Eastern Island, this remediation will reduce exposure to any offspring or future nesting birds on Sand Island. The degree to which any of these or other toxins impact short-tailed albatross remains uncertain,

and further research is needed to examine the prevalence of these contaminants in short-tailed albatrosses and their impact on the population.

Plastics

Plastics have been found in most, if not all, species of albatross. Both black-footed and Laysan albatross are well known to ingest plastics in the course of foraging. Lavers and Bond (in review) have recently examined the role of plastic as a vector for trace metals in Laysan albatrosses. Lavers et al. (2014) studied sub-lethal effects of plastic ingestion in flesh-footed shearwaters (*Puffinus carneipes*) and found birds with high levels of ingested plastic exhibited reduced body condition and increased contaminant load ($p < 0.05$) (Lavers et al. 2014). Tanaka et al. (2013) analyzed polybrominated dephenyl ethers in the abdominal adipose of short-tailed shearwaters (*Puffinus tenuirostris*). Some of the birds were found to contain higher-brominated constituents (BDE209 and BDE 183), which were not present in their pelagic fish prey. These same birds were found to contain plastics in their stomach. Plastic ingestion is therefore not only a direct dietary risk but may contribute to chronic accumulation of contaminants that adhere to and are absorbed by plastics.

Polar Bear

Species Description

Polar bears are carnivorous, and a top predator of the Arctic marine ecosystem. The polar bear is usually considered a marine mammal since its primary habitat is the sea-ice (Amstrup 2003), and it is evolutionarily adapted to life on sea-ice. Polar bears are the largest of the living bear species (DeMaster and Stirling 1981; Stirling and Derocher 1990). They are characterized by large body size, a stocky form, and fur color that varies from white to yellow. They are sexually dimorphic; females weigh 181 - 317 kilograms (kg) (400 - 700 pounds (lbs)), and males up to 654 kg (1,440 lbs).

Status and Distribution

Due to threats to its sea-ice habitat, on May 15, 2008 the Service listed the polar bear as threatened (73 FR 28212) throughout its range under the ESA. In the U.S., the polar bear is also protected under the MMPA and the Convention on International Trade in Endangered Species of Wildlife Fauna and Flora (CITES) of 1973.

Polar bears are widely distributed throughout the Arctic where the sea is ice-covered for large portions of the year (Figure A-23). The number of polar bears is estimated to be 20,000 - 25,000 with 19 recognized management subpopulations or "stocks" (Obbard et al. 2010). The International Union for Conservation of Nature and Natural Resources, Species Survival Commission (IUCN/SSC) Polar Bear Specialist Group (PBSG) ranked nine stocks as data deficient, six as stable, three as declining, and one as increasing (IUCN/PBSG 2015). The status designation of "data deficient" for nine stocks indicates that the estimate of the worldwide polar bear population was made with known uncertainty. The population estimate for the Southern Beaufort stock is 907 whereas the population within the Chukchi Sea population is unknown (IUCN/PBSG 2015).

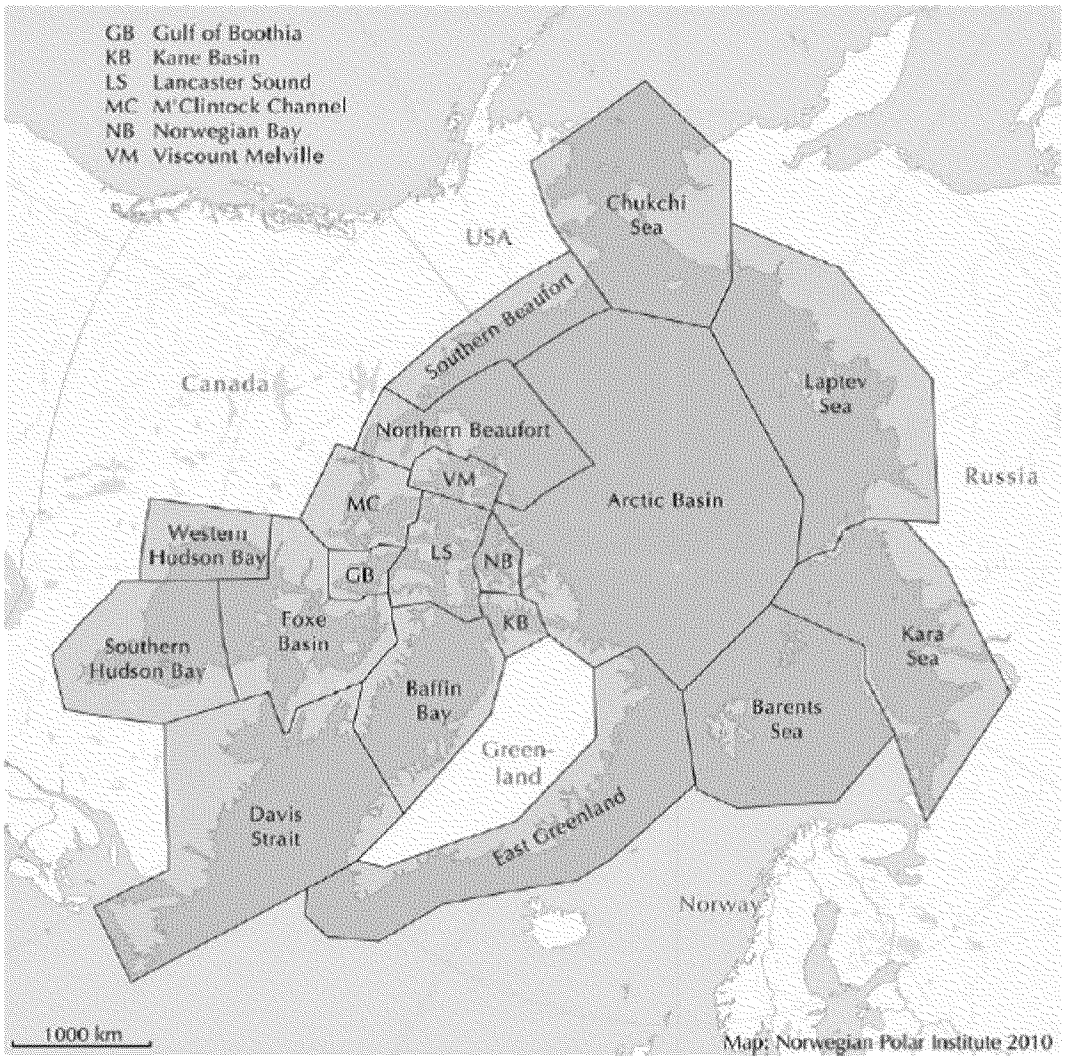


Figure A-23. Distribution of polar bear stocks throughout the circumpolar basin (from Obbard et al. 2010). [Top]

Life History

Breeding Biology

Polar bears are characterized by a late age of sexual maturity, small litter sizes, and extended parental investment in raising young, factors that combine to contribute to a very low reproductive rate (Schliebe et al. 2006). Females may give birth for the first time at age four to six depending on local conditions such as seal abundance (Schliebe et al. 2006), and litters per female varies from 0.25 to 0.45 per adult female (Schliebe et al. 2006). Likewise, litter size and production rate vary geographically with hunting pressure, environmental factors and other population perturbations. Two-cub litters are most common (Schliebe et al. 2006). Body weights of mothers and their cubs decreased markedly in the mid-1970s in the Beaufort Sea

following a decline in ringed (*Phoca hispida*) and bearded (*Erignathus barbatus*) seal pup production (Stirling et al. 1977; Kingsley 1979; DeMaster et al. 1980; Amstrup et al. 1986). Declines in reproductive parameters varied by region and year with the severity of ice conditions and corresponding reduction in numbers and productivity of seals (Amstrup et al. 1986).

Most stocks use terrestrial habitat partially or exclusively for maternity denning; therefore, females must adjust their movements to access land at the appropriate time (Stirling 1988; Derocher et al. 2004). Most pregnant female polar bears excavate dens in the fall-early winter period (Harington 1968; Lentfer and Hensel 1980; Ramsay and Stirling 1990). The only known exceptions are in Western and Southern Hudson Bay where polar bears excavate earthen dens and later reposition into adjacent snow drifts (Jonkel et al. 1972, Richardson et al. 2005), and in the southern Beaufort Sea where a portion of the population dens in snow caves on sea-ice (Schliebe et al. 2006). Polar bears give birth in the dens during midwinter (Kostyan 1954; Harington 1968). Family groups emerge from dens in March and April when cubs are approximately three months old (Schliebe et al. 2006).

Foraging Ecology and Diet

Ringed seals (*Phoca hispida*) are polar bear's primary food source, and, to a lesser extent, bearded seals (*Erignathus barbatus)*, but bears they may occasionally consume other marine mammals such as walruses (*Odobenus rosmarus*), narwhal (*Monodon monoceros*), and belugas (*Delphinapterus leucas*) (Kiliaan and Stirling 1978; Smith 1980; Smith 1985; Lowry et al. 1987). On average, an adult polar bear needs approximately 2 kg (4.4 lbs) of seal fat per day to survive (Best 1985). Sufficient nutrition is critical and may be obtained and stored as fat when prey is abundant (Smith and Sjare 1990). Bowhead whale carcasses have been available as a food source on the North Slope since the early 1970s and may affect local polar bear distributions.

Record numbers of polar bears were observed in 2012 in the vicinity of the bowhead whale carcass "bonepile" on Barter Island; the USFWS observed a minimum, maximum, and average of 24, 80, and 52 bears, respectively (USFWS 2012). Barter Island (near Kaktovik) has had the highest recorded concentration of polar bears on shore (17.0 ± 6.0 polar bears/100 km) followed by Barrow (2.2 ± 1.8) and Cross Island (2.0 ± 1.8) (Schliebe et al. 2008). The high number of bears on/near Barter Island compared to other areas is thought to be due in part to the proximity to the ice edge and high ringed seal densities (Schliebe et al. 2008); the whale harvest at Kaktovik is lower than that at Barrow or Cross Island. The use of whale carcasses as a food source likely varies among individuals and years. Stable isotope analysis of polar bears in 2003 and 2004 suggested that bowhead whale carcasses comprised 11%-26% (95% CI) of the diets of sampled polar bears in 2003, and 0-14% (95% CI) in 2004 (Bentzen et al. 2007). Because polar bears depend on sea-ice to hunt seals, and temporal and spatial availability of sea-ice will likely decline, polar bear use of whale carcasses may increase.

Movement Patterns

Over most of their range, polar bears remain on the sea-ice year-round or spend only short periods on land. Sea-ice provides a platform for hunting and feeding, seeking mates and breeding, denning, resting, and long-distance movements. Areas near ice edges, leads, or polynyas where ocean depth is minimal are the most productive hunting grounds (Durner et al.

2004). However, some polar bear populations occur in seasonally ice-free environs and use land habitats for varying portions of the year. In the Chukchi Sea and Beaufort Sea areas of Alaska and northwestern Canada, for example, less than 10% of the polar bear locations obtained via radio telemetry were on land (Amstrup 2000; Amstrup, USGS, unpublished data); the majority of land locations were maternal dens during the winter. A similar pattern was found in East Greenland (Wiig et al. 2003). In the absence of ice during the summer season, some populations of polar bears in eastern Canada and Hudson Bay remain on land for extended periods of time until ice forms providing a platform for them to move to sea. Similarly, in the Barents Sea, a portion of the population spends greater amounts of time on land.

Although polar bears are generally limited to areas where the sea is ice-covered for much of the year, they are not evenly distributed throughout their range on sea-ice. They show a preference for certain sea-ice characteristics, concentrations, and specific sea-ice features (Stirling et al. 1993; Mauritzen et al. 2001; Durner et al. 2004). Sea-ice habitat quality varies temporally as well as geographically (Amstrup et al. 2000). Polar bears show a preference for sea-ice located over and near the continental shelf (Derocher et al. 2004; Durner et al. 2004), likely due to higher biological productivity in these areas (Dunton et al. 2005) and greater accessibility to prey in nearshore shear zones and polynyas (areas of open sea surrounded by ice) compared to deep-water regions in the central polar basin (Stirling 1997). Bears are most abundant near the shore in shallow-water areas, and also in other areas where currents and ocean upwelling increase marine productivity and serve to keep the ice cover from becoming too consolidated in winter (Amstrup and Demaster 1988; Amstrup et al. 2000).

Polar bear distribution in most areas varies seasonally with the seasonal extent of sea-ice cover and availability of prey. In Alaska in the winter, sea-ice may extend 400 km (248 mi) south of the Bering Strait, and polar bears will extend their range to the southernmost proximity of the ice (Ray 1971). Sea-ice disappears from the Bering Sea and is greatly reduced in the Chukchi Sea in the summer, and polar bears occupying these areas move as much as 1,000 km (621 mi) to stay with the pack ice (Garner et al. 1990; Garner et al. 1994). Significant northerly and southerly movements of polar bears appear to depend on seasonal melting and refreezing of ice (Amstrup 2000). In other areas, for example, when the sea-ice melts in Hudson Bay, James Bay, Davis Strait, Baffin Bay, and some portions of the Barents Sea, polar bears remain on land for up to four or five months while they wait for winter and new ice to form (Schweinsburg 1979; Prevett and Kolenosky 1982; Schweinsburg and Lee 1982; Ferguson et al. 1997).

In areas where sea-ice cover is seasonally dynamic, a large multi-year home range, of which only a portion may be used in any one season or year, is an important part of the polar bear life history strategy. In other regions, where ice is less dynamic, home ranges are smaller and less variable (Ferguson et al. 2001). Data from telemetry studies of adult female polar bears show that they do not wander aimlessly on the ice, nor are they carried passively with the ocean currents as previously thought (Pedersen 1945 cited in Amstrup 2003). Results show strong fidelity to activity areas that are used over multiple years (Ferguson et al. 1997). All areas within an activity area are not used each year.

Threats

Climate Change

Loss of sea-ice habitat due to climate change is identified as the primary threat to polar bears (Schliebe et al. 2006; 73 FR 28212; Obbard et al. 2010). Warming-induced habitat degradation and loss are negatively affecting some polar bear stocks, and unabated global warming will ultimately reduce the worldwide polar bear population (Obbard et al. 2010). Arctic summer sea-ice reached its lowest average extent in 2012 and has declined 13% per decade since 1979 (NSIDC 2012; Figure A-29). The loss rate of ice thickness is increasing (Haas et al. 2010), and trends in arctic sea-ice extent are declining (-12.2% and -13.5% per decade, respectively; Comiso 2012).

Declines in sea-ice are more pronounced in summer than winter (NSIDC 2011a, b). Positive feedback systems (i.e., sea-ice albedo) and naturally-occurring events such as warm water intrusion into the arctic and changing atmospheric wind patterns can cause fragmentation of sea-ice, reduction in the extent and area of sea-ice in all seasons, retraction of sea-ice away from productive continental shelf areas throughout the polar basin, reduction of the amount of heavier and more stable multi-year ice, and declining thickness and quality of shore-fast ice (Parkinson et al. 1999; Rothrock et al. 1999; Comiso 2003; Fowler et al. 2004; Lindsay and Zhang 2005, Holland et al. 2006; Comiso 2006; Stroeve et al. 2008). These climatic phenomena may affect seal abundances, the polar bear's main food source (Kingsley 1979; DeMaster et al. 1980; Amstrup et al. 1986; Stirling 2002). Patterns of increased temperatures, earlier spring thaw, later fall freeze-up, increased rain-on-snow events (which can cause dens to collapse), and potential reductions in snowfall are also occurring. As stated above, the polar bear depends on sea-ice for its survival, and loss of sea-ice due to climate change is its largest threat worldwide. However, threats to polar bears will likely occur at different rates and times across their range, and uncertainty regarding their prediction makes management difficult (Obbard et al. 2010).

Natural sources of mortality among polar bears are not well understood (Amstrup 2003). Polar bears are longlived (up to 30 years in captivity); have no natural predators, except other polar bears; and do not appear prone to death by diseases or parasites (Amstrup 2003). Accidents and injuries incurred in the dynamic and harsh sea-ice environment, injuries incurred while fighting other bears, starvation (usually during extreme youth or old age), freezing (also more common during extreme youth or old age), and drowning are all known natural causes of polar bear mortality (Amstrup 2003). Cannibalism by adult males on cubs and other adult bears is also known to occur; however, it is not thought that this is a common or significant cause of mortality. After natural causes and old age, the most significant source of polar bear mortality is from humans hunting polar bears (Amstrup 2003).

Subsistence Hunting

The largest human-caused loss of polar bears is from subsistence hunting of the species, but for most subpopulations where subsistence hunting of polar bears occurs, it is a regulated and/or monitored activity (Obbard et al. 2010). Polar bears historically have been, and continue to be, an important renewable resource for coastal communities throughout the Arctic (Amstrup and DeMaster 1988; Schliebe et al. 2006). Prior to the 1950s, most hunting was by indigenous people for subsistence purposes. Increased sport hunting in the 1950s and 1960s resulted in

population declines (Prestrud and Sterling 1994). International concern about the status of polar bears resulted in biologists from the five polar bear range nations forming the PBSG within the IUCN. The PBSG was largely responsible for the development and ratification of the 1973 International Agreement on the Conservation of Polar Bears (1973 Polar Bear Agreement) (Prestrud and Sterling 1994). The 1973 Polar Bear Agreement and the actions of the member nations are credited with the recovery of polar bears following the previous period of overexploitation.

The various polar bear subpopulations face different levels of subsistence harvest pressure; some level of hunting is permitted in the U.S., Canada, Greenland, and recently, in the Russian Federation as well. Five populations (including four that are hunted) have no estimate of potential risk from overharvest, since adequate demographic information necessary to conduct a population viability analysis and risk assessment are not available. The Chukchi Sea, Baffin Bay, Kane Basin, and Western Hudson Bay populations may be overharvested (Aars et al. 2006). In other populations, including East Greenland and Davis Strait, substantial harvest occurs annually in the absence of scientifically derived population estimates (Aars et al. 2006). Considerable debate has occurred regarding the recent changes in population estimates based on indigenous or local knowledge and subsequent quota increases for some populations in Nunavut (Aars et al. 2006). Increased polar bear observations along the coast may be attributed to changes in bear distribution due to lack of suitable ice habitat rather than to increased population size (Stirling and Parkinson 2006). Additional data are needed to reconcile these differing interpretations.

Amstrup et al. (2007) used a Bayesian network model to forecast the range-wide status of polar bears during the 21st century, factoring in a number of stressors, including intentional take or harvest. The authors conducted a sensitivity analysis to determine the importance and influence of the stressors on the population forecast. Their analysis indicated that intentional take was the 4th-ranked potential stressor, and could exacerbate the effects of habitat loss in the future. The relatively high ranking for this stressor indicates that effective management of hunting and evaluation of sustainable harvest levels will continue to be important to minimize effects for populations experiencing increased stress.

Other Threats

Other sources of polar bear mortality related to human activities, though few and very rare, include research activities and defense of life kills by non-Natives (Brower et al. 2002). Accumulation of persistent organic pollutants in polar bear tissue, tourism, human-bear conflict, and increased development in the Arctic are also sources of concern (Obbard et al. 2010). Because uncertainty exists regarding how human activities interact to ultimately affect the world-wide polar bear population, conservation and management of polar bears at the world-wide population level is challenging.

Walrus

Species Description

The Pacific walrus is a social and gregarious pinniped that mainly inhabits the shallow Continental Shelf waters of the Bering and Chukchi seas (Fay 1982; Garlich-Miller et al. 2011). Pacific walruses are ecologically distinct from other walrus populations, primarily because they undergo significant seasonal migrations between the Bering and Chukchi seas and principally rely on broken pack ice habitat to access offshore breeding and feeding areas (Fay 1982). Waters deeper than 100 m (328 ft.) and the extent of the pack ice are factors that limit distribution to the north (Fay 1982). Unlike other pinnipeds, walruses are not as adapted for a pelagic existence and must haul out on ice or land regularly to rest between feeding bouts (Ray et al. 2006; 76 FR 7634). Groups may range from <10 - >1,000 animals (Gilbert 1999; Ray et al. 2006).

Status and Distribution

Status and Trends

The Service was petitioned to list the Pacific walrus under the ESA in 2008. In 2011, the Service found that listing was warranted but precluded due to higher listing priorities, making them a candidate species. Pacific walruses are represented by a single stock of animals that inhabit the shallow continental shelf waters of the Bering and Chukchi seas (Sease and Chapman 1988). Though some heterogeneity in the populations has been documented (Jay and Fischbach 2008), Scribner et al. (1997) found no difference in mitochondrial or nuclear DNA among Pacific walruses sampled from different breeding areas. Pacific walruses are managed as a single population (USFWS 2010). The current estimate of population size is 129,000 (95% CI: 55,000 - 507,000; Speckman et al. 2010).

Based on harvest data from the 18th and 19th centuries, Fay (1982) speculated that the pre-exploitation population was at least 200,000 animals. Since then, the population size has likely fluctuated in response to varying levels of human exploitation. Large-scale commercial harvests are believed to have reduced the population to 50,000–100,000 animals in the mid-1950s (Fay et al. 1997: 539). The population size apparently increased rapidly during the 1960s and 1970s in response to harvest regulations that limited take of females (Fay et al. 1989). Population estimates from 1975 and 1990 obtained via aerial surveys ranged from 201,039 - 290,000 individuals. A 2006 survey in Bering Sea pack ice resulted in an estimate of 129,000 walruses (95% CI: 55,000 - 507,000; Speckman et al. 2010) in the survey area. However, uncertainty exists regarding the accuracy of this estimate because weather difficulties forced the early termination of this survey. Differences in survey methods among years preclude estimation of a rate of change in population estimates (76 FR 7634; Speckman et al. 2010).

The walrus population may have reached carrying capacity in the 1970s and 1980s, after which density-dependent mechanisms are thought to have caused a decrease in population size (Fay and Stoker 1982b; Fay et al. 1986; Sease 1986; Fay et al. 1989). Estimates of demographic parameters from the late 1970s and 1980s support the idea that population growth was slowing (Fay and Stoker 1982a; Fay et al. 1986; Fay et al. 1989). Garlich-Miller et al. (2006) found that the median age of first reproduction for female walruses decreased in the 1990s, which is consistent with a reduction in density-dependent pressures. The reduced productivity levels, together with the removal of harvest quotas in the United States beginning in 1979 resulted in

another population decline. Taylor and Udevitz (2015) modeled mortality from non-harvest related factors (natural survival) between 1974–2006 and found that natural survival was high for juveniles (0.97) and adults (0.99) and annual density-dependent vital rates rose from 0.06 - 0.11 for reproduction, 0.31 - 0.59 for survival of neonatal calves, and 0.39 - 0.85 for survival of older calves, which represent patterns that may be expected concomitant with a population decline. Garlich-Miller et al. (2011a) predicted that changing sea-ice dynamics will result in further population declines in the future, but could not specify the magnitude or rate of decline.

Distribution and Movement Patterns

Pacific walruses are highly mobile, and their distribution varies in response to variations in seasonal and inter-annual sea-ice cover. During the January to March breeding season, walruses congregate in Bering Sea pack ice where open leads (fractures in sea-ice caused by wind drift or ocean currents), polynyas (enclosed areas of unfrozen water surrounded by ice), or thin ice allow access to water (Fay 1982; Fay et al. 1984). Breeding aggregations have been reported southwest of St. Lawrence Island, Alaska, south of Nunivak Island, Alaska, and south of the Chukotka Peninsula in the Gulf of Anadyr, Russia (Fay 1982; Mymrin et al. 1990). As the Bering Sea pack ice deteriorates in spring, most of the population migrates north through the Bering Strait to summer feeding areas over the continental shelf in the Chukchi Sea. However, several thousand animals, primarily adult males, remain in the Bering Sea during summer months, foraging from coastal haulouts in the Gulf of Anadyr, Russia, and Bristol Bay, Alaska.

Summer distribution in the Chukchi Sea varies annually depending upon the extent of sea-ice. When broken sea-ice is abundant, walruses are typically found in patchy aggregations over continental shelf waters. Summer concentrations have been reported in loose pack ice off the northwestern coast of Alaska, between Icy Cape and Point Barrow, near Wrangel Island, and along the coast of Chukotka, Russia (Fay 1982; Gilbert et al. 1992; Belikov et al. 1996). In years of low ice concentrations in the Chukchi Sea, some animals range east of Point Barrow into the Beaufort Sea; walruses have also been observed in the Eastern Siberian Sea in late summer (Fay 1982; Belikov et al. 1996).

The pack ice of the Chukchi Sea usually reaches its minimum extent in September. In years when the sea-ice retreats north beyond the continental shelf, walruses congregate in large numbers (up to several tens of thousands of animals in some locations) at terrestrial haulouts along the northern coast of the Chukotka Peninsula, Russia and northwestern Alaska (Fay 1982; Belikov et al. 1996; Kochnev 2004; Ovsyanikov et al. 2007; Kavry et al. 2008). In late September and October, walruses that summered in the Chukchi Sea typically move south in advance of the developing sea-ice (Figure A-25). Satellite telemetry data indicate male walruses that summered at coastal haulouts in the Bering Sea also move northward towards winter breeding areas in November (Jay and Hills 2005). The male walrus' northward movements appear to be driven primarily by the presence of females at that time of year (Freitas et al. 2009).

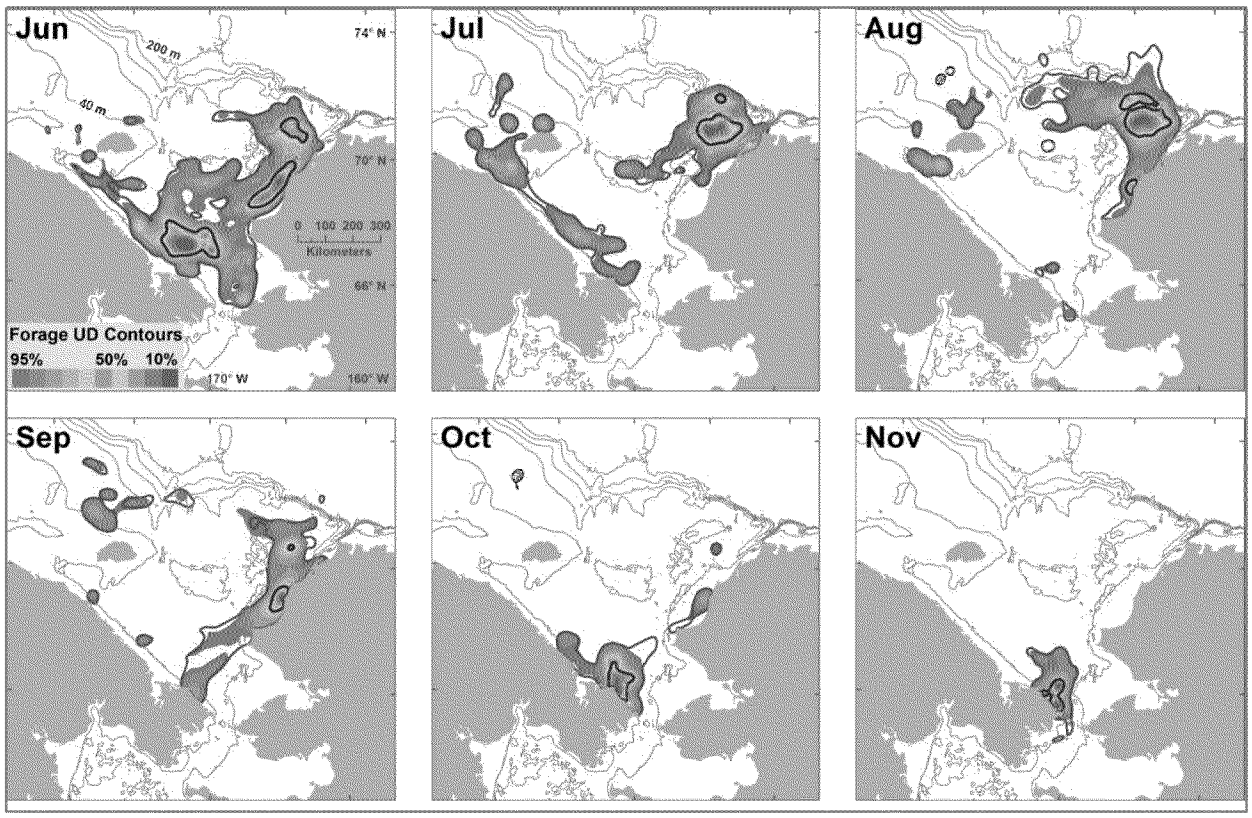


Figure A-24. Utilization distribution estimates (UDs) of walrus foraging (red to blue color ramp contours, 10 - 95% UDs) and occupancy (solid line contours, 50 and 95% UDs) in the Chukchi Sea, 2008 - 2011 (Jay et al. 2012).

[Top]

Life History

Pacific walruses are primarily benthic foragers. Stomachs of some walrus included over 60 benthic invertebrate genera (Fay et al. 1984; Bluhm and Gradinger 2008). Early interpretations of walrus stomach contents indicated walrus feed primarily on benthic bivalves; food items other than clams were suggested to be opportunistically consumed while clams were preferred (citations *in* Sheffield and Grebmeier 2009). However, non-mollusc taxa were likely misrepresented due to digestion and other biases such as sample size (Sheffield and Grebmeier 2009). Examination of fresh stomachs from 1975 - 1985 suggested no difference between the proportion of stomachs containing mostly bivalve and non-bivalve prey (Sheffield and Grebmeier 2009). Bivalves, gastropods (snails and slugs), and polychaete worms occurred most frequently in stomachs from the Bering and Chukchi seas. Although bivalves and gastropods occurred more frequently in stomachs from the Bering and Chukchi seas, respectively, it was most likely due to their differential variability at these locations (Sheffield and Grebmeier 2009). Male and female walruses consumed essentially the same prey when at the same location (Sheffield and Grebmeier 2009).

Although walruses are capable of diving to depths of more than 250 m (820 ft) (Born et al. 2005), they usually forage in waters 80 m (262 ft) deep or less (Fay and Burns 1988; Born et al. 2003; Kovacs and Lydersen 2008), presumably because of higher productivity of benthic foods

in shallow waters (Fay and Burns 1988; Carey 1991; Jay et al. 2001; Grebmeier et al. 2006a; 2006b). Walruses make foraging trips that range from a few hours up to several days from land or ice haulouts (Jay et al. 2001; Born et al. 2003; Ray et al. 2006; Udevitz et al. 2009). Walruses tend to make more frequent but shorter trips, both in duration and distance, when using sea-ice as a foraging platform compared to terrestrial haulouts (Udevitz et al. 2009). Satellite telemetry data from walruses using Bering Sea-ice indicated that walruses spent 46 hours on average in the water between bouts of rest on the ice (Udevitz et al. 2009). Male walruses appear to have greater foraging endurance than females, with such excursions from land haulouts lasting up to 142 hours (Jay et al. 2001).

Threats

The two main stressors for Pacific walruses are loss of sea-ice resulting from climate change and subsistence hunting (76 FR 7634; Jay et al. 2011). We discuss these factors and other stressors that may be influencing walruses across their range.

Climate Change and Use of Coastal Haulouts in Summer

While the overall geographic range of Pacific walruses has not changed, over the past decade the number of walruses coming to shore along the coastline of the Chukchi Sea in both Alaska and Chukotka has increased from the hundreds to thousands to greater than 100,000 (Kavry et al. 2008; Garlich-Miller et al. 2011; Jay et al. 2011). Additionally, adult female and young walruses are arriving at these coastal haulouts as much as a month earlier and staying at the coastal haulouts a week or two longer. In fall 2007, 2009, 2010, and 2011 large walrus aggregations (3,000 - 20,000) were observed along the Alaska coast (Garlich-Miller et al. 2011). This increased use of coastal haulouts is a function of the loss of summer sea-ice over the continental shelf (Garlich-Miller et al. 2011). Summer sea-ice extent in the Chukchi Sea has decreased by about 12% per decade (NSIDC 2012); retreating off the shallow continental shelf and remaining only over deep Arctic Ocean waters where walruses cannot reach the benthos to feed. Declines in Chukchi Sea-ice extent, duration, and thickness are projected to continue in a linear fashion into the foreseeable future (Douglas 2010).

Increased use of coastal haulouts has several consequences. First, increased use of summer land haulouts by adult females and young could result in increased energy expenditures from foraging trips originating from shore and reduced access to preferred feeding grounds (Jay et al. 2011). Second, an increased dependence on coastal haulouts is likely to subject walruses to increased anthropogenic and natural disturbance; exposure to disturbance at coastal haulouts can lead to increased injury and mortality via trampling as walruses stampede into the water following disturbances (76 FR 7634). Such events have led to the trampling and death of hundreds of walruses in Alaska and thousands in Russia (calves are particularly vulnerable), presumably when herds were disturbed from anthropogenic and predator stimuli (citations *in* Jay et al. 2011: Kavry et al. 2008; Kochnev et al. 2008; Fischbach et al. 2009). An unusually high number of walruses hauled out and high levels of mortality occurred on the shores of Wrangel Island, Russia (citation *in* Jay et al. 2011: Ovsyanikov et al. 2008). Predators and human hunters may also indirectly cause calves to be crushed and die by causing stampedes (76 FR 7634). Third, as they become increasingly dependent on coastal haulouts, walruses will become more susceptible to predation by polar bears (especially on calves) and hunting by humans. Continued loss of sea-

ice will likely cause walruses to become increasingly dependent on coastal haulouts in the summer and into the fall and early winter.

Subsistence Harvest

Pacific walruses have been an important subsistence resource for coastal Alaskan and Russian Natives for thousands of years (Ray 1975), and its harvest is likely to continue into the foreseeable future (76 FR 7634). The Pacific walrus population has experienced an estimated annual harvest of 3,200 - 16,100 animals from 1960 through 2000 (mean: 6,993; Angliss and Allen 2009). However, harvest estimates have declined, and recent harvest estimates are lower than historical levels, as demonstrated in a lower five-year mean from 2006 through 2010 (4,852 ± 346 SE; Table A-13; USFWS unpublished data) than the full data range. It is not known whether lower harvest levels reflect changes in walrus abundance or hunting effort. Factors affecting harvest levels include the cessation of Russian commercial walrus harvests after 1991, changes in political, economic, and social conditions of subsistence hunters in Alaska and Chukotka, and the effects of variable weather and ice conditions (Angliss and Allen 2009). No statewide harvest quotas exist in Alaska at this time.

The Service has adopted the average annual harvest over the past five years as a representative estimate of current harvest levels in Alaska and Chukotka (USFWS 2013c). Harvest mortality levels from 2006 - 2010 are estimated at 3,828 - 6,119 walruses per year (Table A-13) which includes adjusting for animals mortally wounded but not retrieved and required harvest reporting non-compliance rates. These harvest levels are approximately 4% of the minimum population estimate of 129,000 animals (Speckman et al. 2011). However, uncertainty regarding the population status and trend makes it difficult to quantify appropriate removal levels (Garlich-Miller et al. 2011). Jay et al. (2011) used Bayesian network modeling to determine that, along with the loss of sea-ice, harvest will likely cause a "worsening condition" (i.e., change the walrus population state from robust or persistent to vulnerable, rare, or extirpated) for the Pacific walrus population. Harvest is likely to continue at or near current levels, despite population declines in response to loss of summer sea-ice (76 FR 7634: 7657).

Table A-13. Mean estimated annual harvest (standard error) of Pacific walruses, 2006 - 2010. Russian harvest information was provided by Chukot TINRO and the Russian Agricultural Department. United States harvest information was collected by USFWS, and adjusted for unreported walruses using a mark-recapture method. Total harvest includes a struck and lost factor of 42% (Fay et al. 1994).

Year	Total harvest	United States harvest	Russian harvest
2006	4,022(157)	1,286(91)	1,047
2007	6,119(127)	2,376(74)	1,173
2008	3,828(185)	1,442(107)	778
2009	5,547(654)	2,123(379)	1,110
2010	4,716(308)	1,682(178)	1,053
Five year mean	4,852(346)	1,782(200)	1,032(67)

[Top]

Walrus Research

The DMA permits walrus research under the MMPA. Currently, the DMA permits researchers to: capture walruses for the purpose of taking tissue samples and attaching satellite telemetry tags; remotely collect tissue samples and attach satellite telemetry to walrus using small harpoon and a crossbow; and survey Pacific walrus population from aircraft and vessels. Typically, DMA allows between one and six deaths annually for each permit (currently, there are three active permits). Permits contain measures to minimize effects of research activities (e.g., to avoid causing stampedes at haulouts).

Disease

Walruses are susceptible to a variety of viral, bacterial, and parasitic infections. Sonsthagen et al. (2014) found low genetic diversity among genes associated with immune response, suggesting walruses may have limited resilience to novel pathogens. Increased use of terrestrial haulouts may escalate the risk of disease transmission (Garlich-Miller et al. 2011). For example, beginning in 2011, about 6% of 300 live walruses presented with unusual ulcerative lesions of the skin of unknown etiology (Garlich-Miller et al. 2011). Most (11/17; 65%) were sub-adults (2 - 6 years old), the other six animals were adults (Garlich-Miller et al. 2011). In general, the animals with skin lesions appeared to be otherwise robust, active and healthy (Garlich-Miller et al. 2011). The number of animals that may have died from this condition is unknown, but at the Point Lay haulout in September 2011, 14 of 19 (74%) fresh or moderately decomposed carcasses exhibited these lesions. This outbreak also affected ice seals, which are managed by the NOAA. The Service and NOAA deemed this infection as an Unusual Mortality Event (UME) in a joint press release dated December 20, 2011 (NOAA Fisheries 2011). Far fewer seals with symptoms of the syndrome were observed in 2012 and no walruses with lesions were seen, but haulouts did not form in the United States or Russia in 2012. Despite these UMEs, the importance of disease as a significant species-level threat to Pacific walruses remains uncertain.

Pollution, Contaminants and Other Activities

Human activity in walrus habitat could impact walruses. For example, noise from aircraft may disturb walruses at haulouts, possibly causing stampedes. Underwater noise, such as open-water seismic exploration (e.g., with air gun arrays), may potentially affect marine mammal hearing and/or communication. Oil and gas activities are a source of human disturbance in walrus habitat. Models of oil and gas exercises (Jay et al. 2011; MacCracken et al. 2013) did not identify activities such as ship and air traffic as stressors strongly influencing modeled outputs, possibly due to the low levels of these activities at that time. Oil and gas activities, spills, commercial fisheries interactions, and shipping do not currently appear to threaten the Pacific walruses population as a whole, and they are not likely to pose a significant risk to the listed species in the foreseeable future (76 FR 7634: 7671), but see the Environmental Baseline and Effects of the Action sections for further discussion of the occurrence of these factors in the Action Area and the role their impacts on individuals.

Spectacled Eider

Species Description

The spectacled eider is a large sea duck, 52–56 cm long (20–22 in). Sea ducks spend at least part of their lives at sea or on large waterbodies, and are a subgroup of the subfamily Anatinae, family Anatidae. The spectacled eider is one of three species in the genus Somateria. All Somateria species' ranges include the United States. In the winter and spring, adult male spectacled eiders are in breeding plumage with a black chest, white back, and pale green head (see Cover Photo). Females, juveniles, and males during the non-breeding season are mottled brown. Spectacled eiders are diving ducks that spend most of the year in marine waters where they primarily feed on bottom dwelling molluscs and crustaceans.

Status and Distribution

Spectacled eiders were listed as threatened throughout their range in based on indications of steep declines in the two Alaska-breeding populations (58 CFR 27474). There are three primary spectacled eider populations, corresponding to breeding grounds on Alaska's North Slope, Y-K Delta, and northern Russia. The Y-K Delta population declined 96% between the early 1970s and 1992 (Stehn et al. 1993). Data from the Prudhoe Bay oil fields (Warnock and Troy 1992) and information from Native elders at Wainwright, Alaska (R. Suydam, pers. comm. *in* USFWS 1996) suggested concurrent localized declines on the North Slope, although data for the entire North Slope breeding population were not available. Historically, spectacled eiders nested in Alaska discontinuously from the Nushagak Peninsula north to Barrow, and east nearly to Canada's Yukon Territory (Phillips 1922 - 1926; Bent 1925; Bailey 1948; Dau and Kistchinski 1977; Derksen et al. 1981; Garner and Reynolds 1986; Johnson and Herter 1989).

The most recent rangewide estimate of abundance of spectacled eiders was 369,122 (364,190–374,054 90% CI), obtained by aerial surveys of the known wintering area in the Bering Sea in late winter 2010 (Larned et al. 2012a). Comparison of point estimates between 1997 and 2010 indicate an average of 353,051 spectacled eiders (344,147 - 361,956; 90% CI) in the global population over that 14-year period (Larned et al. 2012b). The population growth rate is approximately stable over the long term (0.99, 90% CI: 0.98 - 1.01) and over the last 10 years (1.00, 90% CI: 0.97 - 1.03) (Larned et al. 2012a).

Life History

Breeding

In Alaska, spectacled eiders breed primarily on the North Slope (ACP) and the Y-K Delta. On the ACP, spectacled eiders breed north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River about 24 km (15 mi) inland from its mouth, with breeding density varying across the ACP (Figure A-25). Although spectacled eiders historically occurred throughout the coastal zone of the Y-K Delta, they currently breed primarily in the central coast zone within about 15 km (9 mi) of the coast from Kigigak Island north to Kokechik Bay (USFWS 1996). However, sightings on the Y-K Delta have also occurred both north and south of this area during the breeding season (R. Platte, USFWS, unpublished data).

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Numbers of breeding pairs peak in mid-June and decline four to five days later when males begin to depart from the breeding grounds (Smith et al. 1994; Anderson and Cooper 1994; Bart and Earnst

2005). Mean clutch size reported from studies on the Colville River Delta was 4.3 (Bart and Earnst 2005). Spectacled eider clutch size near Barrow has averaged 3.2–4.1, with clutches of up to eight eggs reported (Quakenbush et al. 1995; Safine 2011). Incubation lasts 20–25 days (Kondratev and Zadorina 1992; Harwood and Moran 1993; Moran 1995), and hatching occurs from mid- to late July (Warnock and Troy 1992).

Nest initiation on Kigigak Island on the Y-K Delta occurs from mid-May to mid-June (Lake 2007). Incubation lasts approximately 24 days (Dau 1974). Mean spectacled eider clutch size is higher on the Y-K Delta compared to the ACP. Mean annual clutch size ranged from 3.8–5.4 in coastal areas of the Y-K Delta (1985–2011; Fischer at al. 2011), and 4.0–5.5 on Kigigak Island (1992–2011; Gabrielson and Graff 2011), with clutches of up to eight eggs reported (Lake 2007). On the breeding grounds, spectacled eiders feed on mollusks, insect larvae (craneflies, caddisflies, and midges), small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Ducklings fledge approximately 50 days after hatch, when females with broods move from freshwater to marine habitat prior to fall migration.

Nest success appears to be variable depending on year and location. Bowman et al. (2002) reported high variation in nest success (20–95%) among spectacled eiders on the Y-K Delta. Recruitment rate (the percentage of young eiders that hatch, fledge, and survive to sexual maturity) of spectacled eiders is poorly known because there is limited data on juvenile survival (USFWS 1999). In a coastal region of the Y-K Delta, duckling survival to 30 days averaged 34%, with 74% of mortality occurring in the first 10 days, while survival of adult females during the first 30 days post hatch was 93% (Flint and Grand 1997).

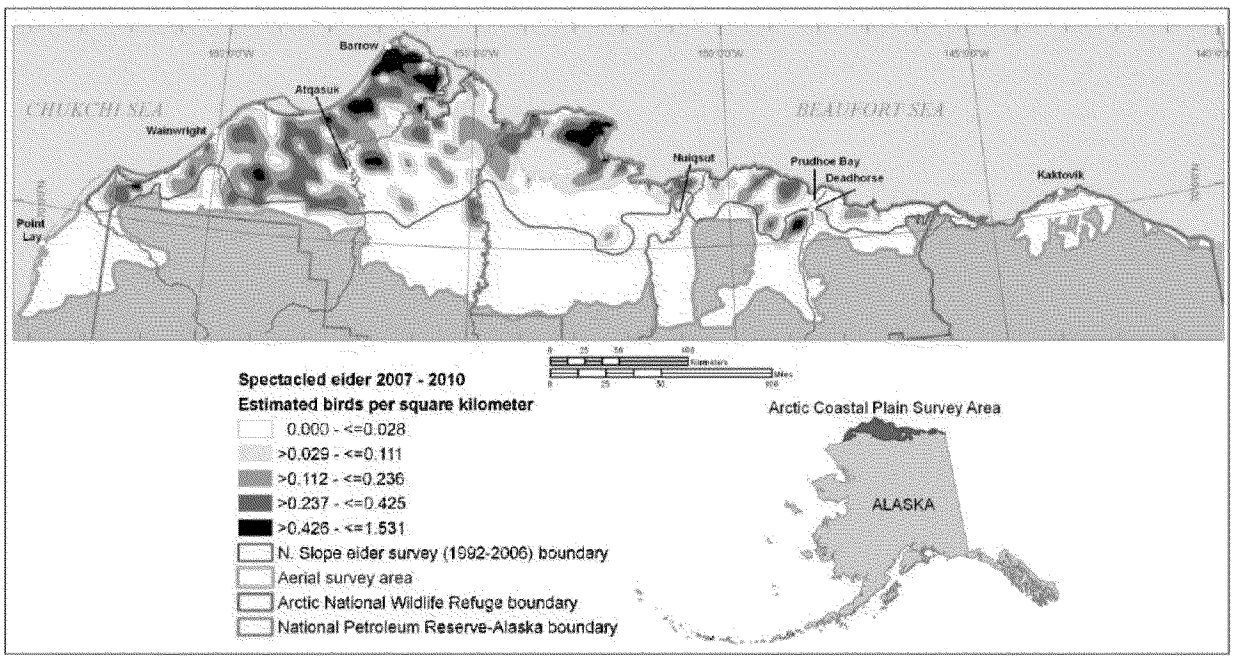


Figure A-25. Density distribution of spectacled eiders observed on aerial transects sampling 57,336 km^2 of wetland tundra on the North Slope of Alaska during early to mid-June, 2007 - 2010. From Larned 2011. [Top]

Fall migration

After breeding, spectacled eiders migrate to several discrete molting areas, with birds from the different populations and genders apparently favoring different molting areas (Petersen et al. 1999). After molting, spectacled eiders migrate to openings in the pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Petersen et al. 1999; Figure A-26), where they remain until March or April (Lovvorn et al. 2003).

As with many other sea ducks, spectacled eiders spend the 8–10 month non-breeding season at sea. Satellite telemetry and aerial surveys led to the identification of spectacled eider migrating, molting, and wintering areas. These studies are summarized in Petersen et al. (1995 and 1999) and Larned et al. (1995). Results of more recent satellite telemetry research (2008–2011) are consistent with earlier studies (Matt Sexson, USGS, unpublished data). Phenology, spring migration and breeding, including arrival, nest initiation, hatch, and fledging, is 3–4 weeks earlier in western Alaska (Y-K Delta) than northern Alaska (ACP); however, phenology of fall migration is similar between areas. Individuals depart breeding areas in July–September, depending on breeding status and success, and molt in September–October.

Males generally depart breeding areas on the ACP when females begin incubation in late June (Anderson and Cooper 1994; Bart and Earnst 2005). Use of the Beaufort Sea by departing males is variable. Some appear to move directly to the Chukchi Sea over land, while the majority move rapidly (average travel of 1.75 days), over nearshore waters from breeding grounds to the Chukchi Sea (TERA 2002). Of 14 males implanted with satellite transmitters, only four spent an extended period of time (11–30 days) in the Beaufort Sea (TERA 2002). Males appeared to prefer areas near large river deltas such as the Colville River where open water is more prevalent in early summer when much of the Beaufort Sea is still frozen. Most adult males marked with satellite transmitters in northern and western Alaska in a recent satellite telemetry study migrated to northern Russia to molt (USGS, unpublished data). Results from this study also suggest that male eiders likely follow coast lines but also migrate straight across the northern Bering and Chukchi seas *en route* to northern Russia (Matt Sexson, USGS, unpublished data).

Females generally depart the breeding grounds later, when more of the Beaufort Sea is ice-free, allowing more extensive use of the area. Females spent an average of two weeks in the Beaufort Sea (range 6 - 30 days) with the western Beaufort Sea the most heavily used (TERA 2002). Females also appeared to migrate through the Beaufort Sea an average of 10 km further offshore than males (Petersen et al. 1999). The greater use of the Beaufort Sea and offshore areas by females was attributed to the greater availability of open water when females depart the area (Petersen et al. 1999, TERA 2002). Recent telemetry data indicate that molt migration of failed/non-breeding females from the Colville River Delta through the Beaufort Sea is relatively rapid (two weeks), compared to 2–3 months spent in the Chukchi Sea (Matt Sexson, USGS, unpublished data).

Molting and Wintering

Spectacled eiders use specific molting areas from July to late October/early November. Larned et al. (1995) and Petersen et al. (1999) found spectacled eiders' show strong preference for

specific molting locations, and concluded that spectacled eiders molt in four discrete areas (Table A-14). Females generally used molting areas nearest their breeding grounds. All marked females from the Y-K Delta molted in nearby Norton Sound, while females from the North Slope molted in Ledyard Bay, along the Russian coast, and near St. Lawrence Island. Males did not show strong molting site fidelity; males from all three breeding areas molted in Ledyard Bay, Mechigmenskiy Bay, and the Indigirka/Kolyma River Delta. Males reached molting areas first, beginning in late June, and remained through mid-October. Non-breeding females, and those that nested but failed, arrived at molting areas in late July, while successfully-breeding females and young of the year reached molting areas in late August through late September and remained through October. Fledged juveniles marked on the Colville River Delta usually staged in the Beaufort Sea near the delta for 2–3 weeks before migrating to the Chukchi Sea.

Table A-14. Important staging and molting areas for female and male spectacled eiders from each breeding population.

Population and Sex	Known Major Staging/Molting Areas
Arctic Russia Males	Northwest of Medvezhni (Bear) Island group Mechigmenskiy Bay Ledyard Bay
Arctic Russia Females	Unknown
North Slope Males	Ledyard Bay Northwest of Medvezhni (Bear) Island group Mechigmenskiy Bay
North Slope Females	Ledyard Bay Mechigmenskiy Bay West of St. Lawrence Island
Y-K Delta Males	Mechigmenskiy Bay Northeastern Norton Sound
Y-K Delta Females	Northeastern Norton Sound

[Top]

Avian molt is energetically demanding, especially for species such as spectacled eiders that complete molt in a few weeks. Molting birds require adequate food resources, and apparently the benthic community of Ledyard Bay (Feder et al. 1989, 1994a, 1994b) provides this for spectacled eiders. Large concentrations of spectacled eiders molt in Ledyard Bay using this food resource; aerial surveys on four days in different years counted 200 - 33,192 molting spectacled eiders in Ledyard Bay (Petersen et al. 1999; Larned et al. 1995).

Spectacled eiders generally depart molting areas in late October/early November (Matt Sexson, USGS, unpublished data), migrating offshore in the Chukchi and Bering seas to a single wintering area in pack-ice lead complexes south/southwest of St. Lawrence Island (Figure A-26). In this relatively shallow area, > 300,000 spectacled eiders (Petersen et al. 1999) rest and feed, diving up to 70 m (230 ft) to eat bivalves, other mollusks, and crustaceans (Cottam 1939; Petersen et al. 1998; Lovvorn et al. 2003; Petersen and Douglas 2004).

Spring migration

Recent information indicates spectacled eiders likely make extensive use of the eastern Chukchi spring lead system between departure from the wintering area in March and April and arrival on the North Slope in mid-May or early June. Limited spring observations in the eastern Chukchi Sea have documented dozens to several hundred common eiders (*Somateria mollissima)* and spectacled eiders in spring leads and several miles offshore in relatively small openings in rotting sea-ice (W. Larned, USFWS, unpublished data). Woodby and Divoky (1982) documented large numbers of king (*Somateria spectabilis*) and common eiders using the eastern Chukchi lead system, advancing in pulses during days of favorable following winds, and concluded that an open lead is probably requisite for spring eider passage in this region. Preliminary results from an ongoing satellite telemetry study conducted by the USGS Alaska Science Center (Figure A-26) suggest that spectacled eiders also use the lead system during spring migration.

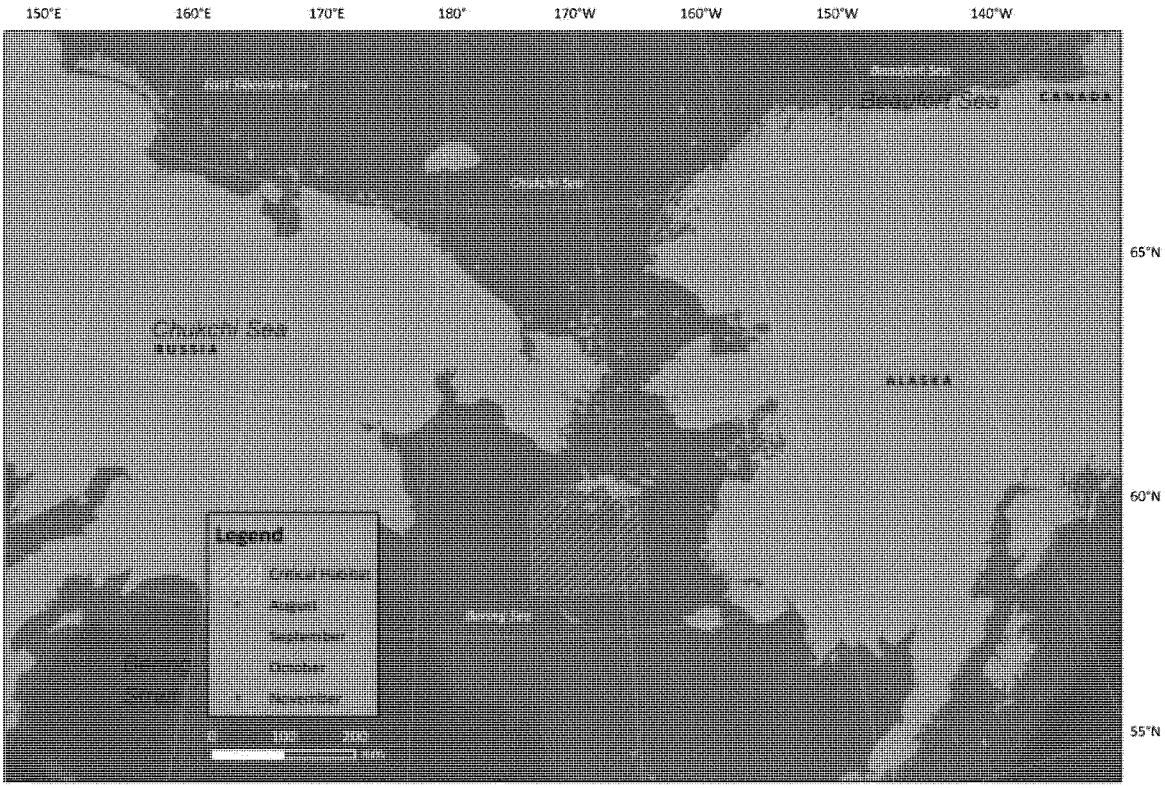


Figure A-26. Spectacled eider satellite telemetry locations 2008 - 2011 (M. Sexson, USGS Alaska Science Center, unpub. data). [Top]

Adequate foraging opportunities and nutrition during spring migration are critical to spectacled eider productivity. Like most sea ducks, female spectacled eiders do not feed substantially on the breeding grounds, but produce and incubate their eggs while living primarily off body reserves (Korschgen 1977; Drent and Daan 1980; Parker and Holm 1990). Clutch size, a measure of reproductive potential, was positively correlated with body condition and reserves obtained prior to arrival at breeding areas (Coulson 1984; Raveling 1979; Parker and Holm 1990). Body reserves must be maintained from winter or acquired during the 4 - 8 weeks

(Lovvorn et al. 2003) of spring staging, and Petersen and Flint (2002) suggest common eider productivity on the western Beaufort Sea coast is influenced by conditions encountered in May to early June during spring migration through the Chukchi Sea (including Ledyard Bay). Common eider female body mass has been found to increase 20% during the 4 - 6 weeks prior to egg laying (Gorman and Milne 1971; Milne 1976; Korschgen 1977; Parker and Holm 1990). For spectacled eiders, average female body weight in late March in the Bering Sea was 1,550 ± 35 g (n = 12), and slightly (but not significantly) more upon arrival at breeding sites (1,623 ± 46 g, n = 11; Lovvorn et al. 2003), indicating that spectacled eiders maintain or enhance their physiological condition during spring staging.

Threats

Predation

Primary predators of spectacled eiders and their eggs include gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), red foxes (*Vulpes vulpes*), and arctic foxes (*Vulpes lagopus*). In arctic Russia, apparent nest success was estimated to be < 2% in 1994 and 27% in 1995; low nest success was attributed to predation (Pearce et al. 1998). Apparent nest success in 1991 and 1993–1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP was also low, varying from 25–40% (Warnock and Troy 1992; Anderson et al. 1998). On Kigigak Island in the Y-K Delta, nest survival probability ranged from 0.06–0.92 from 1992– 2007 (Lake 2007); nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) or when foxes were eliminated from the island prior to the nesting season.

Contaminants/Lead

The deposit of lead shot in habitats used for foraging is a threat to spectacled eiders. An eider was found with ingested lead shot on the Y-K Delta in 1978 (C. Dau *in* Franson et al. 1995), and confirmed mortalities due to lead ingestion were recorded in 1992 - 1994 (Franson et al. 1995). Lead has been detected in blood samples and ingested lead was found on x-rays of spectacled eiders on the Y-K Delta (USFWS 1996). Birds dying of lead poisoning have been confirmed from two locations on the Y-K Delta (Franson et al. 1995), but it is not known how common or widespread this problem is on the Y-K Delta or elsewhere.

Available data indicate egg hatchability is high for spectacled eiders nesting on the ACP, in arctic Russia, and at inland sites on the Y-K Delta, but considerably lower in the coastal region of the Y-K Delta. Spectacled eider eggs that are addled or that do not hatch are very rare in the Prudhoe Bay area (Declan Troy, TERA, unpublished data 1997), and Esler et al. (1995) found very few addled eggs on the Indigirka River Delta in Arctic Russia. Additionally, from 1969 - 1973 at an inland site on the Yukon Delta National Wildlife Refuge, only 0.8% of spectacled eider eggs were addled or infertile (Dau 1974). In contrast, 24% of all nests monitored in a coastal region of the Y-K Delta during the early to mid-1990s contained inviable eggs and ~10% of eggs in successful nests did not hatch due to either embryonic mortality or infertility (Grand and Flint 1997). This relatively high occurrence of inviable eggs near the coast of the Y-K Delta may have been related to exposure to contaminants (Grand and Flint 1997). It is unknown whether hatchability of eggs in this region has improved with decreased use of lead shot in the

region and gradual settling of existing lead pellets (Flint and Schamber 2010) in coastal Y-K Delta wetlands.

Steller's eider

Species Description

The Steller's eider is a sea duck with a circumpolar distribution and the sole member of the genus *Polysticta*. The Steller's eider is the smallest of the four eider species, weighing approximately 700–800 g (1.5–1.8 lbs). Adult male Steller's eiders in breeding plumage have a black back, white shoulders, and a chestnut brown breast and belly. The males have a white head with black eye patches; they also have a black chin patch and a small greenish patch on the back of the head. Females and juveniles are mottled dark brown.

Status and Distribution

The Alaska breeding population of the Steller's eider was listed as threatened on July 11, 1997 based on substantial contraction of the species' breeding range in Alaska, reduced numbers of Steller's eiders breeding in Alaska, and the resulting vulnerability of the remaining breeding population to extirpation (USFWS 1997). Periodic non-breeding of the entire population of Steller's eiders breeding near Barrow, Alaska, the species' primary breeding grounds, coupled with low nesting and fledging success, has resulted in very low productivity (Quakenbush et al. 2004) and may make the population particularly vulnerable to extirpation.

Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further divided into the Russia-breeding population, which nests along the Russian eastern arctic coastal plain, and the Alaska-breeding population. In Alaska, Steller's eiders breed almost exclusively on the ACP. While they historically nested on the Y-K Delta, only a few nests have been found there in recent years. During the molt and over winter, they mix with the majority of the Russia-breeding population in southcentral Alaska (Figure A-27).

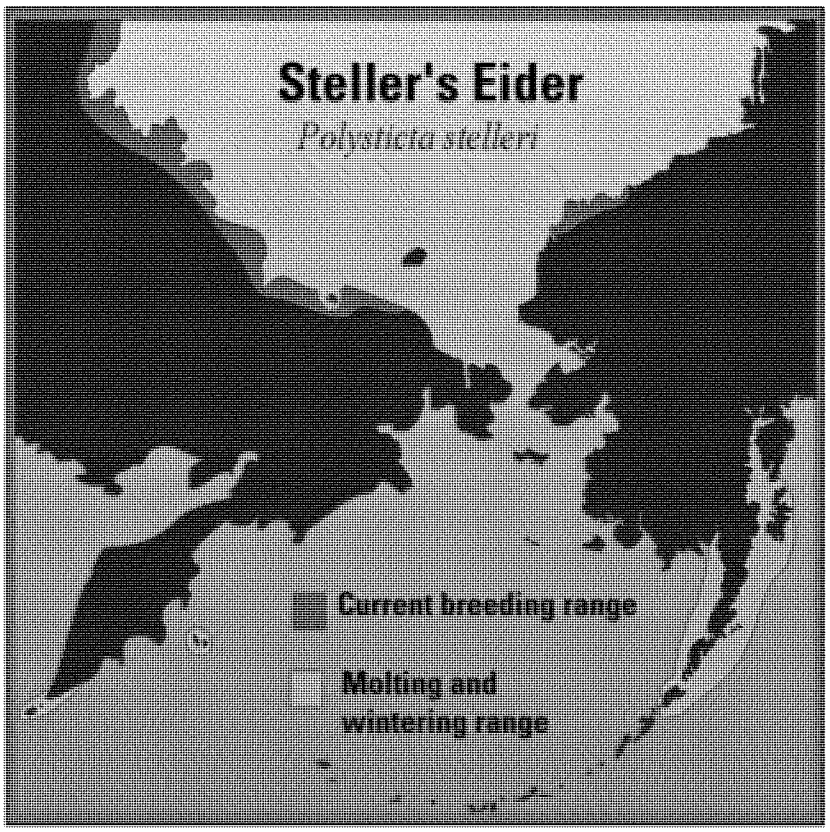


Figure A-27. Steller's eider distribution in the Bering, Beaufort, and Chukchi seas. [Top]

Range-wide Trends

The population of Pacific wintering Steller's eiders molting and wintering along the Alaska Peninsula has declined since the 1960s (Kertell 1991). The long-term trend from annual spring aerial surveys (1992 - 2011) indicates a 2.3% decline per year (R^2=0.34) (Larned 2012). Counts of Steller's eiders conducted during fall surveys for emperor geese indicate a 1.6% per year increase from 1979 - 2010. Banding data from 1975 - 1981 and 1991 - 1997 indicates a reduction in Pacific wintering Steller's eider survival over time (Flint et al. 2000). Population models for other waterfowl, applied to this species, indicate that reductions in annual survival would have a substantial negative effect on populations (Schmutz et al. 1997; Flint et al. 2000).

While current distribution on the North Slope breeding range has been reduced compared to the historical distribution (Quakenbush et al. 2002), the population trajectory for the North Slope population remains ambiguous (Stehn and Platte 2009). Data from the 1989 - 2006 ACP aerial surveys indicate that North American breeding Steller's eiders are in decline (λ=0.778, 0.686 - 0.882, 90% CI; Mallek at al. 2007), while the 1992 - 2008 North Slope Eider (NSE) survey data suggest that the population is increasing (λ=1.059, 0.909 - 1.235, 90% CI; Larned et al. 2008). Aerial survey data from 1999 - 2007 suggest a declining growth rate (λ=0.934, 0.686 - 1.272, 90% CI; Obrischkewitsch et al. 2008). Analysis of a subset of data from the NSE aerial survey

(1993 - 2008) estimates that growth is stable (λ=1.011, 0.857 - 1.193, 90% CI; Stehn and Platte 2009).

Aerial surveys that included the Y-K Delta, but did not include the ACP, indicated that the Y-K Delta population of eiders has declined by 90% since 1957 (Hodges et al. 1996). For the 1950s and early 1960s, the upper limit of the population, excluding the North Slope, had been estimated to be approximately 3,500 pairs (Kertell 1991). Kertell (1991) concluded that the Steller's eider had been extirpated from the Y-K Delta prior to 1990. The numbers of birds currently breeding on the Y-K Delta are not likely to be sufficient to sustain a breeding population (Kertell 1991; Quakenbush 2002). This population is most likely dependent on immigration from the Alaska-breeding or Russian breeding populations. If there is no permanent immigration or emigration between Russian breeding and Alaska-breeding Steller's eiders, if declining trends continue, and if the available estimates of vital rates are accurate and precise, the listed Steller's eiders have a high probability of extinction in the foreseeable future (Swem and Matz 2008).

Population Size

Population sizes are only imprecisely known. The Pacific wintering population is estimated to be about 74,369 birds (Larned 2012). The threatened Alaska-breeding population is thought to number approximately 500 individuals on the ACP (Stehn and Platte 2009), and as few as 10-50 on the Y-K Delta (USFWS, unpublished data).

Arctic Coastal Plain (ACP)/North Slope

Steller's eider population and trends have been obtained from the following three aerial surveys on the ACP: the USFWS ACP survey, 1989–2006 (Mallek et al. 2007) and 2007–2008 (new ACP survey design; Larned et al. 2008, 2009); the Service's North Slope eider survey 1992–2008 (Larned et al. 2009) and 2007–2008 (NSE strata of new ACP survey; Larned et al. 2008, 2009); and the Barrow Triangle (ABR, Inc.,) survey, 1999–2007 (Obrishkewitsch et al. 2008). In 2007, the ACP and NSE surveys were combined under a new ACP survey design.

The aerial survey efforts provide a range of estimates of the North Slope breeding population size. Estimates, including results from previous analyses of the ACP and NSE survey data, are summarized in Table A-15 and Table A-16 Caution must be used when interpreting the survey results. Neither the surveys conducted by Mallek et al. (2006) nor Larned et al. (2010) were originally designed to estimate Steller's eider populations. Surveys differed in spatial extent, seasonal timing, sampling intensity, and duration. Most observations of Steller's eider from both surveys occurred within the boundaries of the NSE survey (Figure A-28).

Following assessment of potential biases inherent in the two Service surveys, Stehn and Platte (2009) identified a subset of the NSE survey data (1993–2008) that they determined was "least confounded by changes in survey timing and observers." Based on this subset of the NSE survey, the average geographically-extrapolated population index total for Steller's eiders was 173 (90% CI: 88–258) with an estimated population growth rate of 1.011 (90% CI: 0.857–1.193). The average population size of Steller's eiders breeding in the ACP was estimated at 576 (292–859, 90% CI; Stehn and Platte 2009), assuming a detection probability of 30%. The 30%

detection probability and associated visibility correction factor of 3.33 was selected based on evaluation of estimates for similar species and habitats (Stehn and Platte 2009).

Table A-15. Aerial population estimates for Steller's eiders, from the North Slope.

Year	Population Estimate	Nesting Status Near Barrow	Year	Population Estimate	Nesting Status Near Barrow
1986	0[4]	Non-nesting	1998	281[4]/0[5]	Non-nesting[1]
1987	0[4]	Non-nesting	1999	1250[4]/785[5]	Nesting[1]
1988	0[4]	Non-nesting	2000	563[4]/0[5]	Nesting[2]
1989	2002[4]	Nesting	2001	176[4]/288[5]	Non-nesting[2]
1990	534[4]	Nesting	2002	0[4]/0[5]	Non-nesting[2]
1991	1118[4]	Nesting[1]	2003	0[4]/93[5]	Non-nesting[2]
1992	954[4]/0[5]	Non-nesting[1]	2004	0[4]/48[5]	Non-nesting[2]
1993	1313[4]/262[5]	Nesting[1]	2005	110[4]/99[5]	Nesting[2]
1994	2524[4]/47[5]	Non-nesting[1]	2006	96[3]/112[5]	Nesting[2]
1995	931[4]/281[5]	Nesting[1]	2007	96[6]	Nesting[2]
1996	2543[4]/0[5]	Nesting[1]	2008	576[7]	Nesting[2]
1997	1295[4]/189[5]	Nesting[1]			

[1] Quakenbush et al. 2001; [2] Nora Rojek, USFWS, pers. comm.; [3] Ritchie et al. 2006; [4] Mallek et al. 2005; [5] Larned et al. 2009; [6] Obritschkewitsch et al. 2008; [7] Stehn and Platte 2009 [Top]

Table A-16. Steller's eider males, nests, and pair densities recorded during ground-based and aerial surveys conducted near Barrow, Alaska 1999–2010 (modified from Safine 2011).

Year	Overall ground-based survey area			Standard Ground-based Survey Area[a]		Aerial survey of Barrow Triangle		Nests found near Barrow
	Area (km^2)	Males counted	Pair density (males/km^2)	Males counted	Pair density (males/km^2)	Males counted	Pair density (males/km^2)[b]	
1999	172	135	0.78	132	0.98	56	0.04	36
2000	136	58	0.43	58	0.43	55	0.04	23
2001	178	22	0.12	22	0.16	22	0.02	0
2002	192	1	<0.01	0	0	2	<0.01	0
2003	192	10	0.05	9	0.07	4	<0.01	0
2004	192	10	0.05	9	0.07	6	<0.01	0
2005	192	91	0.47	84	0.62	31	0.02	21
2006	191	61	0.32	54	0.4	24	0.02	16
2007	136	12	0.09	12	0.09	12	0.02	12
2008	166	114	0.69	105	0.78	24	0.02	28
2009	170	6	0.04	6	0.04	0	0	0
2010	176	18	0.1	17	0.13	4	0.01	2
2011	180	69	0.38	59	0.44	10	0.01	27

[a]Standard area (the area covered in all years) is ~134 km^2 (2008 – 2010) and ~135 km^2 in previous years.
[b]Actual area covered by aerial survey (50% coverage) was ~1408 km^2 in 1999 and ~1363 km^2 in 2000 – 2006 and 2008. Coverage was 25% in 2007 and 2010 (~682 km^2) and 27% in 2009 (~736 km^2). Pair density calculations are half the bird density calculations reported in ABR, Inc.'s annual reports (Obritschkewitsch and Ritchie 2011). [Top]

Currently, this analysis provides the best available estimate of the Alaska-breeding Steller's eider population size and growth rate from the ACP. Surveys of the northernmost portion of the ACP conducted annually by ABR, Inc., provide more intensive coverage of the nesting area (50%, 1999–2004; 25–50%, 2005–2010; Obritschkewitsch and Ritchie 2011). Based on ABR survey data, Stehn and Platte (2009) estimated that the average population index for Steller's eiders residing within the Barrow Triangle was 99.6 (90% CI: 55.5–143.7) with an estimated population growth rate of 0.934 (90% CI: 0.686–1.272). If we also assume the same 30% detection probability, the average population size of Steller's eiders breeding in the Barrow Triangle survey area would be 332 (90% CI: 185–479).

Population Structure

There are often genetic gradients or differences that correspond to the geographic distribution of the species (Lande and Barrowclough 1987). The Alaska-breeding population of Steller's eiders may contain unique geographic sub-populations arising from: 1) the distance between breeding populations on the Y-K Delta and the ACP [about 804 km (500 miles)], and 2) the anticipated site fidelity of nesting adult females (Anderson et al.1992). In contrast, the similarly distributed North Slope and Y-K Delta populations of spectacled eiders possess distinct mitochondrial DNA markers, implying limited maternal gene flow between these two areas for that species (Scribner et al. 2001). However, genetic analyses by Pearce et al. (2005) found little evidence for differentiation among and between nesting groups of Steller's eiders across their range using both nuclear and mitochondrial DNA. Pearce et al. (2005) also observed little evidence for genetic differentiation within the Pacific breeding distribution (Russia vs. Alaska) of Steller's eiders, suggesting that female gene flow is sufficiently high between the two locales, or that divergence of Russian and Alaskan breeding groups has occurred relatively recently.

Pearce and Talbot (2009) observed that the mean level and variance of genetic relatedness among all nests at Barrow in 1999 (n = 19; R_{XY} = -0.07, variance = 0.082) was nearly identical to the mean for 45 samples collected from Steller's eiders molting along the Alaska Peninsula (R_{XY} = -0.02, var = 0.075). The molting samples represent the broadest possible distribution of relatedness values since molting groups of Steller's eiders are thought to contain birds from multiple breeding areas (Dau et al. 2000). These findings corroborate conclusions by Pearce et al. (2005) of limited genetic differentiation among breeding areas. Greater differentiation would be expected if Barrow females were more closely related genetically in comparison to a larger group composed of multiple breeding areas, such as those molting and overwinter along the Alaska Peninsula.

Seasonal Distribution Patterns

Breeding Distribution

Steller's eiders breed on the western ACP in northern Alaska, from approximately Point Lay east to Prudhoe Bay, and in extremely low numbers on the Y-K Delta. On the ACP, anecdotal historical records indicate that the species occurred from Wainwright east, nearly to the Alaska-Canada border (Anderson 1913; Brooks 1915). There are very few nesting records from the eastern ACP, however, so it is unknown if the species commonly nested there or not. Currently, the species predominantly breeds on the western ACP, in the northern half of the National Petroleum Reserve-Alaska (Figure A-28). The majority of sightings in the last decade have

occurred east of the mouth of the Utukok River, west of the Colville River, and within 90 km (56 mi) of the coast.

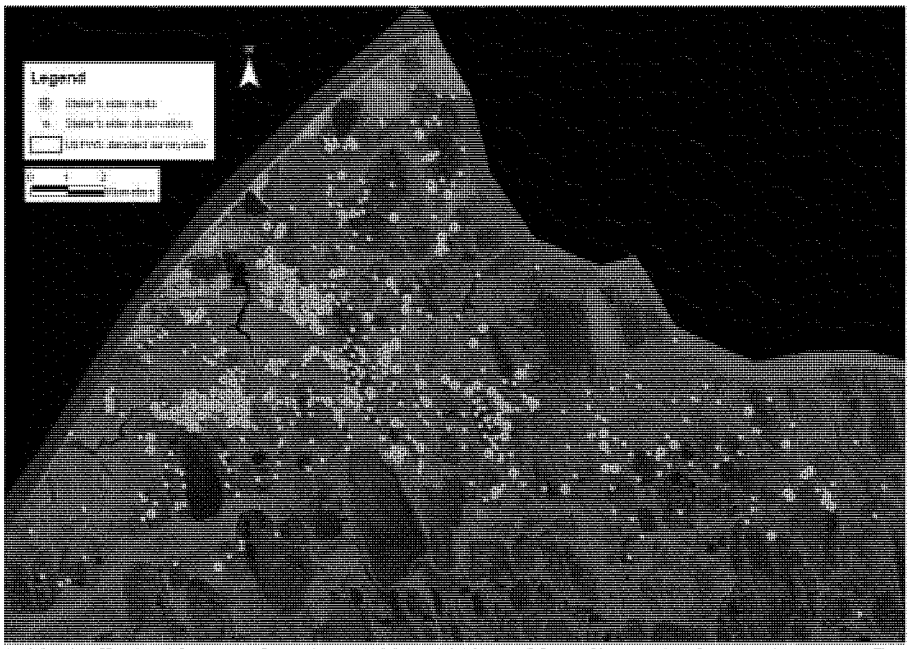


Figure A-28. Steller's eider nest locations (1991 - 2010) and breeding pair observations near Barrow (1999 - 2010). The red border represents the standard annual survey area. This survey is expanded beyond the standard survey in some years. [Top]

Steller's eiders were considered locally "common" in the central Y-K Delta by naturalists early in the 1900s (Murie 1924; Conover 1926; Gillham 1941; Brandt 1943), but nesting was reported in only a few locations. By the 1960s or 70s, the species had become extremely rare on the Y-K Delta; only six nests were found in the 1990s (Flint and Herzog 1999). Given the paucity of early-recorded observations, only subjective estimates can be made of the Steller's eider's historical abundance or distribution on the Y-K Delta. A few Steller's eiders were reportedly found nesting in other locations in western Alaska, including the Aleutian Islands in the 1870s and 1880s (Gabrielson and Lincoln 1959), Alaska Peninsula in the 1880s or 1890s (Murie and Scheffer 1959), Seward Peninsula in the 1870s (Portenko 1972), and on Saint Lawrence Island in the 1950s (Fay and Cade 1959).

Post-Breeding Distribution

Prior to migration in both nesting and non-nesting years, some Steller's eiders rest and forage in Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea in the vicinity of the northern most point of the Barrow spit. Males depart the nesting grounds soon after incubation begins, but females linger longer. From mid-July through September single hens, hens with broods and small groups of two to three birds have been observed in North Saltwater Lagoon, Elson Lagoon and near shore on the Chukchi Sea (Figure 14 in Environmental Baseline).

Molt Distribution

After breeding, Steller's eiders move to marine waters where they mix with birds from the Russian breeding population and undergo a three-week flightless molt. After the populations mix on the molting and wintering areas, there is no way to confirm whether an individual belongs to the Alaskan breeding population. We therefore assume that 0.8% of all Steller's eiders occurring on the molting and wintering grounds in Alaska are from the listed Alaska breeding population. This estimate is derived by taking the most recent North Slope breeding bird estimate (576; Stehn and Platte 2009), adding one for the Y-K Delta population (=577), and then dividing by the population estimate of Pacific-wintering Steller's eiders from 2010 (74,369; Larned 2012). Thus, 577 ÷ 74,369= (0.0078 x 100) = 0.8%.

The Pacific-wintering population molts in several main areas along the Alaska Peninsula: Izembek Lagoon (Dau 1991; Metzner 1993; Laubhan and Metzner 1999), Nelson Lagoon, Herendeen Bay, and Port Moller (Gill et al. 1981; Petersen 1981). Over 15,000 Steller's eiders have also been observed in Kuskokwim Bay (Larned and Tiplady 1996). Smaller numbers of molting Steller's eiders have been reported around islands in the Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (e.g., Dick and Dick 1971; Petersen and Sigman 1977; Wilk et al. 1986; Dau 1987; Petersen et al. 1991). Larned (2005) reported >2,000 eiders molting in lower Cook Inlet near the Douglas River Delta.

A few band recoveries indicate that the Alaska-breeding birds molt in Izembek Lagoon and Kuskokwim Shoals. The best available information is from the satellite telemetry studies described in Martin (2001) and Rosenberg et al. (2011). Martin (2001) marked 14 birds near Barrow, Alaska (within the range of the listed Alaska-breeding population) in 2000 and 2001. Although samples sizes were small, results suggested disproportionately high use of Kuskokwim Shoals by Alaska-breeding Steller's eiders during wing molt compared to the Pacific population as a whole, but Alaska-breeding birds were not found to preferentially use specific wintering areas. The second study marked Steller's eiders wintering near Kodiak Island, Alaska and followed birds through the subsequent spring (n = 24) and fall molt (n = 16) migrations from 2004–2006 (Rosenberg et al. 2011). Most of the birds marked near Kodiak migrated to eastern arctic Russia prior to the nesting period and none were relocated on land or in nearshore waters north of the Yukon River Delta in Alaska (Rosenberg et al. 2011).

Winter Distribution

After molt, many of the Pacific-wintering Steller's eiders congregate in select nearshore waters throughout the Alaska Peninsula and the Aleutian Islands, around Nunivak Island, the Kodiak Archipelago, and in lower Cook Inlet, although thousands may remain in lagoons used for molting (Bent 1987; Larned 2000a; Martin 2001; Larned and Zwiefelhofer 2002). Winter ice formation often temporarily forces birds out of shallow protected areas such as Izembek and Nelson Lagoons. Wintering Steller's eiders usually occur in shallow waters (< 10 meters deep), which are generally within 400 meters (m) of shore or at offshore shallows (USFWS 2002b). However, Martin et al. (*in prep*) reported substantial use of habitats >10 m deep during mid-winter. Use of these habitats by wintering Steller's eiders may be associated with night-time resting periods or with shifts in the availability of local food resources (Martin et al. *in prep*).

Spring Migration
In the spring, Steller's eiders form large flocks along the north side of the Alaska Peninsula and move east and north (Larned et al. 1993; Larned 1998; Larned 2000b). Larned (1998) concluded that Steller's eiders show strong site fidelity to "favored" habitats during migration, where they congregate in large numbers to feed before continuing their northward migration. Spring migration usually includes movement along the coast, although birds may take shortcuts across water bodies such as Bristol Bay (William Larned, USFWS, unpublished data). Several areas receive consistent use during spring migration, including Bechevin Bay, Morzhovoi Bay, Izembek Lagoon, Nelson Lagoon/Port Moller Complex, Cape Seniavin, Seal Islands, Port Heiden, Cinder River State Critical Habitat Area, Ugashik Bay, Egegik Bay, Kulukak Bay, Togiak Bay, Nanwak Bay, Kuskokwim Bay, Goodnews Bay, and the south side of Nunivak Island (Larned et al. 1993; Larned 1998; Larned 2000b). Like other eiders, Steller's eiders probably use spring leads for feeding and resting as they move northward, but there is little information on habitat use after departing spring staging areas.

Summer Distribution in Southern Alaska
A small number of Steller's eiders are known to remain along the Alaska Peninsula and Kachemak Bay during the summer; approximately 100 have been observed in Kachemak Bay, while a few may spend the summer at Izembek Lagoon (Chris Dau, USFWS, unpublished data).

Site Fidelity
In many species of waterfowl, female philopatry to breeding grounds is high (Anderson et al. 1992). Banding data from the Barrow area suggests some level of site fidelity for Steller's eiders breeding there (Quakenbush et al. 1995; P. Martin *in* USFWS 2011). Evidence of nest site philopatry has also been reported on the Y-K Delta. In 2003, 2004, and 2005, a single female Steller's eider nest was found in the same area each year. Nests were located as little as 124 m apart between years (Paul Flint, USGS, pers. comm.). Interestingly, natal philopatry has not been reported in Steller's eiders nesting in Russia (D. Solovieva, Zoological Institute, Russian Academy of Science, pers. comm.).

There is good evidence to suggest that individual eiders return to the same seasonal use areas each year, but individual fidelity to wintering areas is unknown. Eiders are known to overwinter in select nearshore waters year after year (Bent 1987; Larned and Zwiefelhofer 1995; Larned 2000a). Flocks of Steller's eiders also use the same molting areas each year (Larned 1998). About 95% of recaptured molting Steller's eiders were found at the same site at which they were banded (Flint et al. 2000). Telemetry data from Steller's eiders captured near Unalaska showed high within-season site fidelity on wintering areas (Reed and Flint 2007, P. Martin *in* USFWS 2011). Other species of waterfowl show high rates of individual fidelity to wintering areas as well (Robertson et al. 1999). This suggests that overwintering groups of Steller's eiders may belong to individual discrete subpopulations, although no information is available to confirm this.

Life History

Breeding Ecology

Steller's eiders are thought to develop pair bonds on the wintering grounds in early spring (Metzner 1993). They begin to arrive in small flocks of breeding pairs on the ACP in early June. Nesting on the ACP is concentrated in tundra wetlands near Barrow, AK (Figure A-28) and occurs at lower densities elsewhere on the ACP from Wainwright east to the Sagavanirktok River (Quakenbush et al. 2002). Nesting eiders often occupy shallow coastal wetlands in association with tundra (Quakenbush et al. 1995; Solovieva 1997) but have been observed well inland on the ACP. This species establishes nests near shallow ponds or lakes, usually close to water.

Long-term studies of Steller's eider breeding ecology near Barrow indicate periodic non-breeding by the entire local breeding population. Since 1991, Steller's eiders nests were detected in 12 of 20 study years (1991–2010; Safine 2011). Periodic non-breeding by Steller's eiders near Barrow may be associated with fluctuations in lemming populations and related breeding patterns in pomarine jaegers (*Stercorarius pomarinus*) and snowy owls (*Nyctea scandiaca*) (Quakenbush et al. 2004). In years with high lemming abundance, Quakenbush et al. (2004) reported that Steller's eider nesting success was a function of a nest's distance from pomarine jaeger and snowy owl nests. These avian predators nest only in years of high lemming abundance and defend their nests aggressively against arctic foxes (*Vulpes lagopus*). By nesting within jaeger and owl territories, Steller's eiders may benefit from protection against arctic foxes even at the expense of occasional partial nest depredation by the avian predators themselves (Quakenbush et al. 2002; Quakenbush et al. 2004). Steller's eiders may also benefit from the increased availability of alternative prey for both arctic foxes and avian predators in high lemming years (Quakenbush et al. 2004).

Mean clutch size at Barrow was 5.4 ± 1.6 SD (range = 1–8) over five nesting years in 1992–1999 (Quakenbush et al. 2004). Hatching occurs from mid-July through early August (Rojek 2006, 2007, 2008). Observations of known-age ducklings indicate that fledging occurs 32–37 days post hatch (Obritschkewitsch et al. 2001; Quakenbush et al. 2004; Rojek 2006; Rojek 2007). After hatching, hens move their broods to ponds within 0.3–3.5 km from the nests where they feed on aquatic insect larvae and crustaceans until fledging (Quakenbush et al. 2000; Rojek 2006, 2007).

Nest survival (the probability a nest will hatch at least one egg) is affected by predation levels. Predators include snowy owls, short-eared owls (*Asio flammeus*), peregrine falcons (*Falco peregrinus*), gyrfalcon (*Falco rusticolus*), pomarine jaegers, rough-legged hawks (*Buteo lagopus*), common ravens (*Corvus corax*), glaucous gulls (*Larus hyperboreus*), Arctic fox, red fox (*V. vulpes*), and bald eagles (*Haliaeetus leucocephalus*) (Quakenbush et al. 1995; Rojek 2008, Safine 2011). Nest depredation by a family group of polar bears was documented in 2011 (Safine 2011). Nest survival averaged 0.23 (±0.09, standard error [SE]) from 1991–2004 before fox control was implemented near Barrow and 0.49 (±0.10 SE) from 2005–2011 during years with fox control (USFWS, unpublished data; Rojek 2008).

Diet and Energetics

Steller's eiders spend most of the year in shallow, nearshore marine waters feeding on a variety of benthic (seafloor) invertebrates including gastropods, bivalves, crustaceans, echinoderms, and macrobenthic invertebrates (Petersen 1980; Petersen 1981; Quakenbush et al. 1995; Bustnes et al. 2000). Although considered a diving seaduck, Steller's eiders employ a variety of foraging strategies, including diving to depths up to 9 m (30 ft) or more, bill dipping, body tipping, and gleaning food items from the surface of water, plants, and mud. Metzner (1993) concluded that Steller's eiders were opportunistic generalists.

The Steller's eider is a relatively small-bodied sea duck, intermediate in size between the harlequin and long-tailed duck (Bellrose 1980). It overlaps harlequins and long-tails in its choice of foraging areas and prey items, and may, like these two species, exist near its energetic limits, especially during winter and the breeding season. Unlike other larger eiders, Steller's eiders must continue to feed during egg laying and incubation, to build and maintain energy reserves (D. Solovieva, Zoological Institute, Russian Academy of Science, pers. comm.).

Steller's eiders show a pattern of life-history traits indicating their life-history strategy is "K-selected." They can survive up to 21 years in the wild (C. Dau *in* USFWS 2011) and show a pattern of deferred reproduction, site fidelity, and low annual recruitment. Such "K-selected" species minimize the importance of annual reproduction, and maximize the importance of annual survival, relying instead on only a few successful years of reproduction (Wilson 1980). This strategy would only be expected to evolve in environments with predictable and stable resources (Stearns 1992). Robertson et al. (1999) concluded that long-lived species of waterfowl would be expected to show strong site tenacity in areas with stable resources, to allow animals to develop and use local knowledge about resource distribution to ensure high long-term survival. They suggest that site fidelity would be expected of long-lived species that are sensitive to adult mortality and depend, at least in part, upon habitat stability for survival. Under this life history strategy, species are vulnerable to perturbations within their habitat. As a K-selected species that is thought to spend at least part of the year surviving at the edge of its energetic limits, the Steller's eider is likely to be susceptible to habitat impacts resulting in loss of food resources.

Threats

Hunting

Although not cited as a cause in the decline of Steller's eiders, the take of this species by subsistence hunters near Barrow was cited as a factor in the decision to list the population of Steller's eiders (USFWS 1997). Hunting for Steller's eiders was closed in 1991. In 2003, spring/summer subsistence harvest of migratory birds in Alaska was opened by Alaska State regulations and Service policy, but harvest of Steller's eiders remained prohibited. Before this regulation took effect, it was estimated that approximately 97 Steller's eiders were shot each year (USFWS 2006). After 2003, it was predicted that approximately 59 Steller's eiders were killed each year (USFWS 2007). Shooting mortality during 2004 - 2008 was estimated to be 23 birds (USFWS, unpublished data, 2010).

Lead Poisoning

Lead poisoning of Steller's eiders has been documented on the ACP (Trust et al. 1997). Female Steller's eiders nesting at Barrow in 1999 had blood lead concentrations that reflected exposure to lead (>0.2 ppm lead), and six of the seven tested had blood lead concentrations that indicated poisoning (>0.6 ppm lead; Pattee and Pain 2003). Additional lead isotope tests confirmed the lead in the Steller's eider blood was of lead shot origin, not that of the background sediments (Angela Matz, USFWS, unpublished data). Because this species continues to feed near the nesting site before and during incubation, it may be subjected to an increased risk of exposure to lead shot compared to other tundra waterfowl species that largely forego feeding at this time.

Spectacled eiders do not seem to engage in feeding activities as much as Steller's eiders once breeding has commenced, but have higher rates of lead exposure than any other species sampled on the Y-K Delta (Flint et al. 1997). The proportion of spectacled eiders on the Y-K Delta's lower Kashunuk River drainage that contained lead shot in their gizzards was high (11.6%, n = 112) compared to other waterfowl in the lower 48 states from 1938 - 1954 (8.7%, n = 5,088) and from 1977 - 1979 (8.0%, n = 12,880). Blood analyses of spectacled eiders indicated elevated levels of lead in 13% of pre-nesting females, 25.3% of females during hatch, and 35.8% of females during brood rearing. Nine of 43 spectacled eider broods (20.9%) contained one or more ducklings exposed to lead by 30 days after hatch (Flint et al. 1997). Thus, if spectacled eiders have experienced population level effects on the Y-K Delta due to lead poisoning, then it is reasonable to conclude that Steller's eiders may have similar or greater lead-induced effects, since they continue to feed during the nesting period.

Predation

Changes in predation levels are thought to affect Steller's eider populations by reducing nesting success. There is some evidence that predator and scavenger populations may be increasing on the North Slope (Eberhardt et al. 1983; Day 1998). Reduced fox trapping, anthropogenic food sources in villages and oil fields, and nesting/denning sites on human-built structures may have allowed fox, gull, and raven numbers to increase (Day 1998). Poor breeding success at Barrow has been attributed to high predation rates (Obritschkewitsch et al. 2001). In years where arctic fox removal was conducted at Barrow prior to and during Steller's eider nesting, nest success appears to have increased significantly (Rojek 2008). Increased predation by arctic foxes following goose population crashes was cited as a possible contributing factor to the decline of the Steller's eider on the Y-K Delta as well (USFWS 1997).

Seafood Processor Waste

Discharge from seafood processors may affect the water column, sea floor, or shore directly or indirectly through burial and smothering, putrification and decay, eutrophication, nutrient loading and alteration of habitats, aquatic communities and food webs. Although wave action in shallow, nearshore habitat may keep particles suspended and prevent waste deposition, contaminants, parasites, viruses, and other pathogens may be present and/or concentrated in these wastes and may bioaccumulate in prey items consumed by eiders. Furthermore, fish waste directly or indirectly supplies food to scavenging seabirds (Furness et al. 1992), seaducks, and eagles that tend to congregate in the vicinity of processing facilities and outfalls (Reed and Flint 2007; Ellen Lance, USFWS, pers. observation). Therefore, fish-waste from seafood processing

plants could potentially harm Steller's eiders indirectly by degrading foraging habitat, and directly by exposing individuals to contaminants, disease, and increased predation.

Collisions with Manmade Structures

Steller's eiders collide with wires, communication towers, and other on-land structures. Most collisions are likely to involve one or two birds, but "bird storms" have been documented to occur when fishing vessels use bright lights during inclement nighttime weather. The actual number of birds injured and killed through collisions is likely higher than reported: many injured and killed birds are believed to go unreported, or become scavenged before humans detect them. For example, carcass removal rates from scavengers on the Alaska Peninsula could be as high as 50% per 24 hours (Flint et al. 2010). Therefore, unless obstructions are checked every day, few carcasses would ever be documented. Searcher efficiency can also affect bird mortality estimates, for example following oil spills (Ford 2006).

Stochastic Events

Steller's eiders on the Y-K Delta and the ACP comprise a small population size. As discussed by Gilpin (1987), small populations have difficulty surviving the combined effects of demographic and environmental stochasticity. Demographic stochasticity refers to random events that affect the survival and reproduction of individuals (e.g., shifts in sex ratios, striking wires, being shot, oil/fuel spills; Goodman 1987). Environmental stochasticity is due to random, or at least unpredictable, changes in factors such as weather, food supply, and populations of predators (Shaffer 1987). If not already extirpated, Steller's eiders nesting on the Y-K Delta are at high risk of local extirpation due to the low number of birds that breed there. The world population of Steller's eiders is probably not at high risk of extinction due to environmental stochasticity alone, but local groups of wintering birds may be vulnerable to starvation due to stochastic events (e.g., unusually heavy ice-cover in their feeding habitats).

Allee Effect

The "Allee effect" refers to the destabilizing tendency associated with inverse density-dependence as it relates to population size and birth rate. One form of this occurs when the ability to find a mate is diminished (Begon and Mortimer 1986). For the Steller's eider, males are estimated to have higher mortality rates than females (Flint et al. 2000). The annual survival rate for Steller's eiders molting and wintering in Alaska is estimated to be 0.899 ± 0.032 for females and 0.765 ± 0.044 for males (Flint et al. 2000). The observed difference in annual survival between sexes may be manifested in a skewed sex ratio. Female Steller's eiders notably out-numbered male eiders in Akutan, False Pass, Unalaska, and Izembek (Lanctot and King 2000a; Lanctot and King 2000b). However, observations of a skewed sex ratio vary across the range of the species and show shifts through time (Dau et al. 2000; Flint et al. 2000; Lanctot and King 2000a; Lanctot and King 2000b). Skewed sex ratios may be resulting in reduced breeding populations, as adult females are effectively removed from the breeding population if they are unable to find a mate. It is not known to what degree (if any) that skewed sex ratios may be contributing to low breeding rates on the ACP.

Effects of Climate Change

Our analyses under the ESA include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007a). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007).

Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is "very likely" (defined by the IPCC as 90% or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide (CO_2) emissions from use of fossil fuels (IPCC 2007). Various types of changes in climate can have direct or indirect effects on most species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007).

Evidence is emerging that human-induced global climate change is linked to the warming of air and ocean temperatures and shifts in global and regional weather patterns including reduced sea-ice cover. High latitude regions, including Alaska and the surrounding oceans, are thought to be especially sensitive to the effects of climate change (Smol et al. 2005; Schindler and Smol 2006). Reduced sea-ice cover in the Arctic is likely to result in increased storm surges and ocean acidification. Acidification may impact shellfish and other marine organisms that create their shells and other hard parts from calcium carbonate. Sea otters, walruses, and spectacled and Steller's eiders all rely on these types of organisms for food. While climate change will likely affect individual organisms and communities, it is difficult to predict with specificity or reliability how these effects will manifest. Biological, climatological, and hydrologic components of the ecosystem are interlinked and operate on multiple spatial, temporal, and organizational scales with feedback between the components (Hinzman et al. 2005). Changes in the ocean climate are likely to continue on a scale similar to those presently occurring, but it is not clear whether climate change or ocean acidification will affect the long-term survival or recovery of listed species.

Loss of Sea-Ice

Regional-scale environmental shifts may be underway in the Chukchi and the Bering seas that may affect listed species. Ice thickness generally increases from the Siberian Arctic to the Canadian Archipelago, due mostly to convergence of drifting sea-ice (Walsh et al. 2005). Rothrock et al. (1999 *in* Walsh et al. 2005) found a decrease of about 40% (1.3 m) in the sea-ice draft (which is proportional to thickness) in the central Arctic Ocean by comparing sonar data obtained from submarines during two periods: 1958–1976 and 1993–1997. Satellite imagery has documented a downward trend in September sea-ice extent (historically when sea-ice extent is at its minimum (Figure A-29; NSIDC 2012). From 1979 through 2009, satellite data from 10

Arctic regions indicated that nine of 10 regions experienced trends towards earlier spring melt and later autumn freeze onset (Markus et al. 2009). For the entire Arctic, the melt season length had increased by about 20 days during this period (Markus et al. 2009). The Chukchi/Beaufort seas region, which is within the range of polar bears and walruses, has experienced a strong trend toward later autumn freeze-up date and longer ice-free seasons (Markus et al. 2009). Such changes in sea-ice extent and duration will likely affect polar bear and walrus population trends.

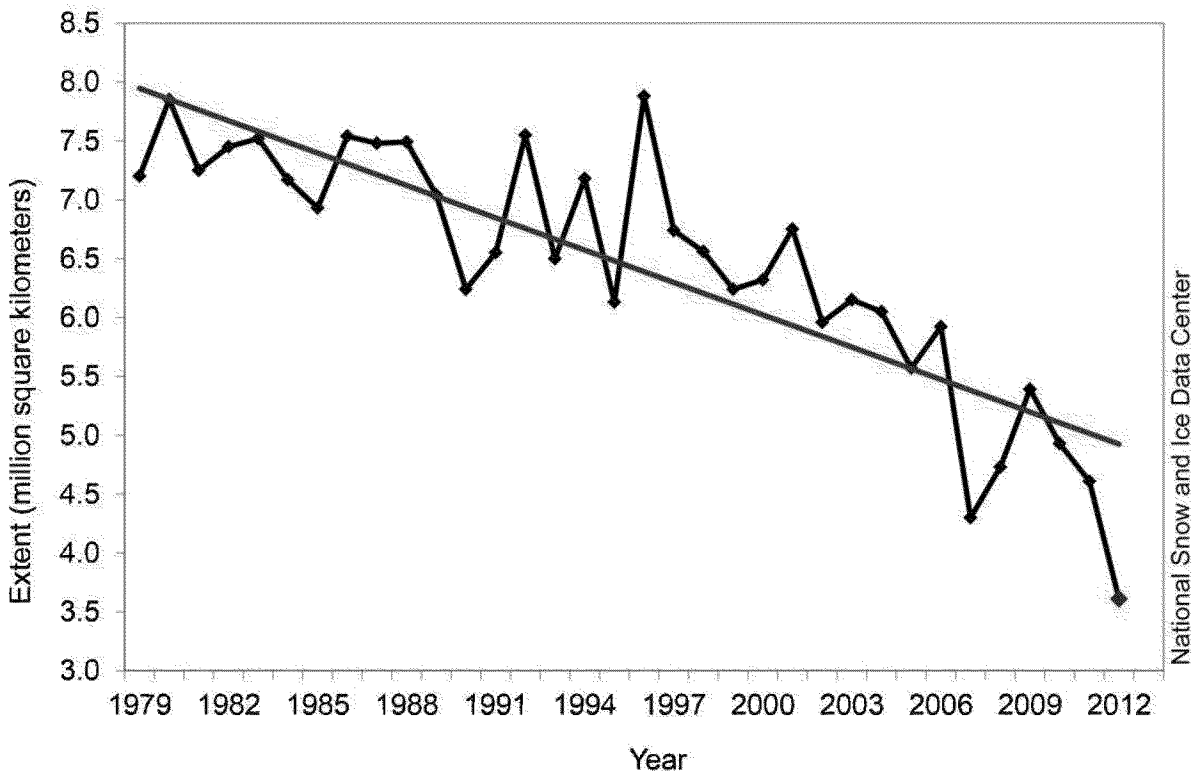


Figure A-29. Average September arctic sea-ice extent from 1979 through 2012 showing a 13.0% decline per decade (from NSIDC 2012). [Top]

Storm Surges

Historically, sea-ice has protected shorelines from erosion; however, this protection has decreased as sea-ice decreases in extent and duration. With the reduction in summer sea-ice, the frequency and magnitude of coastal storm surges has increased. These can cause breaching of lakes and inundation of low-lying coastal wetland areas, killing salt-intolerant plants and altering soil and water chemistry, and hence, the fauna and flora of the area (Jorgenson 2001). These changes may alter the nesting habitat of eiders on the Y-K Delta. Coupled with thawing permafrost, the inundation of the shoreline due to lack of sea-ice has significantly increased coastal erosion rates (Mars and Houseknecht 2007), potentially reducing the quality or quantity of habitats such as bluffs with vegetation that catch snow in which polar bears den and beaches where walruses haul out during periods of low sea-ice along the Chukchi Sea.

Acidification of northern waters

Rising atmospheric CO_2 results in increased oceanic CO_2 uptake; this uptake of CO_2 by the oceans is the predominant factor driving ocean acidification (Dore et al. 2009; Doney et al. 2012). Sea-surface pH has dropped by an estimated 0.1 pH units since the preindustrial era, a 26% increase in acidity over the past 150 years, mostly in the past several decades. Sea-surface pH is projected to decline by an additional 0.2–0.3 pH unit over this century (Feely et al. 2009 *in* Doney et al. 2012). Ocean acidification can cause several chemical changes including elevated aqueous CO2 and reduced carbonate and calcium carbonate saturation (Doney et al. 2009). By lowering carbonate levels, ocean acidification is thought to increase the energetic cost of calcification (Fabry et al. 2008). Observations of mostly negative effects of higher CO_2 on calcification rates for several marine invertebrate species support this hypothesis (Kroeker et al. 2009 *in* Doney et al. 2012). Acidification, therefore, could negatively impact biogenic habitats (e.g., coral reefs, oyster beds) and other food webs (e.g., those of pteropods and other mollusks; Doney et al. 2012). For some taxa, including some mollusks, lower pH reduces the oxygen-binding capacity of respiratory proteins (e.g., hemocyanin), reducing aerobic activity (Doney et al. 2012). Thus, acidification and hypoxia may have synergistic effects (Doney et al. 2012). Immersion in more acidic waters can also disturb the internal acid-base balance of organisms, which in turn can affect several metabolic processes (Pörtner 2010 cited in Doney et al. 2012). Ocean acidification could impact the prey species eaten by otters, eiders, and walruses.

Reduced Availability of Benthic Prey

Benthic biodiversity, community composition, and biomass in the Arctic are affected by climate change (Bluhm and Grebmeier 2011, Grebmeier 2012). Traditionally, nutrients from the Pacific flow across the shallow, often ice-covered Chukchi Sea shelf, and this nutrient influx supports high primary production associated with the edge-ice. This primary production settles to the seafloor, becomes available to benthic organisms, and generates a rich macrobenthic community in a relatively short and efficient food chain (Grebmeier 1993; Grebmeier and Cooper 1995). This Arctic ecosystem supports large populations of benthic-feeding marine mammals and birds, including eiders and walruses. Recent changes in the timing of sea-ice formation and melt coupled with increasing seawater temperatures may have caused shifts in marine species composition; these changes may subsequently cause major changes in the arctic marine ecosystem that will likely affect benthic organisms (Grebmeier 2012).

In some Arctic regions, biotic communities are changing from longer-lived and slower-growing species to faster-growing species due to increasing water temperatures (Bluhm and Grebmeier 2011). Several benthic species have extended their range northward (Bluhm and Grebmeier 2011). Decline in primary production and decline in carbon supply to sediments (Grebmeier 2006; Grebeimer et al. 2012) are thought to be causing changes in community composition in the northern Bering Sea, including declines in clam populations (Grebmeier et al. 2006b; Bluhn and Grebmeier 2011; Doney et al. 2012,). Reduced ice cover may provide habitat for new top predators (i.e., fish; Bluhm et al. 2011) that may compete with for declining food resources in northern regions (Grebmeier et al. 2010, Grebmeier 2012). A shift from a benthic-dominated to pelagic-dominated food chain has also been predicted (Grebmeier 2012, Bluhm and Gradinger 2008). Such changes will likely affect prey availability for walruses and eiders, but predicting climate-mediated changes at the community level, can be difficult due the complexity of food

webs (Doney et al. 2012). Thus, effects of climate change on food resources of listed species are concerning, but remain uncertain.

Contribution of the Action

Fuel consumption, especially oil, gas, and coal, is the primary source of GHG emissions worldwide. An estimated 83% of anthropogenic emissions from the primary GHG-producing countries are associated with use of these fuels (IEA 2013). The actions implemented under the Unified Plan will require varying amounts of fuel. Fuel will be used for transportation of personnel and equipment to and from spill sites. Diesel and gasoline will be used during a spill to power response vessels, aircraft, and equipment. The amount and type of fuel consumption, and the associated amounts of GHG produced will depend on the scale and location of the spill. A small spill response near an established response center will require much less fuel than a large effort in a remote area. The sum total of the effects of fuel consumption for spill response actions will be an increase in the release of GHGs. This is likely to be a tiny fraction of a global problem, and on its own, will not produce a measurable change in the impact of climate change on listed species and critical habitat.

[Top]

LITERATURE CITED

The Service has done our best to ensure this list is complete, but please contact us in the case of missing references.

Northern Sea Otter (Enhydra kenyoni)

Ballachey BE, CS Gorbics, AM Doroff. 2002. Sea otter mortality in Orca Inlet, Prince William Sound, Alaska, winter 1995-1996. U.S. Fish and Wildlife Service. Marine Mammals Management, Anchorage, Alaska. Technical Report MMM 02-1.

Ballachey BE, JL Bodkin, S Howlin, AM Doroff, AH Rebar. 2003. Correlates to survival of juvenile sea otters in Prince William Sound, Alaska, 1992-1993. Canadian Journal of Zoology 81:1494-1510.

Ballachey BE, JL Bodkin, S Howlin, KA Kloecker, DH Monson, AH Rebar, PW Snyder. 2000a. Hematology and serum chemistry of sea otters in oiled and un-oiled areas of Prince William Sound, Alaska, from 1996-1998. Appendix BIO-01 in Final Report, Exxon Valdez Oil Spill restoration project 95025-99025.

Ballachey BE, JJ Stegeman, PW Stegman, PW Snyder, GM Blundell, JL Bodkin, TA Dean, L Duffy, D Esler, G Golet, S Jewett, L Holland-Bartels, AH Rebar, PA Seiser, KA Trust. 2000b. Oil exposure and health of nearshore vertebrate predators in Prince William Sound following the Exxon Valdez oil spill. Chapter 2 in final report, Exxon Valdez Oil Spill restoration project 95025-99025.

Barabash-Nikiforov II. 1947. Kalan (The sea otter). Soviet Ministry RSFSR. (Translated from Russian by Israel Program for Scientific Translation, Jerusalem, Israel, 1962) 227 pp.

Barabash-Nikiforov II, SV Marakov, AM Nikolaev. 1968. Otters (sea otters). Izd-vo Nauka, Leningrad. 184 pp. [In Russian].

Bickham JW, MJ Smolen. 1994. Somatic and heritable effects of environmental genotoxins and the emergence of evolutionary toxicology. Environ. Health Perspect. 102(12):25-28.

Bickham JW, Sandhu S, Hebert PDN, Chikhi L, Athwal R (2000) Effects of chemical contaminants on genetic diversity in natural populations: implications for biomonitoring and ecotoxicology. *Mutation Research-Reviews in Mutation Research* 463, 33-51.

Bodkin JL, MS Udevitz. 1999. An aerial survey method to estimate sea otter abundance. Pages 13-26 In: G.W. Garner et al., editors.Marine Mammal Survey and Assessment Methods. Balkema, Rotterdam, Netherlands.

Bodkin, JL, DH Monson, GE Esslinger. 2003. A report on the results of the 2002 Kenai Peninsula and Lower Cook Inlet aerial sea otter survey. U.S. Geological Survey, Alaska.

Bodkin JL, GJ Esslinger, DH Monson. 2004. Foraging depths of sea otters and implications to coastal marine communities. Marine Mammal Science 20(2):305-321.

Bodkin JL, BE Ballachey, MA Cronin, K.T. Scribner. 1999. Population demographics and genetic diversity from remnant and reestablished populations of sea otters (*Enhydra lutris*). Conservation Biology 13:1378-1385.

Bodkin JL, BE Ballachey TA Dean, AK Fukuyamam, SC Jewett, LM McDonald, DH Monson, CE O'Clair, and GR VanBlaricom. 2002. Sea otter population status and the process of recovery from the Exxon Valdez spill. Marine Ecology Progress Services 241:237-53.

Brueggeman JJ, GA Green, RA Grotefendt, DG Chapman. 1988. Aerial surveys of sea otters in the northwestern Gulf of Alaska and the southeastern Bering Sea. Minerals Management Service and NOAA Final Report. Anchorage, Alaska.

Burn DM, AM Doroff. 2005. Decline in sea otter (Enhydra lutris) populations along the Alaska Peninsula, 1986-2001. Fishery Bulletin 103: 270-279.

Burn, DM, AM Doroff, MT Tinker. 2003. Carrying capacity and pre-decline abundance of sea otters (*Enhydra lutris kenyoni*) in the Aleutian Islands. Northwestern Naturalist 84:145-148.

Clements WH. 2000. Integrating effects of contaminants across levels of biological organization: An overview. Journal of Aquatic Ecosystem Stress and Recovery (Formerly Journal of Aquatic Ecosystem Health) 7(2):113-116.

Coletti HA, JL Bodkin, TA Dean, KA Kloecker. 2009. Nearshore Marine Vital Signs Monitoring in the Southwest Alaska Network of National Parks. Natural Resource Technical Report NPS/SWAN/NRTR —2009/252. Natural Resource Program Center. National Park Service. Fort Collins, Colorado.

Costa DP. 1978. The ecological energetics, water, and electrolyte balance on the California sea otter, Enhydra lutris. Ph.D. dissertation, University of California, Santa Cruz.

Costa DP, GL Kooyman. 1984. Contribution of specific dynamic action to heat balance and thermoregulation in the sea otter *Enhydra lutris*. Physiol. Zool. 57: 199-203.

Cronin MA, J Bodkin, B Ballachey, J Estes, JC Patton. 1996. Mitochondrial DNA variation among subspecies and populations of sea otters (*Enhydra lutris*). Journal of Mammalogy 77:546-557.

DeGange AR, DC Douglas, DH Monson, CM Robbins. 1995. Surveys of sea otters in the Gulf of Alaska in response to the Exxon Valdez oil spill. Natural Resource Damage Assessment Marine Mammal Study 6-7. Final report. 11 pp.

Doroff AM, AR DeGange. 1994. Sea otter, *Enhydra lutris*, prey composition and foraging success in the northern Kodiak Archipelago. Fishery Bulletin 92:704-

Doroff AM, JA Estes, MT Tinker, DM Burn, TJ Evans. 2003. Sea Otter Population Declines in the Aleutian Archipelago Journal of Mammalogy 81(1): 55-64.

Eberhardt LL. 1977. Optimal management policies for marine mammals. Wildlife Society Bulletin 5:162-169.

Estes JA. 1980. *Enhydra lutris*. American Society of Mammalogists. Mammalian Species 133. 8 pp.

Estes JA.1990. Growth and equilibrium in sea otter populations. Journal of Animal Ecology 59:385 401.

Estes JA, JL Bodkin, MT Tinker. 2010. Threatened Southwest Alaska sea otter stock: delineating the causes and constraints to recovery of a keystone predator in the North Pacific Ocean. North Pacific Research Board Final Report 717. 117 p.

Estes JA, RJ Jameson, EB Rhode. 1982. Activity and prey selection in the sea otter: Influence of population status on community structure. American Naturalist 120:242-258.

Estes JA, NS Smith, JF Palmisano. 1978. Sea otter predation and community organization in the western Aleutian islands, Alaska. Ecology 59:822-833.

Estes JA, MT Tinker. 1996. The population ecology of sea otters at Adak Island, Alaska. Final report to the Naval Facilities Engineering Command, 19917 7th Ave. NE, Poulsbo, Washington 98370. 37 pp.

Estes JA, MT Tinker, AM Doroff, DM Burn. 2005. Continuing sea otter population declines in the Aleutian archipelago. Marine Mammal Science 21:169-172.

Estes JA, MT Tinker, TM Williams, DF Doak. 1998. Killer whale predation linking oceanic and near-shore ecosystems. Science 282:473-476.

Evans TJ, DM Burn, AR DeGange. 1997. Distribution and relative abundance of sea otters in the Aleutian Archipelago. U.S. Fish and Wildlife Service, Marine Mammals Management Office, Anchorage, Alaska. Technical Report, MMM 97-5. 29 pp.

Funk F. 2003. Overview of state-managed marine fisheries in southwest Alaska, with reference to northern sea otters. Alaska Department of Fish and Game, Juneau, Alaska. Regional Information Report 5J03-02.

Garshelis DL, JA Garshelis. 1984. Movements and Management of Sea Otters in Alaska. The Journal of Wildlife Management 48(3): 665-678.

Garshelis DL, AM Johnson, JA Garshelis. 1984. Social organization of sea otters in Prince William Sound. Alaska. Can. J. Zool. 62:2648-2658.

Goldstein T, JAK Mazet, VA Gill, AM Doroff, KA Burek, JA Hammond. 2009. Phocine distemper virus in northern sea otters in the Pacific Ocean, Alaska, USA. Emerging Infectious Diseases. Vol. 15(6):925-927. www.cdc.gov/eid.

Jameson RJ. 2002. Trans-located sea otter populations of the Oregon and Washington coasts. U.S. Geological Survey Biological Resources Division, California Science Center. Sea Otter Project, 200 S.W. 35th Street, Corvallis, Oregon 99773.

Johnson AM. 1982. Status of Alaska sea otter populations and developing conflicts with fisheries. Pages 293-299 *In* Transactions of the 47th North American Wildlife and Natural Resources Conference, Washington DC.

Kenyon KW. 1969. The sea otter in the eastern Pacific Ocean. U.S. Dept. Interior. N.A. Fauna, No. 68. 352 pp.

Kenyon KW. 1981. Sea otter (*Enhydra lutris*). Handbook of marine mammals, Vol 1. The walrus, sea lions, fur seals, and sea otter. Academic Press, San Diego, CA. 235 pp.

Lensink, CJ. 1962. The history and status of sea otters in Alaska. Ph.D. dissertation, Purdue University, West Lafayette, IN. 188 pp.

Manly BFJ, AS Van Atten, KJ Kletz, C Nations. 2003. Incidental catch of marine mammals and birds in the Kodak Island set gillnet fishery in 2002. Western EcoSystems Technolgy Inc. report, Cheyenne, WY 91 pp.

Mazet JAK, IA Gardner, DA Jessup, LJ Lowenstine. 2001. Effects of petroleum on mink applied as a model for reproductive success in sea otters. Journal of Wildlife Diseases 37(4):686-692.

Monnett C, LM Rotterman. 1988. Movement patterns of adult female and weanling sea otters in Prince William Sound, Alaska. Pages 131-161 *In* Population status of California sea otters. D.B. Siniff, K. Ralls (*eds.*). Final report to the Minerals Management Service, U.S. Department of Interior 14-12-001-3003.

Nowak R. 1999. Walker's mammals of the world. Baltimore and London: Johns Hopkins University Press.

Perez MA. 2006. Analysis of marine mammal by-catch data from the trawl, longline, and pot groundfish fisheries of Alaska, 1998-2004, defined by geographic area, gear type, and target groundfish catch species. NOAA Technical Memorandum NMFS-AFSC-167.

Perez, MA. 2007. By-catch of marine mammals in the groundfish fisheries of Alaska, 2006. Alaska Fisheries Science Center Processed Draft Report.

Peterson CH, SD Rice, JW Short, D Esler, JL Bodkin, BE Ballachey, DB Irons. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. Science 302.

Ralls K, Siniff DB, AM Doroff, A Mercure. 1992. Movement patterns of sea otters relocated along the California coast. Marine Mammal Science 1992(2):179-184.

Rausch R. 1953. Studies on the helminth fauna of Alaska. XIII. Disease in the sea otter with special reference to helminth parasites. Ecology 34:584-604.

Riedman ML, JA Estes. 1990. The Sea Otter (Enhydra lutris): Behavior, Ecology, and Natural History. U.S. Fish and Wildlife Service, Santa Cruz, California Biological Report 90 (14).

Rotterman LM, T Simon-Jackson. 1988. Sea otter. Pages 237-275 *In* Selected marine mammals of Alaska. JW Lentfer (*ed.).* National Technical Information Service. PB88-178462, Springfield, Virginia.

Schneider KB. 1976. Assessment of the Distribution and Abundance of Sea Otters Along the Kenai Peninsula, Kamishak Bay and the Kodiak Archipelago. 333-358 pp.

Short JW, PM Harris. 1996. Petroleum hydrocarbons in caged mussels deployed in Prince William Sound after the Exxon Valdez oil spill. SD Rice, RB Spies, DA Wolfe, BA Wright (*eds.*). Proc. Exxon Valdez Oil Spill Symp. Am. Fish. Soc. Symp. 18:29-39.

Sinha AA, CH Conaway, KW Kenyon. 1966. Reproduction in the female sea otter. Journal of Wildlife Management 30:121-130.

Springer AM, JA Estes, GB van Vleit, TM Williams, DF Doak, EM Danner, KA Forney, and B. Pfister. 2003. Sequential megafaunal collapse in the North Pacific Ocean: An ongoing legacy of industrial whaling? Proceedings of the National Academy of Sciences of the United States of America.

Stephensen SW, DB Irons, SJ Kendall, BK Lance, LL MacDonald. 2001. Marine bird and sea otter population abundance of Prince William Sound, Alaska: trends following the T/V Exxon Valdez oil spill, 1989-2000. Restoration Project 00159 Annual report. USFWS Migratory Bird Management, Anchorage, Alaska. 114 pp.

[USFWS] U.S. Fish and Wildlife Service. 2005. Endangered and threatened wildlife and plants; Determination of threatened status and special rule for the southwest Alaska distinct population segment of the northern sea otter (*Enhydra lutris kenyoni*). Federal Register 70(152):46371.

[USFWS] U.S. Fish and Wildlife Service. 2008a. Stock assessment report. Northern sea otter (*Enhydra lutris kenyoni*): Southwest Alaska stock. August 1, 2008. Accessed 10/6/08. http://edocket.access.gpo.gov/2008/E8- 17804.htm.

[USFWS] U.S. Fish and Wildlife Service. 2008b. Biological opinion for Bureau of Land Management for the northern planning areas of the National Petroleum Reserve-Alaska. Unpublished report. Fairbanks Field Office, Alaska.

[USFWS] U.S. Fish and Wildlife Service. 2008c. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Southwest Alaska Distinct Population Segment of the Northern Sea Otter (Enhydra lutris kenyoni). Federal Register. 73 (242):76454.

[USFWS] U.S. Fish and Wildlife Service. 2010. Southwest Alaska Distinct Population Segment of the Northern Sea Otter (*Enhydra lutris kenyoni*)-Draft Recovery Plan. Marine Mammals Management Office. Region 7, Alaska:171 pp.

[USFWS] U.S. Fish and Wildlife Service. 2014b. Revised Northern Sea Otter (*Enhydra lutris kenyoni*): Southwest Alaska Stock Assessment Report. Anchorage, Alaska. Department of the Interior, Marine Mammals Management.

VanBlaricom GR, JA Ames, MD Harris, RA Hardy. 2001 California's Living Marine Resources: A Status Report to California Department of Fish and Game. California Department of Fish and Game. December, 2001.

Von Biela VR, JW Testa, VA Gill, GM Burns. 2007. Evaluating cementum to determine past reproduction in northern sea otters. Journal of Wildlife Management 72:618-624.

Von Biela VR, VA Gill, JL Bodkin, JM Burns. 2008. Evidence of phenotypic plasticity in the average age at first reproduction of northern sea otters (*Enhydra lutris kenyoni*) in Alaska. Contact: VA Gill, U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, Alaska.

Wilson DE, MA Bogan, RL Brownell, JR, AM Burdin, MK Maminov. 1991. Geographic variation in sea otters (*Enhydra lutris)*. Journal of Mammalogy 72:22-36.

Short-tailed albatross (Phoebastria albatratus)

Artukhin YB, AV Vinnikov, DA Terentiev, and O.I. Il'in 2013. Streamer lines — effective seabird scarer for demersal longline fishery. Proceedings TINRO (Pacific Fisheries Research Center). Vol. 175:277–290.

Austin OL. 1949. The Status of Steller's Albatross. Pacific Science 3: 283-295.

[BOEM] Bureau of Ocean Energy Management. 2014. Notice of Intent To Prepare an Environmental Assessment for Proposed Wind Energy-Related Development Activities on the Pacific Outer Continental Shelf (OCS) Offshore Oregon and Notice of Public Scoping Meetings. Federal Register 79:30876-30877.

[COSEWIC] Committee on the Status of Endangered Wildlife in Canada. 2014. COSEWIC Assessment and Status Report on the Short-tailed Albatross Phoebastria albatrus in Canada - 2013. November 20, 2014. Government of Canada. Available:

http://www.sararegistry.gc.ca/default.asp?lang=En&n=DA30D568-1#_06_4 (January 2015).

DeGange AR. 1981. The short-tailed albatross, *Diomedea albatrus*, its status, distribution and natural history. Unpubl. rep. U.S. Fish and Wildlife Service. 36 pp.

Deguchi T, RM Suryan, K Ozaki, JF Jacobs, F Sato, N Nakamura, and GR Balogh. 2014. Early successes in translocation and hand-rearing of an endangered albatross for species conservation and island restoration. Oryx 48:195-203.

Finkelstein ME, RH Gwiazda, DR Smith. 2003. Lead poisoning of seabirds: environmental risks from leaded paint at a decommissioned military base. Environmental Science and Technology 37: 3256-3260.

Finkelstein M, S Wolf, M Goldman, and D Doak. 2007. A Stochastic Population-based Model for the Short-tailed Albatross (*Phoebastria albatrus*) Unpublished Report to the Short-tailed Albatross Recovery Team, April 17th, 2007. Ecology and Evolutionary Biology Department, University of California, Santa Cruz.

Finkelstein ME, S Wolf, M Goldman, DF Doak, PR Sievert, G Balogh, and H Hasegawa. 2010. The anatomy of a (potential) disaster: Volcanoes, behavior, and population viability of the short-tailed albatross (*Phoebastria albatrus*). Biological Conservation 143(2010):321-331.

Fisheries Agency of Japan. 2004. Implementation of the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (JPOA-IUU). Fisheries Agency, Government of Japan. 11 pp.

Fisheries Agency of Japan. 2009. Japan's National Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries Revised Version. Fisheries Agency, Government of Japan. 8 pp.

Fisheries and Oceans Canada. 2007. National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries. 33 pages. http://www.dfo-mpo.gc.ca/npoapan/ npoa-pan/NPOA-Seabirds_e.pdf [Accessed July 20, 2014].

Fry MD, Fefer SI, Sileo, L. 1987. Ingestion of plastic debris by Laysan Albatrosses and Wedge-tailed Shearwaters in the Hawaiian Islands. Marine Pollution Bulletin 18(6): 339- 343.

Gall AE, RH Day, and TC Morgan. 2013. Distribution and Abundance of Seabirds in the Northeastern Chukchi Sea, 2008–2012, Final Report. Prepared by ABR, Inc. - Environmental Research & Services, Fairbanks, Alaska for ConocoPhillips Company, Shell Exploration & Production Company and Statoil USA E & P, Inc, Anchorage, Alaska. 88 pp.

Gray H, GL Lattin, CJ Moore. 2012. Incidence, mass and variety of plastics ingested by Laysan (*Phoebastria immutabilis*) and Black-footed Albatrosses (*P. nigripes*) recovered as by-catch in the North Pacific Ocean. Mar Pollut Bull. 64(10):2190-2.

Guy TJ, SL Jennings, RM Suryan, EF Melvin, MA Bellman, LT Ballance, BA Blackie, D.A. Croll, T. Deguchi, T.O. Geernaert, et al. 2013. Overlap of North Pacific albatrosses with the U.S. west coast groundfish and shrimp fisheries. Fisheries Research. 147:222-234.

Hasegawa, H. 1982. The breeding status of the short-tailed albatross *Diomedea albatrus*, on Torishima, 1979/80 1980/81. Journal of the Yamashina Institute of Ornithology 14: 16-24.

Hasegawa, H. and A. DeGange. 1982. The short-tailed albatross *Diomedea albatrus*, its status, distribution and natural history. American Birds 6: 806-814.

Hasegawa, H. 1977. Status of the short-tailed albatross on Torishima in 1976/77. Pacific Seabird Group Bull. 4: 13-15 Hasegawa, H. 1978. Recent observations of the short-ailed albatross, *Diomedea albatrus*, on Torishima. Misc. Rpt. J. Yamashina Inst. Ornithol. 10 no. 1,2 :58-68.

[IPCC] Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K., and A. Reisinger (eds.)]. Geneva, Switzerland: IPCC.

Iwaki T, Y Yokohata, H Kajigaya, F Sato, and T Hiraoka, 2006. *Tetrabothrius* sp. (Cestoda: Tetrabothriidae) and *Stegophorus stellaepolaris* (Nematoda: Acuariidae) Collected from a Short-tailed Albatross (*Diomedea albatrus*). Japanese Journal of Zoo and Wildlife Medicine, 11(2): 83-86. (in Japanese with an English abstract).

Kenyon, KW, and Kridler, E. 1969. Laysan Albatross swallow indgestible matter. Auk 86: 339-34.

Kuletz KJ, M Renner, EA Labunski and GL Hunt Jr. 2014. Changes in the distribution and abundance of albatrosses in the eastern Bering Sea: 1975–2010. Deep Sea Research Part II: Topical Studies in Oceanography. DOI: 10.1016/j.dsr2.2014.05.006.

Lavers JL, AL Bond, and I Hutton, 2014. Plastic ingestion by Flesh-footed Shearwaters (*Puffinus carneipes*): implications for fledgling body condition and the accumulation of plastic-derived chemicals. Environmental Pollution 187:124–129.

Melvin EF, KS Dietrich, S Fitzgerald, and T Cardoso. 2011. Reducing seabird strikes with trawl cables in the pollock catcher-processor fleet in the eastern Bering Sea. Polar Biology 34:215–226.

[NMFS] National Marine Fisheries Service. 2002. Alaska Regional Office, Sustainable Fisheries Division. Information Bulletin 02-65. August 15, 2002, 2:10 p.m. Website accessed on 11/14/2012. http://alaskafisheries.noaa.gov/index/infobulletins.asp?BulletinID=213 "Volcanic Eruption on Torushima Island, Japan site of breeding colony of the endangered STAL".

[NMFS] National Marine Fisheries Service. 2013. 2013 Report of the Secretary of Commerce to the Congress of the United States concerning U.S. actions taken on foreign large-scale high seas driftnet fishing. National Marine Fisheries Service, Washington, D.C. 15 pp.

Nunn GB, J Cooper, P Jouventin, CJR Robertson, GG Robertson. 1996. Evolutionary relationships among extant albatrosses (Procellariiformes: Diomedeidae) established from complete Cytochrome-B gene sequences. The Auk 13(4): 784-801.

O'Connor AJ. 2013. Distributions and fishery associations of immature short-tailed albatrosses *Phoebastria albatrus*, in the North Pacific. Oregon State University, Corvallis, Oregon.

Ormseth OA, 2012. Assessment of the squid stock complex in the Bering Sea and Aleutian Islands, *In* Stock assessment and fisheries evaluation report, North Pacific Fisheries Management Council, Anchorage, Alaska, pp. 1850-1886. http://www.afsc.noaa.gov/REFM/stocks/plan_team/BSAIsquid.pdf.

Richardson S. 1994. Status of the short-tailed albatross on Midway Atoll. Elepaio 54: 35-37.

Robertson D. 1980. Rare birds of the West Coast of North America. Pacific Grove, CA: Woodcock Publications, pp. 6-9.

Sanger GA. 1972. The recent pelagic status of the short-tailed albatross (*Diomedea albatrus*). Biological Conservation 4(3): 186-193.

Sato N, D Ochi, H Minami, K Yokawa. 2012. Evaluation of the Effectiveness of Light Streamer Tori-Lines and Characteristics of Bait Attacks by Seabirds in the Western North Pacific. PLoS ONE 7(5): e37546.

Sato N, H Minami, N Katsumata, D Ochi, K Yokawa. 2013. Comparison of the effectiveness of paired and single tori lines for preventing bait attacks by seabirds and their bycatch in pelagic longline fisheries. Fisheries Research 140: 14–19

Sherburne J. 1993. Status Report on the Short -tailed Albatross *Diomedea albatrus*. Unpublished Rep. for the U.S. Fish and Wildlife Service. Alaska Natural Heritage Program. 33pp.

Sievert PR, L Sileo. 1993. The effects of ingested plastic on growth and survival of albatross chicks. Pp. 212-17 in The status, ecology, and conservation of marine birds of the North Pacific ed by K. Vermeer, K. T. Briggs, K. H. Morgan and D. Siegal-Causey. Canadian Wildlife Service Special Publication: Ottawa.

Steinhauser G, A Brandl, TE Johnson. 2013. Comparison of the Chernobyl and Fukushima nuclear accidents: A review of the environmental impacts. Science of the Total Environment 487:575.

Steinhauser G, A Brandl, TE Johnson. 2014. Erratum to "Comparison of the Chernobyl and Fukushima nuclear accidents: A review of the environmental impacts" Science of the Total Environment 470–471:800–817.

Storlazzi CD, P Berkowitz, MH Reynolds, JB Logan. 2013. Forecasting the impact of storm waves and sea-level rise on Midway Atoll and Laysan Island within the Papahānaumokuākea Marine National Monument—a comparison of passive versus dynamic inundation models: U.S. Geological Survey Open-File Report 2013-1069.78 pp.

Suryan RM, DJ Anderson, SA Shaffer, DD Roby, Y Tremblay, DP Costa, PR Sievert, F Sato, K Ozaki, GR Balogh, and N Nakamura. 2008. Wind, waves, and wing loading: Morphological specialization may limit range expansion of endangered albatrosses. PLoS ONE 3:e4016. doi:4010.1371/journal.pone.0004016.

Suryan RM, KS Dietrich, EF Melvin, GR Balogh, F Sato, K Ozaki. 2007. Migratory routes of short-tailed albatrosses: Use of exclusive economic zones of North Pacific Rim countries and spatial overlap with commercial fisheries in Alaska. Biological Conservation 137:450-460.

Suryan RM, KN Fischer. 2010. Stable isotope analysis and satellite tracking reveal interspecific resource partitioning of nonbreeding albatrosses off Alaska. Canadian Journal of Zoology 88:299-305.

Suryan RM, F Sato, GR Balogh, DK Hyrenbach, PR Sievert, K Ozaki. 2006. Foraging destinations and marine habitat use of short-tailed albatrosses: A multi-scale approach using first-passage time analysis. Deep-Sea Research, Part II 53:370-386.

Suryan RM, KS Dietrich, EF Melvin, GR Balogh, F Sato, and K Ozaki. 2007. Migratory routes of short-tailed albatross: use of exclusive economic zones of North Pacific Rim countries and spatial overlap with commercial fisheries in Alaska. Biological Conservation 137: 450-460.

Suryan R, K Ozaki, G Balogh. 2008. Unpublished breeding short-tailed albatross telemetry data.

Swem T, A Matz. 2008. Analysis of the current status of the Alaska-breeding population of the Steller's Eider. Report of the Steller's Eider Recovery Team workshop, January, 2008. Fairbanks. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office.

Tanabe S, A Subramanian. 2011. Great Eastern Japan Earthquake – Possible marine environmental contamination by toxic pollutants (Editorial). Marine Pollution Bulletin 62:883-884.

Tanaka K, H Takada, R Yamashita, K Mizukawa, M Fukuwaka, Y,Watanuki. 2013. Accumulation of plastic-derived chemicals in the tissues of seabirds ingesting marine plastics. Marine Pollution Bulletin. 69(1-2):219-222.

Taylor SK, CS Gorbics, E Luciani, C Zeeman, J Gibson, A Little. 2009. Ecological Risk assessment for lead in soil and Laysan albatross chicks on Sand Island, Midway Atoll National Wildlife Refuge. U.S. Fish and Wildlife Service. Carlsbad, California. 47 pp.

Tickell WLN. 1975. Observations on the status of Steller's albatross (*Diomedea albatrus*) 1973. Bulletin of the International Council for Bird Preservation XII:125-131.

Tokyo Metropolitan Government. 2014. An Albatross Chick that seemed to be the Short-tailed Albatross (*Phoebastria albatrus*), was found on the Nakodojima Island of the Mukojima Island Group of the Ogasawara Archipelago after WWII period. Press Release, May 12, 2014. Tokyo Metropolitan Government, Bureau of the Environment 2pp. (Translated by Kazuo Horikoshi, June 10, 2014.

Tuck GS. 1978. A Field Guide to the Seabirds of Britain and the World. London: Collins Co. Ltd. 17 pp.

United Nations. 1989. United Nations General Assembly Resolution 44/225: Large-scale pelagic driftnet fishing and its impact on the living marine resources of the world's oceans and seas. United Nations General Assembly. http://www.un.org/documents/ga/res/44/a44r225.htm.

United Nations. 1990. United Nations General Assembly Resolution 45/197: Large-scale pelagic driftnet fishing and its impact on the living marine resources of the world's oceans and seas. United Nations General Assembly. http://www.un.org/documents/ga/res/45/a45r197.htm.

United Nations. 1991. United Nations General Assembly Resolution 46/215: Large-scale pelagic drift-net fishing and its impact on the living marine resources of the world's oceans and seas. United Nations General Assembly. http://www.un.org/documents/ga/res/46/a46r215.

Uosaki K, H Minami, O Abe1, K Satoh, O Sakai, T Matsumoto, and Y Akatsuka. 2013. National tuna fisheries report of Japan, annual report to the Commision, Part1: Information on fisheries, research and statistics. Western and Central Pacific Fisheries Commission. Pohnpei, Federated States of Micronesia. 39 pp.

Uosaki K, H Minami, O Abe1, K Satoh, T Matsumoto, and Y Akatsuka. 2014. National tuna Fisheries report of Japan, annual report to the Commision, Part1: Information on fisheries, research and statistics. Western and Central Pacific Fisheries Commission. Pohnpei, Federated States of Micronesia. 39 pp.

[USCG and EPA] U.S. Coast Guard and Environmental Protection Agency. 2014. Biological Assessment of the Alaska Federal/State preparedness plan for response to oil and hazardous substance discharges/releases (Unified Plan). Prepared by Windward Environmental LLC and ERM. 426 pp w/appendices.

[USFWS] U.S. Fish and Wildlife Service. 2008. Short-tailed albatross recovery plan. Anchorage, AK, 105 pp.

[USFWS] U.S. Fish and Wildlife Service. 2009. Short-tailed albatross (*Phoebastria albatrus*) 5-Year review: Summary and evaluation. Anchorage, AK. 78 pp.

[USFWS] U.S. Fish and Wildlife Service. 2014a. 5-Year Review: Summary and Evaluation Short-tailed Albatross (*Phoebastria albatrus*). Anchorage. Anchorage Fish and Wildlife Field Office.

[USFWS] U.S. Fish and Wildlife Service. 2012. Biological opinion regarding the effects of the continued operation of the Pacific Coast Groundfish Fishery. Fish and Wildlife Service, Portland, Oregon, 48 pp.

[USFWS] U.S. Fish and Wildlife Service. 20014. Short-tailed albatross (*Phoebastria albatrus*) 5-Year review: Summary and evaluation. Anchorage, AK. 42 pp.

Vo AE, MS Bank, JP Shinec, SV Edwards. 2011. Temporal increase in organic mercury in an endangered pelagic seabird assessed by century-old museum specimens. Proceedings of the National Academy of Science. 108(18):7466–7471.

World Wildlife Fund. 2014. Protecting Albatross from Fishing Lines. Fall 2014. World Wildlife Fund Magazine. Available: http://www.worldwildlife.org/magazine/issues/fall-2014/articles/protecting-albatross-from-fishing-lines (January 2015).

Yokota K, H Minami, M Kiyota. 2011. Effectiveness of tori-lines for further reduction of incidental catch of seabirds in pelagic longline fisheries. Fisheries Science 77:479–485.

Young LC, BJ Zaun, and EA VanderWerf. 2008. Successful same-sex pairing in Laysan albatross. Biology Letters 4:323-325.

Young LC, C Vanderlip, DC Duffy, V Afanasyev, SA Shaffer. 2009. Bringing home the trash: Do colony-based differences in foraging distribution lead to increased plastic ingestion in Laysan Albatrosses? PLoS ONE 4(10): e7623.

Young LC, EA VanderWerf. 2014. Adaptive value of same-sex pairing in Laysan albatross. Proceedings of the Royal Society B: Biological Sciences 281.

Polar Bear (Ursus maritimus)

Aars J, NJ Lunn and A.E. Derocher, (eds.). 2006. Polar Bears: Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 20–24 June 2005, Seattle, Washington, USA. IUCN, Gland, Switzerland and Cambridge, UK.ABR, Inc. 2007.

Amstrup SC. 2000. Polar Bear. In J. C. Truett and S. R. Johnson, editor. The Natural History of an Oil Field. San Diego, CA: Academic Press.

Amstrup SC. 2003. Polar Bear (*Ursus maritimus*). In G. A. Feldhamer, B. C. Thompson and J. A. Chapman, editor. Mammals of North America: Biology, Management, and Conservation. Baltimore, Maryland, USA: John Hopkins University Press.

Amstrup SC, DP DeMaster. 1988. Polar Bear - *Ursus maritimus*. In J. W. Lentfer, editor. Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations. Washington, D.C.: Marine Mammal Commission.

Amstrup SC, GM Durner, I Stirling, NJ Lunn, F Messier. 2000. Movements and distribution of polar bears in the Beaufort Sea. Canadian Journal of Zoology 78(6):948-966.

Amstrup SC, BG Marcot, DC Douglas. 2007. Forecasting the Range-wide Status of Polar Bears at Selected Times in the 21st Century Reston, Virginia. U.S. Geological Survey

Amstrup SC, I. Stirling, and J.W. Lentfer. 1986. Past and present status of polar bears in Alaska. Wildlife Society Bulletin 14: 241-254.

Best RC. 1985. Digestibility of ringed seals by the polar bear. Canadian Journal of Zoology 63(5):1033-1036.

Brower CD, A Carpenter, ML Branigan, W Calvert, T Evans, AS Fischbach, JA Nagy, S Schliebe, I Stirling. 2002. The Polar Bear Management Agreement for the Southern Beaufort Sea: an Evaluation of the First Ten Years of a Unique Conservation Agreement. Arctic 55(4):362-372.

Bentzen TW, EH Follman, S.C. Amstrup, G.S .York, M.J.Wooler, and T.M. O'Hara. 2007. Variation in winter diet of Southern Beaufort Sea polar bears inferred from stable isotope analysis. Can J Zool 85:596–608.

Comiso JC. 2012. Large decadal decline of the arctic multiyear ice cover. Journal of Climate 25: 1176-1193. doi: 10.1175/JCLI-D-11-00113.1.

Comiso JC. 2003. Warming trends in the Arctic from clear sky satellite observations. Journal of Climate 16:3498-3510.

Comiso JC. 2006. Arctic warming signals from satellite observations. Weather 61(3): 70-76.

DeMaster DP, MC Kingsley, and I. Stirling. 1980. A multiple mark and recapture estimate applied to polar bears. Canadian Journal of Zoology 58:633-638.

Derocher AE, NJ Lunn, and I. Stirling. 2004. Polar bears in a warming climate. Integrative and Comparative Biology 44:163-176.

Dunton KH, JL Goodall, SV Schonberg, JM Grebmeier, DR Maidment. 2005. Multi-Decadal Synthesis of Benthic-Pelagic Coupling in the Western Arctic: Role of Cross-Shelf Advective Processes. Deep-Sea Research Part II-Topical Studies in Oceanography 52(24-26):3462-3477.

Durner GM, SC Amstrup, R. Nielson, T. McDonald. 2004. Using discrete choice modeling to generate resource selection functions for female polar bears in the Beaufort Sea. Pages 107–120 *in* S. Huzurbazar (Editor). Resource Selection Methods and Applications: Proceedings of the 1st International Conference on Resource Selection, 13–15 January 2003, Laramie, Wyoming.

Ferguson SH, MK Taylor, and F. Messier. 1997. Space use by polar bears in and around Auyuittuq National Park, Northwest Territories, during the ice-free period. Can. J. Zool, 751585-1594.

Ferguson SH, MK Taylor, EW Born, A Rosing-Asvid, F Messier. 2001. Activity and movement patterns of polar bears inhabiting consolidated versus active pack ice. Arctic 54(1):49-54.

Fowler C, WJ Emery, and J. Maslanik. 2004. Satellite-derived evolution of Arctic sea-ice age: October 1978 to March 2003. Geoscience and Remote Sensing Letters, IEEE, Volume 1, Issue 2, April 2004 pp.71–74.

Garner GW, SE Belikov, MS Stishov, VG Barnes, Jr., SM Arthur. 1994. Dispersal patterns of maternal polar bears from the denning concentration on Wrangel Island. Ninth International Conference on Bear Research and Management; Missoula, Montana, USA: International Association for Bear Research and Management.

Garner GW, ST Knick, DC Douglas. 1990. Seasonal Movements of Adult Female Polar Bears in the Bering and Chukchi Seas. Bears: Their Biology and Management 8(A Selection of Papers from the Eighth International Conference on Bear Research and Management, Victoria, British Columbia, Canada, February 1989):219-226. http://www.jstor.org/stable/3872922 (January 2015).

Haas C, S Hendricks, H. Eicken, and A. Herber, 2010: Synoptic airborne thickness surveys reveal state of Arctic sea-ice cover. Geophysical Research Letters 37.

Harington CR. 1968. Denning habits of the polar bear (Ursus maritimus Phipps). Report Series 5, Canadian Wildlife Service, Ottawa, Canada.

Holland M, CM Bitz, and B. Tremblay. 2006. Future abrupt reductions in summer Arctic sea-ice. Geophysical Research Letters 33 L25503: doi 10.1029/200661028024: 1-5.

International Union for Conservation of Nature/Polar Bear Specialist Group (IUCN/PBSG) 2015. Summary of polar bear population status per 2014. January 2015 Accessed January 28, 2015. http://pbsg.npolar.no/export/sites/pbsg/en/docs/status-table-2014.pdf.

Jonkel CJ, GB Kolenosky, R.Robertson, and R.H. Russell. 1972. Further notes on the polar denning habits. International Conference on Bear Biology and Management 2: 142-158.

Kiliaan HPL, I Stirling. 1978. Observations on overwintering walruses in the eastern Canadian High Arctic. J. Mammal, 59197-200.

Kingsley MCS. 1979. Fitting the von Bertalanffy growth equation to polar bear age–weight data. Canadian Journal of Zoology 57:1020–25.

Kostyan EY. 1954. New data on the reproduction of the polar bear. Zoologicheskii Zhurna I33:207-15.

Lentfer JW, RJ Hensel. 1980. Alaskan polar bear denning. International Conference on Bear Research and Management 4:101–8.

Lindsay RW, J Zhang. 2005. The thinning of the Arctic sea-ice, 1988-2003: have we passed a tipping point? Journal of Climate 18: 4879-4894.

Lowry LF, JJ Burns, and R. R. Nelson. 1987. Polar bear, Ursus maritimus, predation on belugas, Delphinapterus leucas, in the Bering and Chukchi seas. Can. Field-Nat, 101141-146.

Mauritzen M, AE Derocher, O Wiig. 2001. Space-use strategies of female polar bears in a dynamic sea ice habitat. Canadian Journal of Zoology 79(9):1704-1713.

[NSIDC] National Snow and Ice Data Center (NSIDC). 2011a. Ice extent low at start of melt season; ice age increases over last year. NSIDC Press Release. Boulder, Co: Cooperative Institute for Research in Environmental Sciences, National Snow and Ice Data Center; 2011; 05 April 2011. 4 pp. Available at http://nsidc.org/arcticseaicenews/2011/040511.html (accessed December 19, 2011).

[NSIDC] National Snow and Ice Data Center (NSIDC). 2011b. Summer 2011: Arctic sea-ice near record lows. NSIDC Sea-ice News and Analysis. Boulder, Co: Cooperative Institute for Research in Environmental Sciences, National Snow and Ice Data Center; 2011; 04 October 2011. 4 pp. Available at http://nsidc.org/arcticseaicenews/2011/100411.html, accessed December 19, 2011.

[NSIDC] National Snow and Ice Data Center. 2012. Monthly September ice extent for 1979 to 2012 shows a decline of 13.0% per decade. Credit: National Snow and Ice Data Center http://nsidc.org/arcticseaicenews/2012/10/poles-apart-a-record-breaking-summer-and-winter/, accessed December 18, 2012.

Obbard ME, GW Thiemann, E Peacock, and T.D. DeBruyn, eds. 2010. Polar Bears: Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009. Gland, Switzerland and Cambridge, UK: IUCN. vii + 235 pp.

Parkinson CL, DJ Cavalieri, P. Gloersen, H.J. Zwally, and J.C. Comiso. 1999. Arctic sea-ice extents, areas, and trends, 1978-1996. Journal of Geophysical Research 104(C9):20837-20856.

Pedersen A. 1945. The polar bear: Its distribution and way oflife. Aktieselskabet E. Bruun, Copenhagen.

Prestrud P, I Sterling. 1994. The international polar bear agreement and the current status of polar bear conservation. Aquatic Mammals 20(3):113-124.

Prevett JP, GB Kolenosky. 1982. The status of polar bears in Ontario. Le Naturalist Canadien 109(4):933-939.

Ramsay MA, I. Stirling. 1990. Fidelity of female polar bears to winter-den sites. Journal of Mammalogy 71:233–36.

Ray CE. 1971. Polar bear and mammoth on the Pribilof Islands. Arctic 24(1):9-18.

Richardson E, I Stirling, and D.S. Hilk. 2005. Polar bear (*Ursus maritimus*) maternity denning habitat in Western Hudson Bay: a bottom –up approach to resource selection functions. Canadian Journal of Zoology 83:860-870.

Rothrock DA, Y Yu, GA Maykut. 1999. Thinning of the Arctic sea-ice cover, Geophysical Research Letters 26: 3469-3472.

Schliebe S, KD Rode, JS Gleason, J. Wilder, K. Proffitt, T.J. Evans, and S. Miller. 2008. Effects of sea-ice extent and food availability on spatial and temporal distribution of polar bears during the fall open-water period in the Southern Beaufort Sea. Polar Biology 31: 999-1010. DOI 10.1007/s00300-008-0439-7.

Schliebe S, TJ Evans, K Johnson, M Roy, S Miller, C. Hamilton, R. Meehan, and S. Jahrsdoerfer. 2006. Status assessment in response to a petition to list polar bears as a threatened species under the U.S. Endangered Species Act. U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, Alaska. 262pp.

Schweinsburg RE. 1979. Summer snow dens used by polar bears in the Canadian high Arctic. Arctic 32(2):165-169.

Schweinsburg RE, LJ Lee. 1982. Movement of four satellite-monitored polar bears in Lancaster Sound, Northwest Territories. Arctic 35(4):504-511.

Smith TG. 1980. Polar bear predation of ringed and bearded seals in the land-fast sea-ice habitat. Can. J. Zool, 582201-2209.

Smith TG. 1985. Polar bears, Ursus maritimus, as predators of belugas, Delphinapterus leucas. Can. Field-Nat, 9971-75.

Smith TG, B Sjare. 1990. Predation of belugas and narwhals by polar bears in nearshore areas of the Canadian High Arctic. Arctic, 4399-102.

Stirling I, C Jonkel, P Smith, R Robertson, D Cross. 1977. The ecology of the polar bear (*Ursus maritimus*) along the western coast of Hudson Bay. Occasional Paper No. 33. Canadian Wildlife Service. Ottowa.

Stirling I. 1988. Polar Bears. The University of Michigan Press, Ann Arbor.

Stirling I. 2002. Polar bears and seals in the eastern Beaufort Sea and Amundsen Gulf: a synthesis of population trends and ecological relationships over three decades. Arctic 55:59-76.

Stirling I, AM Pearson, FL Bunnell. 1976. Population ecology studies of polar and grizzly bears in northern Canada. Transactions of the Forty-first North American Wildlife and Natural Resources Conference. Washington, D.C., March 21-25, 1976. 41: 421–30.

Stirling I, D Andriashek, W Calvert. 1993. Habitat preferences of polar bears in the western Canadian Arctic in late winter and spring. Polar Record 29(168):13-24.

Stirling I. 1997. The importance of polynyas, ice edges, and leads to marine mammals and birds. J. Mar. Syst, 109-21.

Stirling I, CL Parkinson. 2006. Possible effects of climatic warming on selected populations of polar bears (*Ursus maritimus*) in the Canadian Arctic. Arctic 59(3):261-275.

Stroeve J, M Serreze, S Drobot, S Gearheard, M. Holland, J. Maslanik, W. Meier, and T. Scambos. 2008. Arctic Sea-ice Extent Plummets in 2007. EOS, Transactions, American Geophysical Union 89(2):13-14.

[USFWS] U.S. Fish and Wildlife Service. 2012. Trip Report: Polar Bear Conservation Activities at Barter Island September 5-October 3, 2012. By: Susanne Miller, Marine Mammals Management, U.S. Fish and Wildlife Service, Anchorage, Alaska.

Wiig Y, EW Born, LT Pedersen. 2003. Movements of female polar bears (Ursus maritimus) in the East Greenland pack ice. Polar Biology 26(8):509-516.

Walrus (Odobenus rosmarus)

Belikov S, AN Boltunov and Y. Gorbunov. 1996. Distribution and migration of polar bears, Pacific walruses, and gray whales depending on ice conditions in the Russian arctic. Polar Biology 9: 263-274.

Bluhm BA, R Gradinger. 2008. Regional variability in food availability for Arctic marine mammals. Ecological Applications 18: S77-S96.

Fay FH. 1982. Ecology and Biology of the Pacific walrus, *Odobenus rosmarus divergens* Illiger. North American Fauna No. 74.

Fay FH, GC Ray and A. Kibal'chich. 1984. Time and location of mating and associated behavior of the Pacific walrus, *Odobenus rosmarus divergens*, Illiger. Pages 89-99, *in* Fay, F.H. and G.A. Fedoseev, (*Eds*) Soviet-American cooperative research on marine mammals. Volume 1 - pinnipeds. U.S. Department of Commerce, National Ocean and Atmospheric Association, Anchorage, AK.

Fay FH, BP Kelly, and J.L. Sease. 1989. Managing the exploitation of Pacific walruses: A tragedy of delayed response and poor communication. Marine Mammal Science 5: 1–16.

Fay FH, LL Eberhardt, B.P. Kelly, J.J. Burns and L.T. Quakenbush. 1997. Status of the Pacific walrus population, 1950-1989. Marine Mammal Science 13: 537–565.

Freitas C, KM Kovacs, R.A. Ims, M.A. Fedak, and C. Lydersen. 2009. Deep into the ice: Overwintering and habitat selection in male Atlantic walruses. Marine Ecology Progress Series 375: 247-261.

Gilbert JR, GA Fedoseev, D. Seagars, E. Razlivalov, and A. LaChugin. 1992. Aerial census of Pacific walrus, 1990. USFWS R7/MMM Technical Report 92-1. 33 pages.

Gilbert JR 1999. Review of previous Pacific walrus surveys to develop improved survey designs. Pages 75-84, *in* J. L. Laake, D. G. Robertson , and S.C. Amstrup, *eds*. Marine mammal survey and assessment methods. Taylor and Francis, London, UK, 287 pages.

Jay CV, S. Hills. 2005. Movements of walruses radio-tagged in Bristol Bay, Alaska. Arctic 58: 192-202.

Jay CV, AS Fischbach. 2008. Pacific walrus response to Arctic Sea-ice losses. U.S. Department of the Interior, U.S., Geological Survey, Alaska Science Center, Fact sheet 2008-3041, Anchorage, AK. 1 page.

Mymrin NI, GP. Smirnov, A.S. Gaevskiy and V.E. Kovalenko. 1990. Seasonal distribution and abundance of walruses in the Gulf of Anadyr of the Bering Sea. Zoological Journal 3: 105-113.

[NOAA Fisheries] National Oceanic and Atmosheric Administration Fisheries. 2011. Press Release: December 20, 2011 Deaths Of Ringed Seals In Alaska Declared An Unusual Mortality Event; Walrus Pending. Anchorage. National Marine Fisheries Service, Alaska Regional Office. Available: http://www.fws.gov/alaska/fisheries/mmm/walrus/disease_investigation.htm (January 2015).

Ray GC, J. McCormick-Ray, P. Berg, and H. E. Epstein. 2006. Pacific walrus: Benthic bioturbator of Beringia. Journal of Experimental Marine Biology and Ecology 330(1): 403-419.

Scribner KT, S Hill, S.R. Fain and M.A. Cronin. 1997. Population genetics studies of the polar bear (*Ursus maritimus*): a summary of available data and interpretation of results and research needs. Pages 173-184, *in* Dizon, A.E., S.J. Chivers, and W.F. Perrin (*Eds*). Molecular genetics of marine mammals. The Society for Marine Mammalogy, Special Publication 3. Sea coast in 2007. Poster, society for Marine Mammalogy annual meeting, Quebec City, Quebec, Canada.

Sease JL, DG Chapman. 1988. Pacific Walrus, *Odobenus rosmarus divergens*, Pages 17-38, *in* J.W. Lentfer, *ed.* Selected Marine Mammals of Alaska, Species Accounts with Research and Management Recommendations. Marine Mammal Commission, Washington, D.C.

Speckman SG, V. Chernook, D.M. Burn, M.S. Udevitz, A.A. Kochnev, A. Vasilev, and C.V. Jay. 2010. Results and evaluation of a survey to estimate Pacific walrus population size, 2006. Marine Mammal Science 27: 514–553DOI: 10.1111/j.1748-7692.2010.00419.x.

[USFWS] U.S. Fish and Wildlife Service. 2010. Pacific Walrus (*Odobenus rosmarus divergens*): Chukchi/Bering Sea Stock Assessment Report. US Department of Interior, US Fish and Wildlife Service, http://alaska.fws.gov/fisheries/mmm/stock/final_cbs_polar_bear_sar.pdf.

Spectacled Eider (Somateria fischer)

Anderson B, B. Cooper. 1994. Distribution and abundance of spectacled eiders in the Kuparuk and Milne Point oilfields, Alaska, 1993. Unpublished report prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, Alaska by ABR, Inc., Fairbanks, Alaska, and BBN Systems and Technologies Corp., Canoga Park, CA. 71 pp.

Anderson B, R Ritchie, A. Stickney, and A. Wildman. 1998. Avian studies in the Kuparuk oilfield, Alaska, 1998. Unpublished report for ARCO Alaska, Inc. and the Kuparuk River Unit, Anchorage, Alaska. 28 pp.

Bailey AM. 1948. Birds of Arctic Alaska. Denver Museum of Natural History Population Series 8:1–137.

Bart J, SL Earnst. 2005. Breeding ecology of spectacled eiders *Somateria fischeri* in Northern Alaska. Wildfowl 55:85–100.

Bent AC. 1925. Life histories of North American wild fowl. U.S. Natural Museum Bulletin. 130. Washington, DC.

Bowman TD, RA Stehn, and G. Walters. 2002. Population size and production of geese and eiders nesting on the Yukon-Kuskokwim Delta, Alaska in 2002. Unpublished report. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska. 22 pp.

Cottam C. 1939. Food habits of North American diving ducks. USDA Technical Bulletin 643, Washington, D.C.

Coulson JC. 1984. The population dynamics of the Eider Duck *Somateria mollissima* and evidence of extensive non-breeding by adult ducks. Ibis 126:525–543.

Dau CP. 1974. Nesting biology of the spectacled eider, *Somateria fischeri* (Brandt), on the Yukon-Kuskokwim Delta, Alaska. University of Alaska, Fairbanks, Alaska. M.S. thesis. 72 pp.

Dau CP, and S.A. Kistchinski. 1977. Seasonal movements and distribution of the spectacled eider. Wildfowl. 28:65–75.

Derksen DV, TC Rothe, and W.D. Eldridge. 1981. Use of wetland habitats in the National Petroleum Reserve–Alaska. U.S. Fish and Wildlife Service, Research. Publication. 141.

Drent R, S Daan. 1980. The prudent parent: energetic adjustments in breeding biology. Ardea 68:225–252.

Ely CR, CP Dau, and CA Babcock. 1994. Decline in population of Spectacled Eiders nesting on the Yukon-Kuskokwim Delta, Alaska. Northwestern Naturalist 75:81–87.

Esler D, JM Pearce, J. Hodges, and M.R. Petersen. 1995. Distribution, abundance and nesting ecology of spectacled eiders on the Indigirka River Delta, Russia. Unpublished progress report. National Biological Survey, Alaska Science Center. 12 pp.

Feder HM, NR Foster, S.C. Jewett, T.J. Weingartner, and R. Baxter. 1994a. Mollusks in the Northeastern Chukchi Sea. Arctic 47(2): 145–163.

Feder HM, AS Naidu, S.C. Jewett, J.M. Hameedi, W.R. Johnson, and T.E. Whitledge. 1994b. The northeastern Chukchi Sea: benthos-environmental interactions. Marine Ecology Progress Series 111:171–190.

Fischer JB, RA Stehn, and G. Walters. 2011. Nest population size and potential production of geese and spectacled eiders on the Yukon–Kuskokwim Delta, Alaska, 1985–2011. Unpublished Report. U.S. Fish and Wildlife. Service, Anchorage, Alaska. 43 pp.

Flint PL, JL Schamber. 2010. Long-term persistence of spent lead shot in tundra wetlands. Journal of Wildlife Management 74:148–151.

Flint PL and JB. Grand. 1997. Survival of spectacled eider adult females and ducklings during brood rearing. Journal of Wildlife Management 61:217-221.

Franson, J., M.R. Petersen, C. Meteyer, and M. Smith. 1995. Lead poisoning of spectacled eiders (*Somateria fischeri*) and of a common eider (*Somateria mollissima*) in Alaska. Journal of Wildlife Diseases 31:268–271.

Gabrielson, M. and N. Graff. 2011 Monitoring of Nesting Spectacled Eiders on Kigigak Island, Yukon Delta NWR, 2011. Unpublished report. U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, Alaska 99559. 16 pp.

Garner GW, PE Reynolds, editors. 1986. Arctic National Wildlife Refuge coastal plain resource assessment. Final report. Baseline study of fish, wildlife and their habitats, volume 1.

Grand JB. and PL Flint. 1997. Productivity of nesting spectacled eiders on the Lower Kashunuk River, Alaska. Condor 99:926–932.

Grand JB, PL Flint MR. Petersen, and J.B. Grand. 1998. Effect of lead poisoning on spectacled eiders survival rates. Journal of Wildlife Management 62:1103–1109.

Harwood C. and T. Moran. 1993. Productivity, brood survival, and mortality factors for spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1992. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska. 11pp + Appendix.

Johnson SR, DR Herter. 1989. The birds of the Beaufort Sea. BP Exploration (Alaska) Inc., Anchorage, Alaska, U.S.A. 372 pp.

Kondratev A, L Zadorina. 1992. Comparative ecology of the king eider Somateria spectabilis and spectacled eider Somateria fischeri on the Chaun tundra. Zool. Zhur. 71:99– 108. (in Russian; translation by J. Pearce, National Biological Survey, Anchorage, Alaska).

Korschgen CE. 1977. Breeding stress of female eiders in Maine. Journal of Wildlife Management 41:360–373.

Lake BC. 2007. Nesting Ecology of Spectacled and Common Eiders on Kigigak Island, Yukon Delta NWR, Alaska, 2007. Unpublished report. U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, Alaska 99559. 18 pp.

Larned WW, GR Balogh, MR Petersen. 1995. Distribution and abundance of spectacled eiders (Somateria fischeri) in Ledyard Bay, Alaska, September 1995. Unpublished progress report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 11 pp.

Larned WW, R Stehn, R Platte. 2011. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska, 2010. Unpublished report. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska. 52 pp.

Larned, W., K. Bollinger, and R. Stehn. 2012a. Late winter population and distribution of spectacled eiders (*Somateria fischeri*) in the Bering Sea, 2009 and 2010. USFWS. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska. January 12, 2012. 23 pp.

Larned WW, R.Stehn, R Platte. 2012b. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska, 2011. Unpublished report. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska. 51 pp.

Lovvorn JR, SE Richman, J.M. Grebmeier, and L.W. Cooper. 2003. Diet and body condition of spectacled eiders wintering in the pack ice of the Bering Sea. Polar Biology 26:259–267.

Moran T. 1995. Nesting ecology of spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1994. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska. 8pp + appendix.

Parker H, H Holm. 1990. Pattern of nutrient and energy expenditure in female Common eiders nesting in the high arctic. Auk 107:660–668.

Pearce JM, D. Esler and A.G. Degtyarev. 1998. Birds of the Indigirka River Delta, Russia: historical and biogeographic comparisons. Arctic 51:361–370.

Petersen MR and D. Douglas. 2004. Winter ecology of spectacled eiders: environmental characteristics and population change. Condor 106:79–94.

Petersen M, D Douglas, D Mulcahy. 1995. Use of implanted satellite transmitters to locate spectacled eiders at sea. Condor 97: 276–278.

Petersen MR and PL Flint. 2002. Population structure of pacific common eiders breeding in Alaska. Condor 104:780–787.

Petersen, M., WW Larned, and D.C. Douglas. 1999. At-sea distribution of spectacled eiders: a 120-year-old mystery resolved. The Auk 116(4):1009–1020.

Petersen, MR, JF Piatt, KA Trust. 1998. Foods of Spectacled Eiders *Somateria fischeri* in the Bering Sea, Alaska. Wildfowl 49:124–128.

Phillips JC. 1922–1926. A natural history of ducks. Vol. 4, Houghton Mifflin, Boston, MA. 489 pp.

Platte RM, RA Stehn. 2011. Abundance and trend of waterbirds on Alaska's Yukon–Kuskokwim Delta coast based on 1988 to 2010 aerial surveys. Unpublished report, U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska. April 29, 2011. 43 pp.

Quakenbush, L.T., R.S. Suydam, K.M. Fluetsch, and C.L. Donaldson. 1995. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1991–1994. Ecological Services Fairbanks, Alaska, U.S. Fish and Wildlife Service, Technical Report NAES-TR-95-03. 53pp.

Raveling, D.G. 1979. The annual cycle of body composition of Canada Geese with special reference to control of reproduction. Auk 96:234–252.

Safine, D. E. 2012. Breeding ecology of Steller's and spectacled eiders nesting near Barrow, Alaska, 2011. U. S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. Technical Report. 65 pp.

Smith, L., L. Byrne, C. Johnson, and A. Stickney. 1994. Wildlife studies on the Colville River Delta, Alaska, 1993. Unpublished report prepared for ARCO Alaska, Inc., Anchorage, Alaska. 58pp.

Stehn, R., C. Dau, B. Conant, and W. Butler. 1993. Decline of spectacled eiders nesting in western Alaska. Arctic 46: 264–277.

Stehn, R., W. Larned, R. Platte, J. Fischer, and T. Bowman. 2006. Spectacled eider status and trend in Alaska. U.S. Fish and Wildlife Service, Anchorage, Alaska. Unpublished Report. 17 pp.

[TERA] Troy Ecological Research Associates. 2002. Spectacled eider movements in the Beaufort Sea: Distribution and timing of use. Report for BP Alaska Inc., Anchorage, Alaska and Bureau of Land Management, Fairbanks, Alaska. 17 pp.

[USFWS] U.S. Fish and Wildlife Service. 1996. Spectacled Eider (Somateria fischeri) Recovery Plan. Anchorage, Alaska: http://ecos.fws.gov/docs/recovery_plan/960812.pdf (January 2015).

[USFWS] U.S. Fish and Wildlife Service. 1999. Population status and trends of sea ducks in Alaska. Migratory Bird Management, Anchorage, Alaska.

Warnock, N. and D. Troy. 1992. Distribution and abundance of spectacled eiders at Prudhoe Bay, Alaska: 1991. Unpublished report prepared for BP Exploration (Alaska) Inc., Environmental and Regulatory Affairs Department, Anchorage, Alaska, by Troy Ecological Research Associates (TERA), Anchorage, Alaska. 20 pp.

Woodby, D.A. and G.J. Divoky. 1982. Spring migration of eiders and other waterbirds at Point Barrow, Alaska. Arctic 35: 403–410.

Steller's eider (Polysticta stelleri)

Anderson BA, SM Murphy, MT Jorgenson, DS Barber, BA Kugler. 1992. GHX-1 water bird and noise monitoring program. Final report prepared for ARCO Alaska, Inc., Anchorage, Alaska by Alaska Biological Research, Inc., Fairbanks, Alaska and BBN Systems and Technologies Corp., Canoga Park, California.

Bellrose FC. 1980. Ducks, geese, and swans of North America. Stackpole Books, Harrisburg, Pennsylvania. 540 pp.

Bent AC. 1987. Life histories of North American waterfowl. Two parts bound as one. Dover Publications, Inc., New York.

Brandt, H. 1943. Alaska bird trails. Bird Research Foundation, Cleveland, Ohio. 464 pp.

Bustnes JO, M Asheim, TH Bjorn, H Gabrielsen, GH Systad. 2000. The diet of Steller's eiders wintering in Varangerfjord, Northern Norway. Wilson Bull. 112(1):8-13.

Conover HB. 1926. Game birds of the Hooper Bay Region, Alaska. The Auk 43:162-180.

Dau CP. 1987. Birds in nearshore waters of the Yukon–Kuskokwim Delta, Alaska. Murrelet 68:12–23.

Dau CP. 1991. Population size and migratory phenology of Soviet breeding Steller's eiders at the Izembek National Wildlife Refuge. (Abstract) Alaska Bird Conf. and Workshop: Shared avian resources of Beringia. Nov. 19-22, 1991. Anchorage, Alaska.

Dau CP, PL Flint, MR Petersen. 2000. Distribution of recoveries of Steller's eiders banded on the lower Alaska Peninsula, Alaska. Journal of Field Ornithology 71:541-548.

Day, RH 1998. Predator populations and predation intensity on tundra-nesting birds in relation to human development. Report prepared by ABR Inc., for Northern Alaska Ecological Services, U.S. Fish and Wildlife Service, Fairbanks, AK. 106pp.

Dick MH, LS Dick. 1971. The natural history of Cape Pierce and Nanvak Bay, Cape Newenham National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service. Unpublished report. Bethel, Alaska. 77 pp.

Fay, F.H., and T.J. Cade. 1959. An ecological analysis of the avifauna of St. Lawrence Island, Alaska. University of California Press, Berkley, California. 149 pp.

Flint PL, JB Grand, JA Morse, and TF Fondell. 2000. Late summer survival of adult female and juvenile spectacled eiders on the Yukon–Kuskokwim Delta, Alaska. Waterbirds 23:292–297.

Flint PL, MP Herzog. 1999. Breeding of Steller's eiders (*Polysticta stelleri*) on the Yukon–Kuskokwim Delta, Alaska. Can. Field Nat. 113:306–308.

Gill RE, MR Petersen, and PD Jorgensen. 1981. Birds of Northcentral Alaska Peninsula, 1978–80. Arctic 34:286–306.

Gillham CE. 1941. Report on waterfowl investigations, summer 1941, lower Yukon River, Chevak, Hooper Bay. Unpublished report. U.S. Fish and Wildlife Service, Washington, DC.

Lande R, GF Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. Pages 87-123 *In* Viable populations for conservation. ME Soule (*ed.*). Cambridge University Press, New York.

Larned WW. 1998. Steller's eider spring migration surveys, 1998. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larned WW. 2000b. Aerial surveys of steller's eiders and other water birds and marine mammals in southwest Alaska areas proposed for navigation improvements by the U.S. Army Corps of Engineers, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larned WW. 2000a. Aerial surveys of Steller's eiders and other water birds and marine mammals in southwest Alaska areas proposed for navigation improvements by the U.S.

Army Corps of Engineers, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larned WW. 2000b. Steller's eider spring migration surveys, 2000. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larned WW. 2005. Trip Report: Aerial Survey of Lower Cook Inlet To Locate Flocks of Steller's Eiders and Mergansers 8. Sept 14, 2005 U.S. Fish and Wildlife Service, Soldotna, Alaska. 9 pp.

Larned WW. 2012. Steller's Eider Spring Migration Surveys Southwest Alaska, 2011. U.S. Fish and Wildlife Service Anchorage. 24 pp.

Larned WW, B Butler, G Balogh. 1993. Progress report: Steller's eider spring migration surveys southwest Alaska, 1993. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larned WW, R Platte, R Stehn. 2009. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska, 2008. Unpublished report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 42 pp.

Larned WW, R Stehn, R Platte. 2008. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska 2007. U. S. Fish and Wildlife Service, Division of Migratory Bird Management. Anchorage, Alaska. 44pp.

Larned W, R Stehn, and R. Platte. 2010. Waterfowl breeding population survey Arctic Coastal Plain, Alaska 2009. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, AK. 42 pp.

Larned WW, T Tiplady. 1996. Distribution and abundance of sea ducks in Kuskokwim Bay, Alaska, September 1996. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larned WW, D Zwiefelhofer. 1995. Distribution and abundance of steller's eiders (*Polysticta stelleri*) in the Kodiak Archipelago, Alaska, 1994. 18 pp.

Larned WW, D Zwiefelhofer. 2002. Distribution and abundance of steller's eiders (*Polysticta stelleri*) in the Kodiak Archipelago, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larned WW, Karen S. Bollinger 2011. Steller's Eider Spring Migration Surveys Southwest Alaska 2010. Anchorage. U.S. Fish and Wildlife Service.

Laubhan MK, KA Metzner. 1999. Distribution and diurnal behavior of steller's eiders wintering on the Alaska Peninsula. Condor 101:694–698.

Martin P. 2001. Memorandum: Steller's Eider Telemetry Update - 29 November 2001. Anchorage. U.S. Fish and Wildlife Service.

Mallek EJ, R Platte, R Stehn. 2005. Aerial breeding pair surveys of the Arctic Coastal Plain of Alaska 2004. U.S. Fish and Wildlife Service. Fairbanks, Alaska.

Mallek EJ, R Platte, R Stehn. 2006. Aerial breeding pair surveys of the Arctic Coastal Plain of Alaska 2005. U.S. Fish and Wildlife Service. Fairbanks, Alaska.

Martin, PD, T Obritschkewitsch, DC Douglas. in prep. Distribution and movements of Steller's eiders in the non–breeding period.

Metzner, KA. 1993. Ecological strategies of wintering Steller's eiders on Izembeck Lagoon and Cold Bay, Alaska. M.S. Thesis, University of Missouri, Columbia, MO. 193 pp.

Murie OJ. 1924. Report on investigations of birds and mammals of the Hooper Bay section of Alaska during the spring and summer of 1924. Unpublished report. U.S. Dept. Agric., Bur. Biol. Surv., Washington DC.

Murie OJ, VB Scheffer. 1959. Fauna of the Aleutian Islands and Alaska Peninsula, with notes on the invertebrates and fishes collected in the Aleutians, 1936-38. North American Fauna No. 61. 406 pp.

Obritschkewitsch, T, P Martin, R Suydam. 2001. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1999–2000. Northern Ecological Services, U.S. Fish and Wildlife Service, Technical Report NAES–TR–01–04, Fairbanks, Alaska pp 113.

Obrischkewitsch T, RJ Ritchie. 2011. Steller's eider surveys near Barrow, Alaska, 2010. Final Report. ABR, Inc., Fairbanks, Alaska. 13 pp.

Obrischkewitsch T, RJ Ritchie, J King. 2008. Steller's eider surveys near Barrow, Alaska, 2007. Final Report. ABR, Inc., Fairbanks, Alaska. 17 pp.

Pearce JM, SL Talbot, MR Petersen, JR Rearick. 2005. Limited genetic differentiation among breeding, molting, and wintering groups of the threatened Steller's eider: the role of historic and contemporary factors. Conservation Genetics 6: 743-757.

Pearce JM, S Talbot. 2009. Population Genetics of Steller's Eiders: Additional Analyses U.S. Geological Survey, Alaska Science Center. Anchorage, Alaska.

Petersen MR. 1980. Observations of wing-feather moult and summer feeding ecology of Steller's eiders at Nelson Lagoon, Alaska. Wildfowl 31:99–106.

Petersen MR. 1981. Populations, feeding ecology and molt of Steller's eiders. Condor 83:256–262.

Petersen MR, MJ Sigman. 1977. Field studies at Cape Pierce, Alaska 1976. Pages 633–693 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Vol. 4. NOAA, Boulder, Colorado. 39pp.

Petersen MR, DN Weir, MH Dick. 1991. Birds of the Kilbuck and Ahklun Mountain Region, Alaska. North American Fauna No. 76. 158 pp.

Portenko LA. 1972. Birds of the Chukchi Peninsula and Wrangel Island. Vol. 2, Nauka, Leningrad, USSR (in Russian).

Quakenbush LT, RH Day, BA Anderson, FA Pitelka, BJ McCaffery. 2002. Historical and present breeding season distribution of Steller's eiders in Alaska. Western Birds 33:99–120.

Quakenbush LT, RS Suydam, KM Fluetsch, CL Donaldson. 1995. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1991–1994. Ecological Services Fairbanks, AK, U.S. Fish & Wildlife Service, Technical Report NAES–TR–95–03. 53 pp.

Quakenbush L, R Suydam, T Obritschkewitsch, M Deering. 2004. Breeding biology of Steller's eiders (*Polysticta stelleri*) near Barrow, Alaska, 1991–1999. Arctic 57:166–182.

Reed JA, PL Flint. 2007. Movements and foraging effort of Steller's eiders and harlequin ducks wintering near Dutch Harbor, Alaska. J. of Field Ornithology 78:124-132.

Robertson GJ, F Cooke, RI Goudie, WS Boyd. 1999. Within-year fidelity of harlequin ducks to a moulting and wintering area. Pages 45-51 *In* Behaviour and ecology of sea ducks. RI Goudie, MR Petersen, GJ Robertson (*eds.*). Canadian Wildlife Service Occasional Paper Series #100, Ottawa, Ontario, Canada.

Rojek, NA. 2006. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 2005. Technical report for U.S. Fish & Wildlife Service, Fairbanks, Alaska. 61 pp.

Rojek, NA. 2007. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 2006. Technical report for U.S. Fish & Wildlife Service, Fairbanks, Alaska. 53 pp.

Rojek, NA. 2008. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 2007. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. Technical Report. 44 pp.

Rosenberg, DA, MJ Petrula, D Zwiefelhofer, T Holmen, DD Hill, JL Schamber. 2011. Seasonal movements and distribution of Pacific Steller's eiders (*Polysticta stelleri*). Final Report. Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska. 44 pp.

Safine DE. 2011. Breeding ecology of Steller's and spectacled eiders nesting near Barrow, Alaska, 2008–2010. U. S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. Technical Report. 66 pp.

Scribner KT, R Fields, S Talbot, J Pearce, M Petersen. 2001. Sex-biased dispersal in threatened Spectacled eiders: evaluation using molecular markers with contrasting modes of inheritance. Evolution. 55: 2105-2115.

Solovieva D. 1997. Timing, habitat use and breeding biology of Steller's eider in the Lena Delta, Russia. Wetlands International Seaduck Specialist Group Bulletin.

Stearns SC. 1992. The evolution of life histories. Oxford University Press, UK. 249 pp.

Stehn R, and R Platte. 2009. Steller's eider distribution, abundance, and trend on the Arctic Coastal Plain, Alaska, 1989–2008. Unpublished report for the U.S. Fish and Wildlife Service, Anchorage, Alaska. 35pp.

[USFWS] U.S. Fish and Wildlife Service. 1997. Endangered and threatened wildlife and plants; Threatened status for the Alaska breeding population of the Steller's eider. Final rule. Published 11 July 1997 by the U.S. Fish and Wildlife Service. Federal Register 62(112):31748–31757.

[USFWS] U.S. Fish and Wildlife Service. 2001. Endangered and Threatened Wildlife and Plants; Final determination of critical habitat for the Alaska–breeding population of the Steller's eider. Final rule. Published 2 February 2001 by the U.S. Fish and Wildlife Service. Federal Register 66(23):8849–8884.

[USFWS] U.S. Fish and Wildlife Service. 2002a. Steller's Eider Recovery Plan. Fairbanks Field Office. Fairbanks, Alaska. 27 pp.

[USFWS] U.S. Fish and Wildlife Service. 2002b. Stock assessment for sea otters (Enhydra lutris): southwest Alaska stock. Marine Mammals Management Branch. Anchorage, Alaska.

[USFWS] U.S. Fish and Wildlife Service. 2011. Biological opinion for approval of the state of Alaska's mixing zones regulation section of the Alaska water quality standards. Consultation with the. U. S. Environmental Protection Agency Seattle, Washington. Prepared by: Anchorage Fish and Wildlife Field Office, Anchorage, Alaska April 25, 2011.

Wilk RJ, KI Wilk, RC Kuntz, II. 1986. Abundance, age composition and observations of emperor geese in Cinder lagoon, Alaska Peninsula, 17 September–10 October 1986. Unpublished report. U.S. Fish and Wildlife Service, King Salmon, Alaska. 41 pp.

Wilson EO. 1980. Sociobiology. The abridged edition. The Belknap Press of Harvard University Press, Cambridge, Massachusetts. 366 pp.

Climate Change

Bluhm BA , JM Grebmeier. 2011. Biodiversity - Status and Trends of Benthic Organisms. November 21, 2011 [in Arctic Report Card 2011], Available: http://www.arctic.noaa.gov/reportcard. (January 2015).

Bluhm BA, R Gradinger. 2008. Regional variability in food availability for Arctic marine mammals. Ecological Applications 18: S77-S96.

Doney SC, M Ruckelshaus, JE Duffy, JP Barry, F Chan, CA English, HM Galindo, JM Grebmeier, AB Hollowed, N Knowlton, J Polovina, NN Rabalais, WJ Sydeman, and L.D. Talley. 2012. Climate change impacts on marine ecosystems. Annual Review of Marine Science. 4:11-37.

Dore JE, R Lukas, DW Sadler, MJ Church, and DM Karl. 2009. Physical and biogeochemical modulation of ocean acidification in the central North Pacific. Proc. Natl. Acad. Sci. USA 106:12235–40.

Fabry VJ, BA Seibel, RA Feely and JC Orr. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. ICES Journal of Marine Science 65: 414–432.

Feely RA, SC Doney, SR Cooley. 2009. Ocean acidification: present conditions and future changes in a high-CO2 world. Oceanography 22:36–47.

Grebmeier JM, LW Cooper, HM Feder, BI Sirenko. 2006. Ecosystem dynamics of the Pacific-influenced Northern Bering and Chukchi Seas in the American arctic. Progress in Oceanography 71:331-361.

Grebmeier JM, LW Cooper. 1995. Influence of the St. Lawrence Island polynya upon the Bering Sea benthos. Journal of Geophysical Research 100: 4439-4460.

Grebmeier JM, SE Moore, JE Overland, KE Frey, and R Gradinger. 2010. Biological Response to Recent Pacific Arctic Sea-ice Retreats, Eos, Transactions, American Geophysical Union Vol. 91, No. 18, pg. 161-162.

Grebmeier JM. 2012. Shifting patterns of life in the Pacific Arctic and Sub-arctic seas. Annual Review of Marine Science 4:63-78.

Grebmeier JM. 1993. Studies on pelagic-benthic coupling extended onto the Russian continental shelf in the Bering and Chukchi Seas. Continental Shelf Research 13:653-668.

Grebmeier JMO, E James SE Moore, EV Farley, EC Carmack, LW Cooper, KE Frey, JH Helle, FA McLaughlin, SL McNutt. 2006. A Major Ecosystem Shift in the Northern Bering Sea. 311: 4.

Hinzman LD, ND Bettez, WR Bolton, FS Chapin, MB Dyurgerov, CL Fastie, B Griffith, RD Hollister, A Hope, HP Huntington, et al. 2005. Evidence and implications of recent climate change in northern Alaska and other arctic regions. Climatic Change 72: 251–298.

[IPCC] Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, RK, and A Reisinger (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

[IEA] International Energy Agency. 2013. CO_2 Emissions from Fuel Combustion Highlights. Paris. Available: www.iea.org (January 2015).

Jorgenson TE, Craig. 2001. Topography and Flooding of Coastal Ecosystems on the Yukon-Koskokwim Delta; Alaska: Implications for Sea-Level Rise. Journal of Coastal Research 17(1):124-136.

Markus T, JC Stroeve, J Miller. 2009. Recent changes in Arctic sea-ice melt onset, freezeup, and melt length season. Journal of Geophysical Research 114(C12024):1-14.

Mars JC, DW Houseknecht. 2007. Quantitative remote sensing study indicates doubling of coastal erosion rate in past 50 yr along a segment of the Arctic coast of Alaska. Geology 35(7):583-586. http://search.ebscohost.com/login.aspx?direct=true&db=eih&AN=25752285&site=ehost-live

[NSIDC] National Snow and Ice Data Center. 2012. Monthly September ice extent for 1979 to 2012 shows a decline of 13.0% per decade. Credit: National Snow and Ice Data Center http://nsidc.org/arcticseaicenews/2012/10/poles-apart-a-record-breaking-summer-and-winter/, accessed December 18, 2012.

Schindler DW, and JP Smol. 2006. Cumulative effects of climate warming and other human activities on freshwaters of arctic and subarctic North America. Ambio 35:160–168.

Smol JP, AP Wolfe, HJB Birks, MSV Douglas, VJ Jones, A Korhola, R Pienitzi, K Rühland, S Sorvari, D Antoniades, et al. 2005. Climate-driven regime shifts in the biological communities of arctic lakes. Proceedings of the National Academy of Science 102:4397–4402.

Walsh JJ, DA Dieterle, W Maslowski, JM Grebmeier, TE Whitledge, M Flint, IN Sukhanova, N Bates, GF Cota, D Stockwell, SB Moran, DA Hansell, CP Mcroy. 2005. A Numerical Model of Seasonal Primary Production Within the Chukchi/Beaufort Seas. Deep-Sea Research Part Ii-Topical Studies in Oceanography 52(24-26):3541-3576.

Walsh, JE 2005. Arctic Climate Impact Assessment. New York. Cambridge University Press Available: http://www.acia.uaf.edu/pages/scientific.html (January 2015).

[Top]

APPENDIX B. Definitions

ACTION AREA: all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. [50 CFR §402.02]

ACTION; THE PROPOSED ACTION: all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas [50 CFR §402.02]. For this consultation, the action includes any actions taken to implement the Unified Plan or its Annexes.

ADVERSE EFFECT: an ADVERSE EVENT that is caused by an action or intervention or has a causal association to the action or intervention.

BENEFICIAL EFFECTS: contemporaneous positive effects with no adverse effects to listed species or designated critical habitat.

DISCOUNTABLE EFFECTS: are those that are extremely unlikely to occur. Based on best judgment, one would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur.

DISTURBANCE (ENVIRONMENTAL): any discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical, chemical, or biotic environment. Two general kinds of disturbance can be distinguished: disturbance events and environmental fluctuation.

DISTURBANCE (BEHAVIORAL): any event that has the potential to disrupt the normal behavior or physiological state of an animal. Disturbance most often causes a stress response and results in increased vigilance or displacement from preferred habitat.

ECOLOGICAL RISK ASSESSMENT: a systematic method for estimating the qualitative or quantitative probability of adverse consequences resulting from exposure to specific physical, chemical or biotic hazards (or from the absence of beneficial influences) on specific entities. Risk assessment uses clinical, epidemiological, toxicological, environmental, and any other data that is relevant. See also "Risk".

EFFECTS OF THE ACTION: for the purposes of section 7(a)(2) consultation, NMFS and the U.S. Fish and Wildlife Service defined this term to mean "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the ENVIRONMENTAL BASELINE.

EMERGENCY CONSULTATION: the process specified in the *Inter-agency Memorandum of Agreement Regarding Oil Spill Planning and Response Activities Under the Federal Water Pollution Control Act's National Oil and Hazardous Substances Pollution Contingency Plan and the Endangered Species Act* (USCG et al. 2001) for conducting consultation pursuant to Section 7 of the ESA for spill response actions that may result in effects on listed species or critical habitat. The emergency consultation process includes both incident-specific informal consultation during the event, and formal consultation, if necessary, after the case is closed, if listed species or critical habitat have been adversely affected.

ENDANGERED SPECIES: any species which is in danger of extinction throughout all or a significant portion of its range. When only a portion of the taxonomic species is listed under the ESA, the endangered species refers to the portion of the species that is designated as endangered.

ENVIRONMENTAL BASELINE: for the purposes of section 7(a)(2) consultation, NMFS and the U.S. Fish and Wildlife Service defined this term to include the past and present impacts of all Federal, State, or private actions and

other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with a consultation in process [50 CFR §402.02].

EXPOSURE: the fact or condition of being affected by something or experiencing something—the condition of being exposed to something.

EXTREMELY HAZARDOUS SUBSTANCE: any agent which may as the result of short-term exposures associated with spills cause death, injury or property damage due to its toxicity, reactivity, flammability, volatility, or corrosivity, including substances listed in the appendices to 40 CFR part 355. Agents common to Alaska include Acrylamide, Ammonia (Anhydrous), Chlorine, Formaldehyde, Hydrazine (Anhydrous), Hydrochloric Acid, Hydrogen Cyanide, Hydrogen Sulfide, Hydroquinone (Solid), Nitric Acid (>40% Solution), Phosphoric Acid, Dimethyl 4-(Methylthio), Phosphorus, Sodium Azide, Sodium Cyanide, Sulfur (Dioxide), Sulfuric Acid, Toluene, and others.

FREQUENCY: the number of times that something happens during a particular period. A count per unit time.

HAZARD: a source of danger.

HAZARDOUS MATERIAL: any substance that can pose a health or environmental risk.

INCIDENT-SPECIFIC CONSULTATION: the informal and formal consultation components of the EMERGENCY CONSULTATION process. This term is used in this BO to refer to the Service's involvement in spill response decision-making processes which may affect listed species and critical habitat prior to, and regardless of, whether take occurs. We use this term to avoid potential confusion arising from the use of the term "emergency consultation" which in some contexts outside of this BO, can be intended to refer only to the formal component of section 7 consultation.

INCIDENTAL TAKE: take that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant.

INDIRECT EFFECTS: are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

INSIGNIFICANT EFFECTS: relate to the size of the impact and should never reach the scale where a take will occur.

INTERDEPENDENT ACTIONS: are those that have no independent utility apart from the action under consideration" [50 CFR §402.02].

INTERRELATED ACTIONS: are those that are part of a larger action and depend on the larger action for their justification.

JEOPARDIZE THE CONTINUED EXISTENCE OF: means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species [50 CFR §402.02].

LIKELY: "probable". In most cases, no specific value can be attributed to the degree of probability, but an action that is likely will have a greater probability of occurring than not; >50% chance or higher.

LIKELIHOOD: the chance that something will happen; a synonym for "probability".

LISTED ENTITY, LISTED POPULATION: see listed species. These terms are commonly used when only a proportion of the taxonomic species is listed, as is the case with the southwest Alaska distinct population segment of the northern sea otter and the Alaska-breeding Steller's eiders.

LISTED SPECIES: means any species of fish, wildlife or plant which has been determined to be endangered or threatened under section 4 of the Act. Listed species are found in 50 CFR. 17.11-17.12. Listed species, for the purposes of this Biological Opinion, include threatened, endangered *and* candidate species, including the Steller's eider, spectacled eiders, the southwest Alaska distinct population segment of northern sea otters, polar bears, Pacific walruses, and the short-tailed albatross. When only a portion of the taxonomic species is listed under the ESA, the listed species refers to the portion of the species that is designated as a threatened, endangered or candidate species under the ESA.

MAY AFFECT: the appropriate conclusion when a proposed action may pose any effects on listed species.

MINIMUM VIABLE POPULATION SIZE: the smallest possible size at which a biological population can exist without facing extinction from natural disasters or demographic, environmental, or genetic stochasticity.

POPULATION: groups of individuals whose patterns of increase or decrease in abundance over time are determined by internal dynamics (births resulting from sexual interactions primarily between individuals in the group and deaths of individuals in the group) rather than external dynamics (immigration or emigration). Groups of individuals that meet this definition may also be spatially-separated from other groups of individuals that would also be defined as populations or genetically distinct from those other groups of individuals, but these characteristics are secondary to the internal dynamics of the group.

PRIMARY CONSTITUENT ELEMENT: specific physical and biological features of the environment within designated critical habitat necessary to support the conservation of listed species.

PROBABLE: "likely"; in most cases, no specific value can be attributed to the degree of probability, but an action that is likely will have a greater probability of occurring than not; >50% chance or higher.

PROBABILITY: the chance that something will happen; more specifically a number between 0 and 1 (where 0 indicates impossibility and 1 indicates certainty), often expressed as a percentage, e.g., there is a 50% probability that event will happen.

QUASI-EXTINCTION PROBABILITY: probability that population levels will decrease below a quasi-extinction threshold.

QUASI-EXTINCTION THRESHOLD: the number of individuals below which the population is likely to be immediately and critically imperiled. This threshold is typically the minimum number of animals in a population below which demographic stochasticity and genetic drift are likely to cause extinction.

RISK: the potential to lose something of value; in Ecological Risk Assessment, Risk is defined as an interaction between hazard and exposure, where there must concurrently be both a hazard and an exposure to it to result in risk. When quantified in Ecological Risk Assessment, risk is the product of the consequence and the probability of a hazardous event. Though we are often unable to quantify the risks discussed here due to lack of numerical probability data, risk is generally defined as the probability of a hazard resulting in an adverse event, times the severity of the event.

RESPONSE: an outcome associated with an activity; in this document, we use the term "response" to describe the positive or negative effects of the activities described in the unified plan; negative responses are synonymous with "hazards", but responses may also be positive.

SIGNIFICANT; SIGNIFICANCE: Our evaluation considers different "significance" to mean "clinically or biotically significant" rather than statistically significant. We distinguish our use of the terms as separate and independent from its use for analyses conducted under the National Environmental Policy Act (NEPA).

STRESSOR: the term has been defined variously as (a) any physical, chemical, or biological entity that can induce an adverse response (synonymous with agent); (b) any condition or situation that causes a system to mobilize its resources and increase its energy expenditure (Seyle 1956; Fitch and Johnson 1977); (c) a physical, chemical, or biotic phenomenon, circumstance, or condition that constitutes a real or perceived challenge or threat to an organism's homeostasis or homeostatic mechanisms. Because some physical, chemical, and biotic phenomena are stressors to some organisms in some circumstances, but not others, stressors are commonly referred to as "potential stressors."

THE PLAN; THE UNIFIED PLAN; THE PROGRAM; PROGRAM STRUCTURE: the actions and processes identified and implemented under the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases (Unified Plan; ARRT 2010) and the proposed Dispersant Use Plan for Alaska (ARRT 2014).

TAKE: under the ESA: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct involving a species listed.

HARM is further defined by the Service as an act which actually kills or injures wildlife, and may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.

HARASS is defined by the Service as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.

TAKE under the MMPA: to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

HARASS: The current definition of harassment in the MMPA separates harassment into two levels.

LEVEL A HARASSMENT: any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild.

LEVEL B HARASSMENT: any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

THE SERVICE; SERVICE: U.S. Fish and Wildlife Service

THE SERVICES: U.S. Fish and Wildlife Service and National Marine Fisheries Service, collectively

THREATENED SPECIES: any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. When only a portion of the taxonomic species is listed under the ESA, the threatened species refers to the portion of the species that is designated as threatened.

[Top]

APPENDIX C. Boat Operation Guidance to Avoid Disturbing Sea Otters

Because the southwest Alaska Distinct Population Segment (DPS) of the northern sea otter (Enhydra lutris kenyoni) is listed as threatened under the Endangered Species Act (ESA), and because the listed population and all other sea otter populations are protected under the Marine Mammal Protection Act (MMPA), the US Fish and Wildlife Service has developed guidance to boat operators to avoid the risk of disturbing or striking sea otters. Collectively, the ESA and MMPA make it illegal to take[51] sea otters.

Sea otter habitat is broadly defined as all near shore maritime waters within their range. Sea otters occupy waters up to 91 m deep (300 ft, 50 fathoms) and spend several hours a day foraging in waters usually less than 40 m deep (132 ft, 22 fathoms). Boats operating in sea otter habitat run the risk of disturbing sea otters, which is considered harassment, or of killing sea otters by striking them with the boat propeller or hull. To avoid the risk of such takings, please follow these guidelines:

- While operating boats in near shore areas, scan the water surface ahead of the boat vigilantly for otters. In choppy water conditions sea otters are difficult to spot. If you are boating with another person, place them in the bow to help search. You may encounter otters as individuals, a mother and a pup, or rafts of 10 or more.

- When you see an otter(s), alter your course and slow down to avoid disturbance and collision. Once you have spotted an otter(s), you should not assume that the otter(s) will dive and get out of the way. Even if they are alert, capable, and do dive, your action of knowingly staying your course would be considered harassment.

- Do not operate a vessel at ANY rate of speed heading directly at the otter(s). A good rule of thumb is that your buffer should be great enough that there is ample room for the otter(s) to swim away without startling them. It is your responsibility to minimize the stimulus and threat of a loud boat approaching quickly.

- The more otters you see, the wider the berth you need to give. Also, do not pass between otters, but rather go around the outside perimeter, plus add a buffer.

- It is illegal to pursue or chase sea otters. Do not single out or surround an otter(s).

Thank you for your efforts to help conserve Alaska's sea otters. If you have any questions, comments or concerns, please contact the US Fish and Wildlife Service's Marine Mammals Management Program or Ellen Lance (907-271-1467) at the Anchorage Fish and Wildlife Field Office's Endangered Species Program.

---

[51] take under the ESA means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct; take under the MMPA means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal. [Top]

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Anchorage Fish and Wildlife Field Office
4700 BLM Road, Anchorage, Alaska 99507

In Reply Refer To:
FWS/AFES/AFWFO

January 2, 2015

EMAILED TO:
Dispersant Working Group Members c/o
CAPT Dan Travers, USCG
Commander, Sector Columbia River/Air Station Astoria
Captain of the Port
2185 SE 12th Place
Warrenton, OR 97146

RE: Avoidance Areas

Dear Dispersant Working Group Members:

The enclosed analysis, resulting from the ongoing consultation under section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq., as amended), illustrates areas where endangered short-tailed albatrosses (*Phoebastria albatrus*) concentrate within Alaska's proposed preauthorization area (Annex F of Appendix I of the *Draft* Alaska Regional Response Team Dispersant Use Plan for Alaska, Revised 4-3-14; Dispersant Use Plan). We recommend these short-tailed albatross concentration areas be designated as avoidance areas and be excluded from preauthorization in accordance with Section 1.4 of the Dispersant Use Plan. It is our hope that the avoidance areas can be approved and incorporated into the Dispersant Use Plan as soon as possible to allow us to modify the proposed action our section 7 evaluations and avoid possible delays of our February 18, 2015 target completion deadline. We appreciate your consideration and look forward to your response. If you have any questions, please contact me at (907) 271-1467 or Kimberly Klein at (907) 271-2066.

Sincerely,

Ellen W. Lance
Ecological Services Branch Chief

Enclosure
cc: Marcia Combes, EPA; Mark Everett, USCG; Sadie Wright, NMFS

Short-Tailed Albatross Concentrations in Areas Pre-Authorized for Dispersant Use

The Environmental Protection Agency (EPA) created a distribution map of short-tailed albatross (STAL) observations and locations of hazardous material spills within Alaska's proposed dispersant-use preauthorization zone (the preauthorization zone; http://epa.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=584c580bec0c4c9898e83123ebd4014e Figure 1). STAL observation data was provided by the U.S. Fish and Wildlife Service (Service) and spill information from the Alaska Department of Environmental Conservation. The high percentage of STAL observations within the preauthorization zone prompted the Service to develop avoidance areas where STAL concentrate. If designated, these avoidance areas would be amended to the Dispersant Use Plan, excluded from preauthorization, and incorporated into the applicable Subarea Contingency Plans.

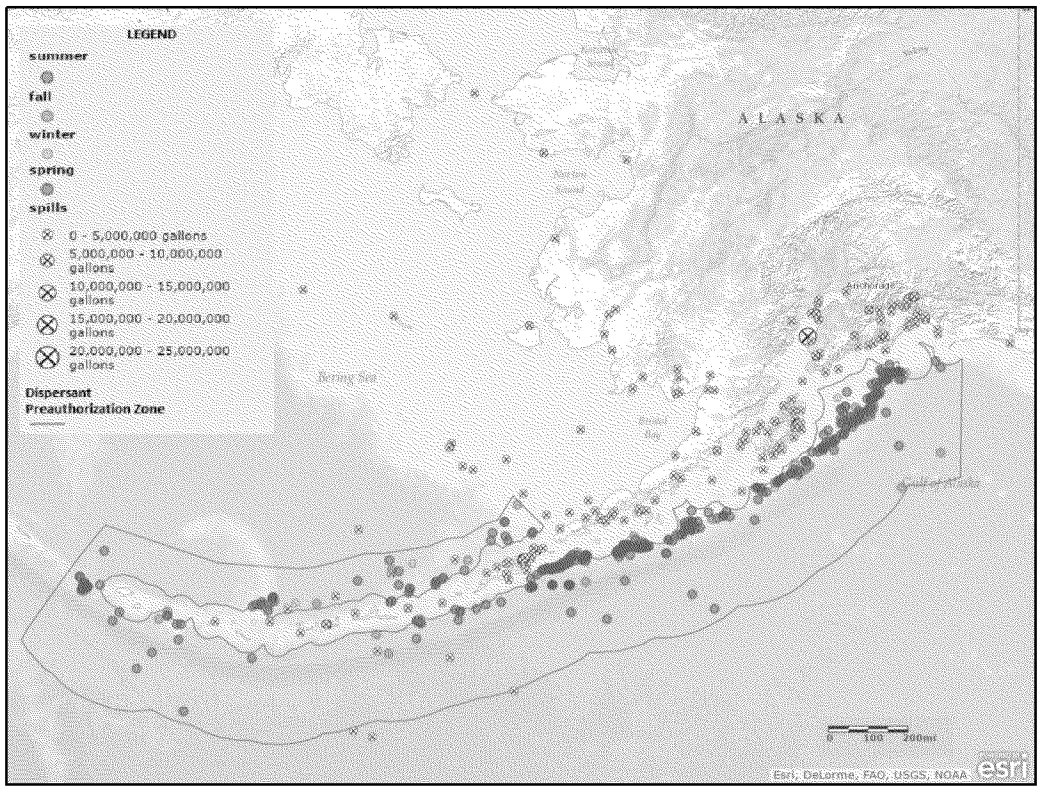


Figure 1. STAL distribution in proposed dispersant preauthorization zone relative to spill occurrences. Map compiled by EPA (2014).

Polygons containing concentrations of STAL within the preauthorization zone were created by: 1) compiling, all available STAL geographic data, ensuring they were not duplicative; 2) using ArcGIS to clip STAL data by the preauthorization zone to remove observations outside of the area of interest; 3) analyzing kernel density using ArcGIS software tools. Kernel density is calculated using a nearest-neighbor function to fit a smoothly tapered surface to each point. The top 5% of kernel density values were identified, and a buffer (4nm) around each polygon was assigned to smooth the polygon surfaces and merge small, isolated concentrations. These

concentration areas comprise the highest densities of short-tailed albatross observed within the preauthorization zone (Figure 2).

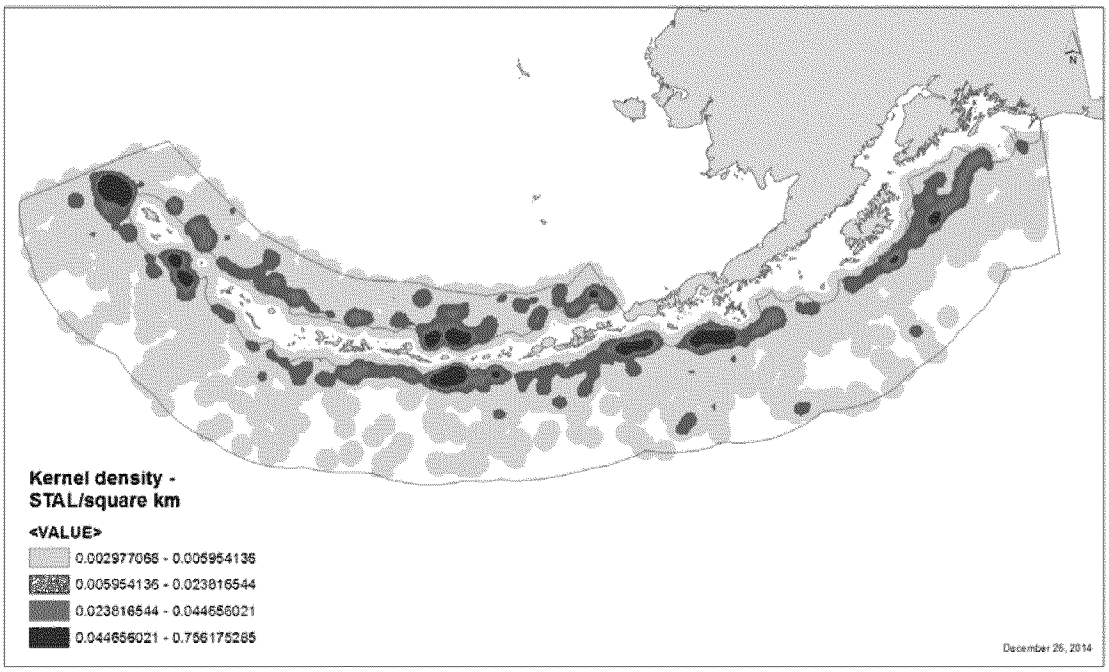


Figure 2. Kernel densities of STAL within the preauthorization zone.

A hotspot analysis was conducted to evaluate whether the top 5% of kernel density values represented a useful threshold for identifying high-density aggregations. To conduct this analysis, STAL observations were spatially joined with 5- and 10-km^2 polygon grids throughout the preauthorization zone. Statistically significant expected values for observations within polygons were identified using the Hotspot Analysis tool (Getis-Ord Gi* statistic) in the Spatial Statistics toolbox of ArcGIS 10. Delaunay triangulation was used to generate spatial weighting because it performs well with isolated polygons and polygons with an uneven spatial distribution of features (ESRI 2012), both of which are characteristics of the STAL dataset.

Statistically significant hotspots generally corresponded with the highest kernel density polygons (Figure 3). Four kernel density polygons did not correspond to hotspots. These were clusters containing a high density of observations, but not higher than expected by chance alone. Those four polygons are not included in our recommendation for avoidance areas. Three polygons in close proximity to one another (30km) were merged, and the border of another polygon smoothed to simplify use of the avoidance areas during an event. We recommend the polygons depicted in Figure 4 as avoidance areas within the preauthorization zone, to ensure protection of endangered STAL. The avoidance areas should be included in the Dispersant Use Plan and respective Subarea Contingency Plans. An ArcGIS shapefile of these areas is attached, and additional copies are available from the Service upon request.

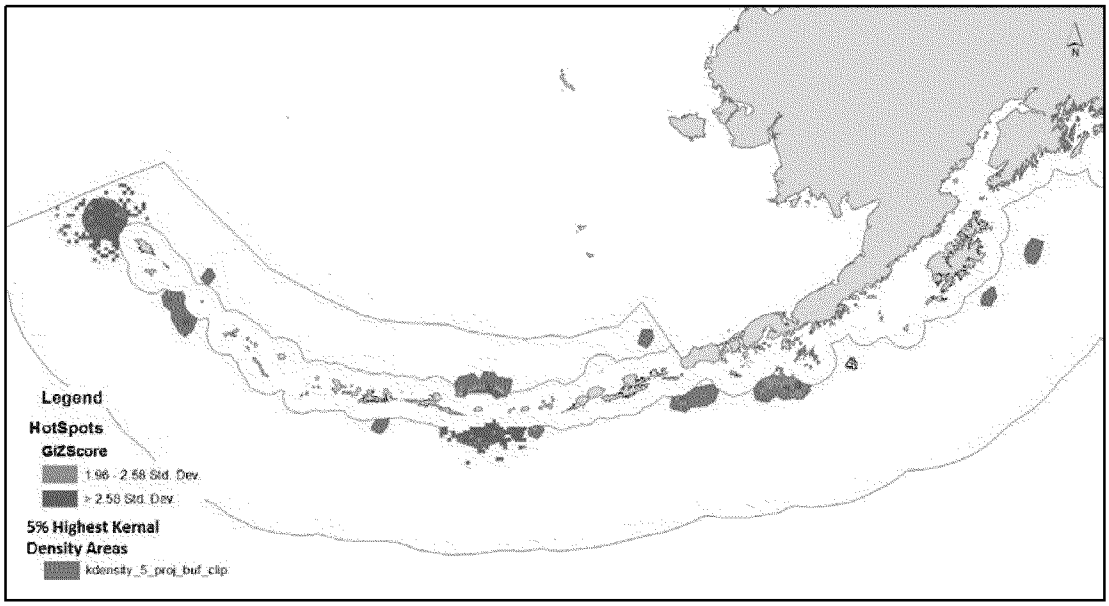


Figure 3. Significant hotspots superimposed on top 5% of kernel densities for STAL within the preauthorization zone.

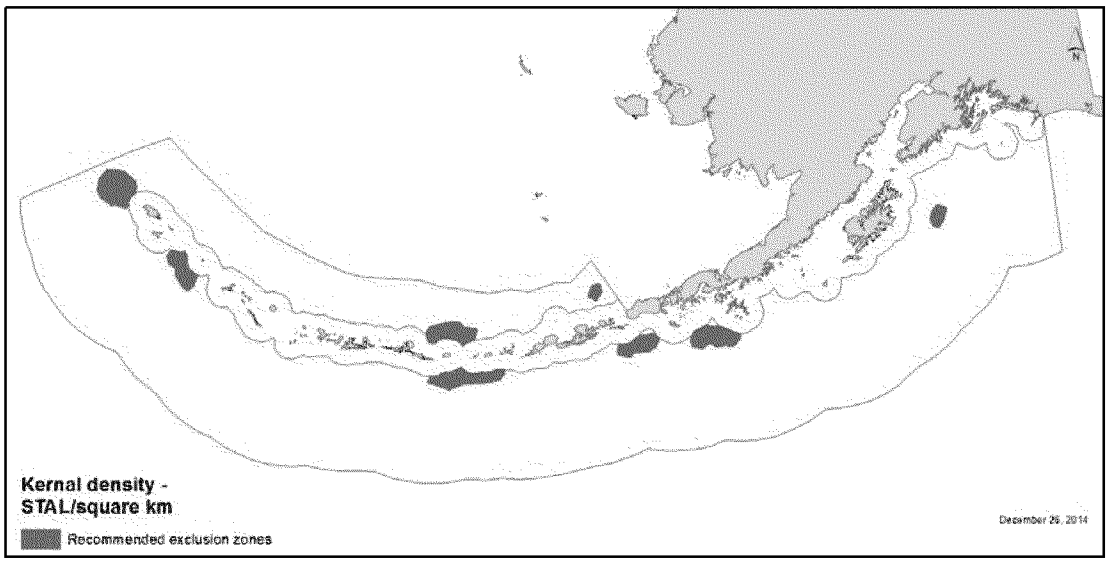


Figure 4. Final recommended avoidance areas based on high density STAL observations.

Literature Cited

ESRI. 2012. Modeling Spatial Relationships *in* ArcGIS 10 Resource Center. Available: http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/Modeling_spatial_relationships/ (December 2014).

Alaska Regional Response Team (ARRT)
c/o USEPA Region 10
ECL Emergency Response, AOO
222 W. 7th Ave. #19
Anchorage, AK 99513
http://alaskarrt.org/

February 17, 2015

Ellen W. Lance
Ecological Services Branch Chief
Fish and Wildlife Service
Anchorage Field Office
605 West 4th Avenue, G-61
Anchorage, Alaska 99501

Dear Ms. Lance:

On November 06, 2014, I received an inquiry via telephone conference regarding the *Biological Assessment of the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases (Unified Plan)* from the U.S. Fish and Wildlife Service (USFWS). The stated reason for the inquiry was that USFWS desired an accommodation for the short-tailed albatross (STAL) critical habitat inside the proposed preauthorization area. As agreed during the telephone conference, I proposed creating avoidance areas for the STAL critical habitat as part of the Endangered Species Act (ESA) section 7 consultation process in accordance with Section 1.4 of the Draft ARRT Dispersant Use Plan for Alaska and also updating footnote 1 on page 7 of the Draft ARRT Dispersant Use Plan for Alaska to highlight this action. The Dispersant Working Group (DWG) met via telephone conference on November 13, 2014 and approved these proposed actions pending USFWS submitting the proposed STAL critical habitat avoidance areas.

On January 02, 2015, I received USFWS's proposed STAL critical habitat avoidance areas and on January 23, 2015, the DWG approved the proposed STAL critical habitat avoidance areas (see enclosure 1). As agreed during the telephone conference with USFWS on November 06, 2014, these avoidance areas are considered final as part of the ESA section 7 consultation process and will be included in the next update to each respective Subarea Contingency Plan. Additionally, footnote 1 on page 7 of the Draft ARRT Dispersant Use Plan for Alaska will be revised to read as follows:

> "Prior to the Alaska Regional Response Team approving this plan, Endangered Species Act section 7 consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service was completed. As a result, there were several avoidance areas created in the preauthorization area in accordance with Section 1.4 of this Dispersant Use Plan to

account for the highest concentrations of the short-tailed albatross and North Pacific right whale critical habitat."

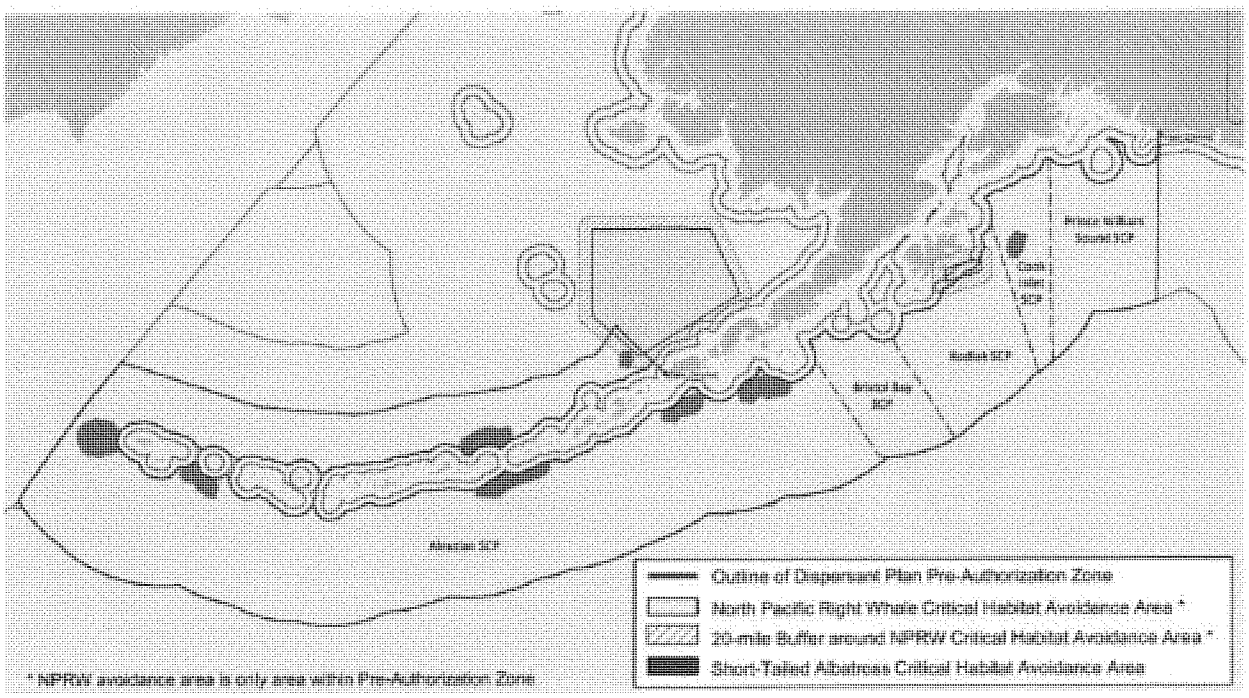
If you require additional information, please contact me at (503) 861-6200.

Sincerely,

Daniel J. Travers
Captain, U. S. Coast Guard
Commander, Sector Columbia River
ARRT Dispersant Working Group Chair

Encl: (1) Updated Preauthorization Area

cc: ARRT U.S. Coast Guard Co-Chair
ARRT U.S. Environmental Protection Agency Co-Chair
State of Alaska ADEC, Division of Spill Prevention and Response
ARRT U.S. Department of Interior Representative
ARRT U.S. Department of Commerce Representative
ARRT U.S. Environmental Protection Agency Liaison



[Top]

DISCUSSION PAPER PREPARED AND SUBMITTED BY USCG AND EPA TO THE SERVICES CLARIFYING THE ACTION: SPECIFICALLY - THE INCLUSION OF SOME ATYPICAL DISPERSANT USES IN FORMAL CONSULTATION ON THE ALASKA UNIFIED PLAN

Background

This paper responds to concerns expressed by the Services regarding a perceived discrepancy identified during review of the *Biological Assessment of the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases (Unified Plan)*. Included in the biological assessment (BA), as coordinated with the Services, is the draft final proposed *ARRT Dispersant Use Plan for Alaska* which describes potential atypical use of chemical dispersants in combating oil spills. At issue is whether atypical use of dispersants is part of the consultation and, if so, whether the action agencies (EPA & USCG) included sufficient analysis to complete the consultation.

Summary

According to 50 CFR §402.14(c)(1) A written request to initiate formal consultation shall be submitted (by a Federal Agency) to the Director and shall include, among other things "a description of the action to be considered". The action agencies clearly laid out the description of the proposed action (Section 1.1.2 of the BA) specifically stating that:

> Subsea dispersant use is not a component of potential response actions identified in the Alaska Unified Plan because it was not conceived of as a response option until the Deepwater Horizon spill in the Gulf of Mexico in 2010. The draft oil dispersant authorization plan, (which will replace Appendix I in Annex F, once approved [approval anticipated for April 2014]; the draft language is included in Appendix A to this BA) indicates any request for subsea dispersant use will be considered using the process for case-by-case dispersant use authorization, with requirements for emergency ESA Section 7 consultation and effectiveness monitoring. As more information and conclusive science becomes available on the subsea application of dispersants, the potential impacts of this response method and any recommended mitigative measures will be further analyzed and evaluated and appropriately incorporated into the Alaska Unified Plan.

The contents of BAs prepared pursuant to the Endangered Species Act are largely at the discretion of the action agency although the regulations provide recommended contents (50 CFR §402.12(f)). As stated in the BA the action under consultation was implementation of the *Unified Plan*. The description of the action presented above states that, due to the lack of information on the effects of subsea application of dispersants (primarily because of its novelty) and the fact that this application method is not currently included in the *Unified Plan*, subsea application of dispersants was not part of the action. Because the subsea application of dispersants had not been conducted before 2010, the state of the

science by the time the BA was in preparation was not developed to the degree that it could be utilized to analyze the effects of this potential response method on Arctic species.

1

Atypical Use Defined

Atypical use of dispersants[1] is defined in the proposed *ARRT Dispersant Use Plan for Alaska* to include: 1) full scale dispersant application on the water surface ongoing for, or expected to exceed or exceeding 96 hours following the dispersant application field test, and/or 2) the use of dispersants subsea (i.e., below the water surface).[2]

Prolonged Use Included in the Consultation

As expanded in the following paragraphs, prolonged surface use (i.e., exceeding 96 hours following the dispersant application field test[3]) is part of this consultation as this form of atypical use is:

1) available under current dispersant policy (Appendix I of Annex F of the *Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases (Unified Plan)*);

2) essentially the same response method as full scale dispersant application less than 96 hours, but with enhanced environmental monitoring;

3) significantly different from subsea application (which is not part of this consultation); and

4) a rare occurrence.

Current Dispersant Policy

The current dispersant policy found at Appendix I of Annex F of the *Unified Plan* places no time limits on the use of dispersants. It stipulates only that:
For areas where there is no preauthorization by EPA, ADEC, DOI, and DOC, Paragraph (b) of Section 300.910 of the National Contingency Plan provides that the FOSC, with the concurrence of the EPA representative to the RRT and, as appropriate, the concurrence of the RRT representative from the state(s) with jurisdiction over the navigable waters threatened by the release or discharge, and in consultation with the DOC and DOI natural resource trustees, when practicable, may authorize the use of dispersants that are listed on the NCP Product Schedule.

---

[1] Some countermeasures, while not presently pre-authorized by the ARRT, are available to FOSCs provided they are approved by the ARRT – including Incident Specific activation of the ARRT which would include review by DOC & DOI – prior to application in accordance with National Contingency Plan (NCP) at 40 CFR §300.910(b).

[2] See footnote on page F-15 of the proposed *ARRT Dispersant Use Plan for Alaska (Draft Revision - April 3, 2014).*

[3] The ARRT standard of "expected to exceed or exceeding 96 hours following the dispersant application field test" contained in the proposed *ARRT Dispersant Use Plan for Alaska* is a more precise refinement of the National Response Team (NRT) standard of "expected to exceed 96 hours or that has already exceeded 96 hours from the time of the first application of any dispersant" found at Section 2.2.1 of the NRT's *Environmental Monitoring for Atypical Dispersant Operations (May 30, 2013).*

ED_001324_00007740-00234

This existing policy harmonizes with the stipulations and protocol for case-by-case dispersant use authorization found in the proposed *ARRT Dispersant Use Plan for Alaska* at Tab 1, Part 1B.

Same Tactic, Longer Duration, Enhanced Monitoring

The general premise behind prolonged use of surface dispersant is that: 1) continued use of dispersants remains the best option based on the overall response picture, and; 2) there is a continuous release of fresh oil amenable to surface dispersion, and/or; 3) the condition of the oil in an existing slick remains amenable to surface dispersion. The methods and tactics for prolonged surface application via vessels and/or aircraft are the same as for surface application periods less than 96 hours via vessels and/or aircraft. What differs between the two time frames is the prescribed monitoring protocols, which are more stringent for prolonged surface application.

The National Response Team's (NRT) *Special Monitoring of Applied Response Technologies (SMART) (rev. August 2006)* and *Environmental Monitoring for Atypical Dispersant Operations (May 30, 2013)* have both been incorporated *in toto* into the *ARRT Dispersant Use Plan for Alaska* at Tab 3, Part 1 and Tab 3, Part 2, respectively. *Environmental Monitoring for Atypical Dispersant Operations* assumes the SMART protocols have been put in place by the FOSC and offers additional guidance, specifically at Section 2.2, for prolonged surface application. Taken together, these documents provide a comprehensive approach to environmental monitoring. Moreover, Section 2.3 Conditions/Stipulations of the *ARRT Dispersant Use Plan for Alaska* requires that, "[d]ispersant application effectiveness and potential trade-offs associated with its use will be evaluated on a daily basis, informing the FOSC's decision to continue, postpone, modify, or cease dispersant application based on that day's monitoring information." This highly protective *daily* re-evaluation stipulation applies to prolonged surface application.

Atypical Modes Vary

While both subsea and prolonged surface application are considered atypical use, they are vastly different tactics and monitored in very different ways. Firstly, the unique and extreme conditions and chain of events that ushered in the first and *only* use of subsea dispersant application (i.e., an inaccessible high pressure reservoir – over a mile deep – with a severely damaged blowout preventer spewing an unprecedented volume of hydrocarbons) during the *Deepwater Horizon/Macondo* response are not present in Alaska[4]. Secondly, the technical means of application of dispersant are different. In subsea scenarios – based on the novel *Deepwater Horizon/Macondo* response – dispersant is injected directly into the oil's flow stream at the source, the wellhead, via a special apparatus on the blowout preventer and/or remotely operated vehicle (ROV) and the necessary mixing energy is derived from the intermix of the fluids rising up through the water column. In surface (or prolonged surface) application, dispersant is applied via a nozzle array from a vessel or aircraft and natural or artificial mixing energy must be adequate to ensure the intermix and proper dispersion down through the water column.

[4] According to the head of the Bureau of Safety and Environmental Enforcement's Oil Spill Preparedness Division, while the overall likelihood of a subsea wellbore incident is greater during exploration activities than during production operations, the shallow depth (~120'-150') and low reservoir pressures of the Chukchi offshore field make such an occurrence very unlikely, particularly in comparison to the high reservoir pressures present far offshore in the Gulf of Mexico. Moreover, industry has proposed and is therefore required to implement other, more direct source control measures (i.e., 'mudding' the hole, engaging the blowout preventer, wellhead capping stack, and/or 'cap and flow' systems). Industry has not proposed nor are they required to use subsea dispersant.

Thirdly, the NRT-mandated monitoring protocols (previously referred to and included in the BA) are very different.

Rarity of Use

Both forms of atypical use of dispersants are rare occurrences. However, it is conceivable that prolonged surface application could be employed on a large, continuous source spill either from a vessel or offshore drilling operation, so it is desirable to include in this consultation.
Dispersants are used on only a small percentage of oil spills. Of those, the vast majority are surface applications for less than 96 hours. Therefore, little data exists on the chronic exposure from prolonged use, particularly in cold water. What does exist was included or referenced in Appendix B of the BA.

Subsea Use Not Included in the Consultation

As mentioned above, subsea dispersant application as a countermeasure has only been used *once* and under unique and extreme tactical conditions. Moreover, the met-ocean and environmental conditions of that use – the Gulf of Mexico in summer time – are not comparable to the cold water conditions in Alaska. Subsea use has never been attempted in Alaska and there are no plans to use this tactic at any of the offshore drilling locations in the state and surrounding waters. Therefore, the action agencies do not consider it part of this consultation, even though it remains a potential tool in the FOSC's response toolbox per 40 CFR §300.910(b)..

The Bureau of Safety and Environmental Enforcement (BSEE) – a Federal agency which regulates offshore oil and gas development activities – does not require industry operators to possess a subsea dispersant use capability *per se*. BSEE, at 30 CFR §254.27, requires industry dispersant use plans to be consistent with the National Contingency Plan (NCP) Product Schedule and other provisions of the NCP and the appropriate Area Contingency Plan(s). The regulation also requires industry dispersant use plans to include:

1) An inventory and a location of the dispersants and other chemical or biological products which they might use on the oils handled, stored, or transported at the facility;

2) A summary of toxicity data for these products;

3) A description and a location of any application equipment required as well as an estimate of the time to commence application after approval is obtained;

4) A discussion of the application procedures;

5) A discussion of the conditions under which product use may be requested; and

ED_001324_00007740-00236

6) An outline of the procedures they must follow in obtaining approval for product uses.

Given the novel use of subsea application during the *Deepwater Horizon/Macondo*, it's reasonable to assume that data on the acute and chronic environmental impacts are being generated for use in the Natural Resource Damage Assessment (NRDA). These NRDA findings remain cloaked in the legal process and follow-on settlement adjudication.

Data Availability

Under 50 CFR 402.14(6)(d) the "The Federal agency requesting formal consultation shall provide the Service with the best scientific and commercial data available or which can be obtained during the consultation for an adequate review of the effects that an action may have upon listed species or critical habitat." The action agencies compiled the information that was available at the time the BA was in preparation and presented what was known about the use of dispersants in an appendix (Appendix B) to the document. The purpose of this appendix was to describe the known or potential adverse impacts of chemical dispersants, alone or in a mixture with oil, both directly and indirectly on species listed under the Endangered Species Act (ESA) (or using surrogates) and through their prey.

As previously mentioned, atypical use of dispersants falls into two categories: prolonged and subsea. The National Response Team, which includes DOI and DOC, specified a 96 hour dispersant period in the *Environmental Monitoring for Atypical Dispersant Operations* document because 96 hours is a common exposure duration in toxicity studies on dispersants (and other chemicals). Because we didn't identify *a priori* a specific spill scenario to evaluate in the BA, we didn't define a spill response duration, either greater or less than 96 hours.

A rigorous literature search was conducted to compile acute and chronic, lethal and sublethal data to analyze the effects of dispersants and dispersed oil on listed species and their prey. The majority of the available data was for tests run at 48 and 96 hour exposure periods. A limited amount of data were available for 14 and 21 day exposures. Data for 96 hour exposure periods was compiled to develop the species sensitivity distribution curves for aquatic species, along with chronic toxicity data to evaluate sensitive endpoints. Chronic exposure durations include a notable portion of a species entire life cycle or early life stages, and are often characteristically longer that acute exposures; where available, we included these in an attachment to the BA (Attachment B-1). Finally, effects were also described more generally for some species, in terms of duration (short or long-term) and magnitude (low or high), which was necessary due to the uncertainties associated with the assessment.

The BA addressed both direct and indirect effects, and potential impacts to listed species, not specifically restricted to short term exposure, including effects on: 1) herring spawning in nearshore waters from potential exposure to dispersed oil; 2) avian reproduction from potential exposure of eggs to dispersants; and 3) prey base resulting in a potential reduction in food resources.

---

[5] Appendix I in Annex F of the *Unified Plan* provides the basis for these procedures. The proposed *ARRT Dispersant Use Plan for Alaska*, which will update Appendix I in Annex F of the *Unified Plan*, will provide a comprehensive, fully-vetted, and more protective standard.

Effects Determinations Unchanged

The purpose of Appendix B of the BA was to describe the known or potential adverse impacts of chemical dispersants, alone or in a mixture with oil, both directly and indirectly on listed species. As a result of this analysis it was determined that the use of dispersants would result in a "likely to adversely affect" determination for numerous (13/25) species. While certainly useful, we don't anticipate that data derived for longer exposure periods (should it have been available) would have changed these determinations.

The Role of Emergency Consultation

Atypical use of dispersant, as contemplated under the proposed *ARRT Dispersant Use Plan for Alaska,* occurs only under the process for case-by-case dispersant use authorization described in Tab 1, Part 1B. This protocol clearly offers several opportunities for input by the Services, including ESA Section 7 emergency consultation described at Step 4.

#

[Top]

APPENDIX F. Effects of Natural Attenuation of Spills on Listed Species

The majority of spills in the Action Area involve petroleum products, generally referred to here as "oil", thus we focus our review on the effects of oil spills. The effects of spilled oil on listed species and critical habitat is an important consideration when evaluating to what degree spill response actions might exceed the effects of exposure to the oil. In some circumstances, the Unified Plan allows spilled oil to attenuate naturally when the adverse impacts resulting from response activities outweigh the benefits. Evaluation of the effects of oil spills as a component of spill response action is limited to this "Natural Attenuation" scenario. This Appendix is not intended to evaluate the effects of spills on listed species as an Action in the Unified Plan, but may be useful to help tease apart the individual and combined effects of spilled material and the actions to respond to the spills. Because the available information specific to listed species is limited, where appropriate, we include information on related taxa as proxies for listed species.

Birds – Spectacled Eider, Steller's Eider, and Short- tailed Albatross

Direct effects on seabirds exposed to spills include acute mass mortality and morbidity caused by fouling of feathers subsequent loss of waterproofing and insulation (discussed in more detail, below). This leads to hypothermia, weakness, behavioral deficits (inability to fly, forage, avoid predators, incubate, or care for young), and mortality. Birds can also exhibit debilitating sublethal effects or mortality from ingestion of toxic oil components (total petroleum hydrocarbons, or more specifically PAHs) via preening of fouled feathers or consumption of contaminated prey (discussed in more detail, below). Direct exposure to fumes or aspiration exposure can result in pneumonia (Albers 2003). Effects from acute exposure may be long-lasting; even after cleaning, rehabilitated birds exhibited weight loss and organ damage (necrosis of the liver, kidney, and duodenum) (Khan and Ryan 1991), and have lower productivity than unoiled birds (Giese et al. 2000). Further, birds that survive acute exposure may be re-exposed to toxic elements of crude oil and experience sublethal physiological impacts for many years following an oil spill (Peterson et al. 2003, Trust et al. 2000). Finally, developing embryos are particularly sensitive to oil exposure, and even small amounts of oil transferred from parent feathers or contaminated nest material may cause embryo death (discussed in more detail, below).

Effects of feather fouling

Exposure to crude oils can have a significant negative effect on the structure and function of the "waterproofed" feathers of waterbirds. Birds are dependent on an insulating layer of air within the plumage for effective thermoregulation. Aquatic bird feathers must be highly water repellent to prevent displacement of the air layer within the plumage. Feathers are not inherently waterproof; they are porous structures that water can pass through under certain circumstances. Feather waterproofing is conferred mostly by its lattice-like fine structure. The physical aspects of feathers that confer repellence include the radii of the barbs, the distance between their axes, and the contact angle of the air/water interface (Rajke 1970). A high contact angle causes water droplets to 'pearl' off a duck's back (Rajke 1970). Birds must preen elaborately and frequently to preserve ideal feather structure. Oil from the uropygial gland is spread during preening; it contains fatty, hydrophobic waxes and esters, and serves as a lubricant to keep feathers smooth and flexible (Rajke 1970).

Water surface tension plays an important role in feather wettability for water birds, because the pressure exerted by the weight of a floating bird must be sufficiently counteracted to keep water from penetrating its feathers (Stephenson and Andrews 1997). Researchers have calculated (Rejke 1970), and empirically shown (Stephenson and Andrews 1997), that feathers may be only marginally resistant to water penetration because only a small pressure gradient across the feather vane, above that caused by the bird's weight, would cause water to pass through. Since surface tension is the force resisting passage of water through the feather pores, only a small change of water surface tension may be required to enable feather wetting. In one experiment, it was shown that ducks and geese would become instantly wetted if they alighted on water where the surface tension had decreased to approximately 50 - 55% of its normal value (Stephenson & Andrews 1997). Water surface tension is decreased during spills of oils, surface-active organic pollutants including organic solvents, and detergents, thus compounding the negative effects of feather structure disruption.

Mallard ducks (*Anas platyrhynchos*) exposed to Prudhoe Bay crude oil were observed shivering, suggesting that the insulating properties of their plumage had been affected. Matting and clumping of feather barbules, which disrupted natural feather layering, were observed, and metabolic rates were increased (Lambert et al. 1982). Stephenson (1997) reviewed the effects of oil and other surface-active organic compounds on aquatic birds, using lesser scaup (*Aythya affinis*) as a model species. He also concluded that once wetted, unless the birds could reach land, preening was unlikely to restore the feathers' insulating ability. Stephenson further noted that wet, weakened birds on shore would be at greater risk of predation relative to healthy birds that rarely come ashore or that may be more capable of escape.

At the microscopic scale, O'Hara and Morandin (2010) studied the physical effects of sheens associated with marine oil and gas development on the feather miscrostructure of common murres (*Uria aalge*) and dovekies (*Alle alle*). They concluded that thin oil or drilling fluid sheens affected feather structure, causing feather barbules to clump together more than in controls. Stephenson (1997) reviewed the mechanisms and effects of external oiling on waterbirds, including studies that demonstrated lower body temperatures and increased metabolic rate (an energetic cost) from external oiling. In water, metabolic rates increased more than on air, expected given the greater heat loss associated with water. Smaller birds have a greater surface:volume ratio may be more vulnerable than large birds.

Molting water birds are particularly vulnerable to loss of plumage insulation, waterlogging and hypothermia (Stephenson 1997). Shortly before molt there is a loss of structural integrity due to feather wear, and the total mass of feathers is reduced as worn feathers are lost. One experiment found that the "wettability safety factor," expressed as the difference between the pressure required to force water through the feather and the pressure exerted by the weight of the bird, is reduced by about half during molt (Stephenson 1997). Molting birds are thus more vulnerable to wetting, while at the same time their energy demands may be elevated due to the cost of feather synthesis.

Effects of ingested oil

Birds (and mammals) are able to metabolize and excrete Polycyclic aromatic hydrocarbon (PAHs), but the energetic cost of doing so (by increasing detoxifying enzymes such as CYP1A1) can be substantial and lead to reduced fitness; if detoxifying systems are overwhelmed, individuals can become ill, have lowered reproduction, or die. PAHs effects on birds have been studied with dosing research and samples collected from the field during oil spills. Effects included lower egg production, lower hatching rates, increased clutch or brood abandonment (likely from mortality or morbidity of one or both parents), reduced growth, increased organ weights, and a variety of biochemical responses (Albers 2006). Hemolytic anemia and other blood abnormalities are common with oiling, as PAH metabolites attack red blood cells (Troisi et al. 2007). Yamato (1996) noted decreased mature erythrocytes, hemoglobin, and hematocrit values, and hemosiderosis (from iron released from red blood cells) in white-winged scoters (*Melanitta fusca*) oiled with Bunker C from a capsized ship, and attributed the exposure to ingestion from preening. Cassins auklets (*Ptychoramphus aleuticus*) exhibited liver damage (hepatocellular dissociation and hemosiderosis), kidney damage (renal tubular necrosis), and hemolytic anemia after experimental exposure to weathered crude oil on their feathers; common murres recovered from an accidental oil spill exhibited the same effects (Fry and Lowenstine 1985).

Pigeon guillemots (*Cepphus columba)* following the EVOS had acute effects of continued exposure to unweathered oil including elevated hepatic cytochrome P4501A (CYP1A), and other detoxifying enzyme activities (Golet 2002). Adult body mass, body condition, and nestling survival of pigeon guillemots were related to oil exposure, perhaps because of reduced availability of a preferred forage fish (Golet 2002). Peterson et al. (2003) summarized other effects of continued exposure to EVOS oil long after the spill event, including higher winter mortality, CYP1A induction, weight loss, and decreased densities of adult female harlequin ducks (*Histrionicus histrionicus*). Black oystercatchers (*Haematopus bachmani*) had reduced productivity on oiled shores compared to unoiled, including reduced incidence of breeding, smaller eggs, and chick mortality. Both species feed on tidal benthic invertebrates, as do listed spectacled and Steller's eiders; black oystercatchers were shown to consume oiled mussels with subsequent negative effects on chick growth, with negative implications for chick survival (Peterson et al. 2003).

Some metabolites of PAHs are far more toxic than the parent compound. For example, the carcinogenicity of PAHs such as benzo(a)pyrene is mediated by reactive metabolites, such as epoxides and dihydrodiols, that bind to cellular proteins and DNA (Albers 2003). The addition of alkyl groups to the base PAH structure also often induces or enhances carcinogenicity of PAHs (Albers 2003). Reactive metabolites of PAHs cause biochemical disruptions and cell damage that can lead to mutations, developmental malformations, tumors and cancer (Varanasi 1989). Thus, PAH metabolism is not always indicative of detoxification.

Effects on embryos (eggs)

Developing avian embryos are particularly sensitive to oil (PAH) toxicity; this has been studied with laboratory-based egg injection, egg immersion, and egg shell application of a variety of oils and PAH mixtures; and with some experimental and observational field research following oil

spills (White et al. 1979). Oil ingested by laying females may cause reduced hatchability, eggshell thickness, or altered yolk structure (Grau et al. 1977, Ainley 1981, Clark 1984, Leighton 1993), but external oiling of eggs also has negative effects. Oil can be transferred to eggs from water (Albers 1980) via parent plumage, feet, or contaminated nest material (Albers 2006, 2003). Effects likely come from PAH toxicity, rather than smothering (Hoffman 1978, 1979). Effects include embryo death, developmental abnormalities (such as retarded growth and teratogenic effects; Hoffman 1978, 1979), and cellular and biochemical responses (Albers 2006), even with no behavioral changes on the part of incubating parents (Albers 1980). Even very small quantities of fresh crude oil (e.g., 1 - 20 ul) can cause mortality (Albers 2003). Although toxicity varies with degree of weathering and developmental stages, Finch et al. (2011) concluded that bird eggs exposed to Gulf of Mexico weathered crude may have had reduced hatching success.

Population- and community-level mortality rates for bird species affected by oil spills are difficult to estimate for various reasons, but a number of large oil spills were estimated to affect tens to hundreds of thousands of birds (1989 EVOS, 1991 *Sea Empress*, 1996 Arabian Gulf; Albers 2003). However, before and after comparisons are often lacking and effects may be confounded by other environmental conditions. When differences in population sizes can be detected, the effects of natural variability make it difficult to attribute the differences to the exposure to spilled substances. We found no research specific to albatrosses or eiders, but some information was available for other species of marine birds. Table F-17 shows taxa for which significant population declines were detected due to the effects of spills. No significant differences were detected for other taxa, some of which were examined in the same studies (Murphy et al. 1997; Piatt et al. 1990).

Table F-17. Estimates of acute bird mortality rates from oil spills.

Taxa	Population Decline (%)	Citation
European shag (*Phalacrocorax aristotelis*)	11	Martinez-Abrian et al. 2006
Grebes, cormorants and sea ducks	44-84	Piatt et al. 1990 (EVOS)
Common murres	50	Piatt et al. 1990 (EVOS)
Marine birds	54	Mcknight et al. 2006 (DHS)
Pigeon guillemots	57	Murphy et al. 1997
Pelagic cormorants (*Phalacrocorax pelagicus)*	32	Murphy et al. 1997
Black oystercatchers	27.5	Murphy et al. 1997

[Top]

When adequate data are available, they show that population and community level effects can be long-lasting: twelve avian taxa (black-legged kittiwakes [*Rissa tridactyla*], buffleheads [*Bucephala albeola*], "goldeneyes," [*Bucephala spp.*] "grebes," glaucous-winged gulls [*Larus glaucescens*], harlequin ducks, "mergansers," [*Mergus*] mew gulls [*Larus canus*], marbled murrelets [*Brachyramphus marmoratus*], common murres, northwestern crows [*Corvus caurinus*], and pigeon guillemots) exhibited no population trends consistent with recovery in 2005, 16 years after the EVOS (McKnight et al. 2006).

Sea Otter

Sea otters are critically dependent upon their fur for thermoregulation, and oiling severely reduces fur thermoregulatory performance. Thermal conductance (an index of insulative quality) of marine mammal fur was significantly decreased after oiling, with sea otter pup fur being the most affected (Kooyman et al. 1976). A live otter would experience thermal stress, including decreased body temperature and significantly increased metabolic rate, as well as increased energy expenditure through additional grooming attempts (Kooyman et al. 1976; Costa and Kooyman, 1980, 1982; Englehardt 1983). Sea otters may also ingest oil, through grooming of oiled fur and through ingestion of contaminated prey. Sea otters have exhibited hemorrhagic gastrointestinal lesions (Baker et al. 1981), lung, liver, and kidney damage, DNA damage, and altered blood chemistry (Lipscomb 1996; Bickham 1998) after oil ingestion.

Spills may cause direct and indirect effects on critical habitat elements for sea otters, particularly kelp forests. For example, the rocky shoreline recovery after the EVOS took a decade or more (Peterson 2003). The initial loss of the rockweed *Fucus gardneri* triggered a community cascade, including blooms of ephemeral green algae caused by loss of *Fucus* on rocks, followed by loss of grazing and predatory gastropods. Fucus recovery was constrained; without canopy cover, *Fucus* recruits were subject to dessication. Even after apparent recovery of *Fucus*, previously oiled shores exhibited more rockweed mortality caused by the senescence of the single-aged stand (Peterson 2003). These studies and others such as those after the Torrey Canyon oil spill in the United Kingdom (Peterson 2003) point out the importance of indirect interactions to the continuity of rocky intertidal communities and the lengthy recovery time after severe oiling. All of these effects may result in population-level impacts to sea otters, as demonstrated by the very large EVOS (Albers 2003), with a reduction in otter survival rates still evident nine years post-spill (Monson 2000).

Polar Bears

Polar bears may also experience decreased fur performance with oiling. Thermal conductance of marine mammal fur including polar bear fur was significantly increased after oiling, which means loss of insulating capacity (Kooyman et al. 1976). Polar bears are most likely to come in contact with spilled material either directly at preferred feeding areas or through ingesting contaminated prey (Neff 1990). Polar bears groom themselves regularly as a means to maintain the insulating properties of their fur, so oil ingestion would likely be by this means (Neff 1990).

Most direct information comes from two experimental studies (Øritisland et al. 1981; St. Aubin 1990) in which polar bears were involuntarily forced into pools of water with oil. These authors suggest that polar bears are particularly vulnerable to oil spills due to inability to thermoregulate and to poisoning from ingestion of oil from grooming and/or eating contaminated prey (St. Aubin 1990; Øritisland et al. 1981). In the St. Aubin (1990) study, the animals immediately attempted to clean the oil from their paws and forelegs by licking, and continued grooming trying to clean their fur for five days. After 26 days one bear died of liver and kidney failure and the other bear was euthanized at day 29. Gastrointestinal fungus-containing ulcers, degenerated kidney tubules, low-grade liver lesions, and depressed lymphoid activity were found during necropsy (St. Aubin 1990). Other effects included hair loss, gastrointestinal damage, anemia, anorexia, and stress (Øritsland et al. 1981; St. Aubin 1990; Derocher and Stirling 1991). Effects

were both acute and chronic, with some occurring five to six weeks after a single exposure to oil (Øritisland et al. 1981). Additionally, polar bears are curious and are likely to investigate oil spills and scavenge oil-contaminated wildlife, especially inexperienced subadults or if behaviorally compromised.

Although oil avoidance behavior by healthy polar bears is unknown, bears that are hungry are likely to scavenge contaminated seals, as they have shown no aversion to ingesting oil (St. Aubin 1990; Derocher and Stirling 1991). Petroleum hydrocarbons irritate or destroy epithelial cells lining the stomach and intestine, thereby affecting motility, digestion, and absorption, potentially contributing to weight loss or poor growth in young bears.

Population-level effects of exposure to oil on polar bears would depend upon the severity, location, and timing of the spill. Pipeline leaks could expose a small number of bears, including vulnerable females with young. Spills during the fall or spring (ice-up or breakup) would expose prime bear feeding areas over the continental shelf. Amstrup et al. (2000a) concluded that the release of oil trapped under the ice from an underwater spill during the winter could be catastrophic during spring break-up. During the autumn freeze-up and spring break-up periods it is expected that any spilled oil in the marine environment would concentrate and accumulate in open leads and polynyas, areas of high activity for both polar bears and seals (Neff 1990), resulting in oiling of both polar bears and seals that are their prey (Neff 1990; Amstrup et al. 2000a; Amstrup et al. 2006). The impact of a large spill, particularly during the broken ice period, could be significant to polar bear populations (71 CFR 43926), especially if the spill spread to seasonal concentration areas (e.g., near Kaktovik). A large oil spill could also indirectly affect polar bears through reductions in prey (ringed seal) as did the EVOS with harbor seals (Frost et al. 1994a; Frost et al. 1994b; Lowry et al. 1994; Spraker et al. 1994). Because of the greater maternal investment a weaned subadult represents, reduced survival rates of subadult polar bears greater impact on population growth rate than reduced litter production rates (Taylor et al. 1987).

Pacific Walrus

Because walruses rely primarily on a layer of blubber under the integument for insulation, direct coating would not affect their thermoregulation as it would sea otters and polar bears (St. Aubin 1990). However, direct exposure to oil could cause corneal ulcers and abrasions, conjunctivitis, and swollen nictitating membranes, as observed in captives ringed seals (Geraci and Smith 1976), harbor seals following the Exxon Valdez oil spill, and seals in the Antarctic after an oil spill (St. Aubin 1988); they could also exhibit increased gastrointestinal motility, vocalizations, and sleep less (Geraci and Smith 1976; Engelhardt 1985; Engelhardt 1987). Oral ingestion of oil can destroy epithelial cells in the digestive tract, affecting motility, digestion, and absorption, leading to illness, death, or reproductive failure (St. Aubin 1990). Walruses depend on scent to recognize pups; sea lion mothers did not recognize their oil-coated pups, though oiled grey seal pups appeared to nurse normally (St. Aubin 1990).

Marine mammals can be exposed to volatile and aerosolized petroleum components through inhalation, as they normally breathe immediately above the air-water interface. This was attributed as one cause of harbor seal mortality following the EVOS (Frost et al. 1994a,b; Lowry

et al. 1994; Spraker et al. 1994). Dolphins sampled over a year after the DHS from heavily oiled regions of the Gulf of Mexico evidenced lung disease, with "significant alveolar interstitial syndrome, lung masses, and pulmonary consolidation" (Schwacke et al. 2013), consistent with laboratory studies and clinical reports of humans and animals exposed via ingestion, inhalation, or aspiration of petroleum hydrocarbons. The dolphins also had reduced adrenal gland function consistent with petroleum exposure (Schwacke et al. 2013). Parasitized lungs are common in walruses and other pinnipeds, and can exacerbate the effects of even mild PAH exposure (St. Aubin 1990).

Indirect Effects on Invertebrate Prey of Listed Species

Food resources are a critical biological feature of the of listed species' environment. Food quality and availability is a key determinant of the ability of habitat to support survival and recovery of the species, and thus the conservation value of designated critical habitat. Effects of spills plus response actions on food resources constitute indirect impacts as well as impacts to habitat. Actions that reduce the availability, quantity, or quality of food resources also reduce the utility of the habitat. For spectacled eiders, Steller's eiders, short-tailed albatross, sea otters, and Pacific walrus (who all depend upon invertebrate and fish prey) indirect effects under the Natural Attenuation spill response action include reduced prey abundance or quality (e.g., smaller prey items), consumption of invertebrate prey that accumulate PAHs over time (bivalves), or ecosystem shifts due to spill impacts on other species (e.g., trophic cascades from loss of macroalgae as described in Peterson et al. 2003). As a result of the EVOS, oil persisted in toxic forms for more than a decade, resulting in long-term impacts to species closely associated with shallow sediments (Peterson et al. 2003).

There are volumes describing the effects of oil exposure on invertebrates and fish (Albers 2003). For invertebrate prey of listed species, we are most concerned with mortality and recolonization rates, which affect abundance; and growth rates following exposure, which could affect size and therefore quality of invertebrate prey. For fish prey of listed species, we are concerned about mortality (abundance), and effects of oil exposure on young, which could result in population declines. We are concerned about oil on the water surface, in the water column (pelagic compartment), and on the bottom (benthic compartment), because life histories of most prey items include residence time in one or more of these.

Oil effects on marine invertebrates include debilitation, mortality, reduced reproduction, lowered respiration, abnormal or slow development and delayed larval emergence, lesions, population declines, and community changes; these are caused by physical smothering, narcosis and other forms of PAH toxicity, and perhaps water chemistry changes including decreased dissolved oxygen or changes in pH (reviewed in Albers 2003). Narcosis, caused by disruption of ion channels in membranes, is a distinct effect on fish and invertebrates including squid (Hendry et al. 1985) (prey of short-tailed albatross). Eggs and larvae are often more sensitive to PAH toxicity compared to young and adults, including to phototoxicity. Although less work has been done on freshwater invertebrates, effects of petroleum or PAH exposure included reduced survival, altered physiology and behavior, inhibited reproduction, soft-tissue abnormalities, and population and community changes (Albers 2003).

Ultra-violet (UV) light enhances oil toxicity, observed in translucent organisms exposed to the UV component of sunlight following tissue accumulation of certain larger-ringed PAHs (photosensitization), or when dissolved PAHs are photo-chemically transformed to compounds of higher toxicity and subsequently absorbed by the organism (photo-modification) (Duersterloh 2002). Photosensitization has been identified as the main mechanism causing photo-enhanced toxicity in various fish and invertebrates (Pelletier et al. 1997, Barron et al. 2003, Incardona et al. 2012), but several authors described photo-modification as a mechanism for increased toxicity of PAHs to plants (Huang et al. 1995, Marwood 1999). When organisms are exposed to phototoxic PAHs and UV, subsequent toxicity can be hundreds or even thousands-fold greater than exposure to the PAH in the absence of UV (Pelletier et al. 1997). Translucent biota inhabiting the upper water column, and the intertidal and shallow subtidal epibenthos, are exposed to UV in sunlight and may encounter PAH dissolved from chronic or catastrophic oil pollution sources (Duesterloh et al. 2002). Species with pelagic larvae are also at particular risk (Pelletier 2003). In one experiment, pyrene LC50s and EC50s for mysids (*Mysidopsis bahia*), bivalve embryos (*Mulinia lateralis*), and bivalve juvenile survival under fluorescent and ultraviolet light differed by a factor of 27.6, 51900, and 5620, respectively (Pelletier 2003). Similarly, the EC50 for embryonic and larval bivalves exposed to Prudhoe Bay crude oil, expressed was total PAHs, was 29-fold lower under UV light relative to fluorescent light (Pelletier 2003). Thus, laboratory toxicity values can underestimate toxicity under field conditions.

Toxic effects of PAHs to fish can have consequences via the food chain for short-tailed albatross and seal-eating polar bears (seals eat fish). Effects depend upon life stage and the specific PAH composition. Smaller 1- and 2-ringed PAHs produce a general narcotic toxicity, which is the type of toxicity best captured by short-term acute lethality studies (including those characterized in the BA's Species Sensitivity Distributions and HC5s). In embryonic fish, 3- to 4-ring compounds produce cardiac dysfunction characterized by pericardial and yolk-sac edema, dorsal curvature of the trunk and tail, significant growth reduction, and often death at later developmental stages (Incardona et al. 2004). In contrast, 4-ring PAHs exhibit Ah receptor-mediated toxicity (such as that produced by dioxins and polychlorinated biphenyls) including CYP1A enzyme induction, reduced circulation in the head and trunk with pericardial edema, failure of erythropoiesis, and apoptotic cell death in the neural tube (Incardona et al. 2004). The 4-, 5-and 6-ring PAHs are the most carcinogenic PAHs, particularly following activation to reactive metabolites that bind to cellular proteins and DNA (Albers 2003).

Multiple studies have shown that herring embryos are exquisitely sensitive to cardiotoxicity caused by 3- and 4-ring PAHs. Concentrations of 0.3 - 1 part per billion of these chemicals, referred to as "cardiotoxicity associated with polycyclic aromatic compounds" or PAH, are sufficient to cause cardiotoxicity and resultant death in herring embryos (Incardona et al. 2012, Carls 1999, Mcintosh et al. 2010), substantially lower than LC50 values generated in laboratory tests (summarized in WindWard 2014). In one experiment, embryos with sub-lethal pericardial edema failed to feed as larvae and did not survive metamorphosis (Hicken et al. 2011). Others have documented negative impacts to growth and marine survival of pink salmon that were exposed to crude oil as embryos, demonstrating the importance of long-term impacts and delayed effects on ecosystems (Heintz et al. 2000).

There may be other components of crude oils, in addition to PAHs, that are also phototoxic. When herring embryos were exposed to sunlight and weathered bunker oil on the day of fertilization, embryos developed "normally" and were viable for seven days, and then there was an abrupt loss of epithelial integrity and mortality by day eight post-fertilization, at the hatching stage (Incardona et al. 2012). Tissue levels of known phototoxic PAHs were too low to explain the observed degree of toxicity, indicating the presence of other unidentified or unmeasured phototoxic compounds derived from bunker oil. Crude oils are complex mixtures of over 500 chemicals; crude oils and products like residual oil are poorly characterized, both with respect to their chemical composition and their biological activities.

In Alaska, calanoid copepods (order Calanoida) occupy an important niche in marine food webs because they ingest a substantial proportion of annual primary production in the temperate and subarctic waters of the North Atlantic and North Pacific Oceans (Parsons and Lalli 1988). Thus, they account for the majority of the secondary production on a biomass basis in these waters. As secondary production, they are prey for most of the higher trophic level species, either directly or indirectly. Forage or juvenile fishes are often zooplanktivorous and are themselves prey for piscivorous fishes and marine mammals. The calanoid copepods are all translucent, and the advanced life stages of many are exposed to UV light while grazing on phytoplankton blooms near the sea surface during daylight (Hays 1995). Many of these copepods are lipid-rich in their later life stages and may bioaccumulate substantial burdens of PAHs through equilibrium partitioning (Duesterloh et al. 2002). Calanoid copepods thus include ecological key-role species that may be especially vulnerable to photo-enhanced toxicity of PAHs derived from crude oil, and their ingestion may be an important exposure pathway for organisms at higher trophic levels. Calanoid copepods exposed to small amounts of Alaska North Slope crude oil (approximately 2 parts per billion total PAH) exhibited passive PAH uptake into lipid-rich tissues, and those concurrently exposed to UV from sunlight exhibited dramatic photo-enhanced toxicity (Duesterloh et al. 2002). The authors postulated that the ecological implications of calanoid copepod toxicity could be particularly severe in nearshore areas where vertical migration of copepods is limited; phototoxicity in this situation could cause a mass mortality of the local plankton population.

Indirect effects of exposure to oil vary by species, but listed eiders, sea otters, and Pacific walruses all consume benthic invertebrates. Some invertebrates including bivalves and some crustaceans do not have a well-developed mixed function oxidase system and do not readily metabolize PAHs (Albers 2003). Organisms are exposed at the sediment-water interface, or by ingestion of sediment particles by filter feeders or sediment-dwelling deposit feeders (Varanasi and Malins 1977, Engelhardt 1987, Akkanen et al. 2012). Thus, if oil reaches the benthos, listed species can be exposed long-term to the toxic compounds in oil, with recovery taking many years, particularly in colder regions (Elmgren et al. 1983).

[Top]

Literature Cited

The Service has done our best to ensure this list is complete, but please contact us in the case of missing references.

Ainley, D. G., Grau, C. R., Roudybush, T. E., Morell, S. H. & Uttis, J. M. (1981). Petroleum ingestion reduces reproduction in Cassins Auklets. Mar. Pollut. Bull., 12, 314-17. Albers, P. H. (1977).

Akkanen J, A Tuikka, JVK Kukkonen. 2012. On the borderline of dissolved and particulate organic matter: Partitioning and bioavailability of polycyclic aromatic hydrocarbons. Ecotoxicology and Environmental Safety 78:91-98.

Albers, P.H. 2003. Petroleum and individual polycyclic aromatic hydrocarbons. Pages 341-371 in D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr., and John Cairns, Jr. Handbook of ecotoxicology. Lewis Publishers, London.

Amstrup SC, GM Durner, TL McDonald, WR Johnson. 2006. Estimating Potential Effects of Hypothetical Oil Spills on Polar Bears. Anchorage, Alaska. U.S. Geological Survey, Alaska Science Center.

Barron MG, MG Carls, JW Short, SD Rice. 2003. Photoenhanced toxicity of aqueous phase and chemically dispersed weathered Alaska North Slope crude oil to Pacific herring eggs and larvae. Environmental Toxicology and Chemistry 22(3):650-660.

Bickham JW, Jonna Mazet, John Blake, Michael Smolen, Yigong Lou, Brnda Ballachey. 1998. Flow cytometric determination of genotoxic effects of exposure to petroleum in mink and sea otters. . Ecotoxicology 7 (1998):191-199.

Clark RB. 1984. Impact of Oil Pollution on Seabirds. In editor. Great Britain: Environmental Pollution (Elsevier Applied Science Publishers, Ltd.).

Costa DP, GL Kooyman. 1984. Contribution of specific dynamic action to heat balance and thermoregulation in the sea otter *Enhydra lutris*. Physiol. Zool. 57: 199-203.

Derocher AE, I Stirling. 1991. Oil contamination of polar bears. Polar Record 127(160):56-57.

Duesterloh S, JW Short, MG Barron. 2002. Photoenhanced toxicity of weathered Alaska North Slope crude oil to the Calanoid copepods *Calanus marshalla*e and *Metridia okhotensis*. Environmental Science & Technology 36:3953-3959.

Finch, B. E., et al. 2011. Embryotoxicity of weathered crude oil from the Gulf of Mexico in mallard ducks (Anas platyrhynchos). Environmental Toxicology and Chemistry, 30(8), 1885-1891,

Golet GHS, Pamela E.//McGuire, A.David//Roby, Daniel D.//Fischer, Julian B.//Kulentz, Katherine J.//Irons, David B.//Dean, Thomas A.//Jewett, Stephen C.//Newman, Scott H. 2002. Long Term direct and indirect effects of the Exxon Valdez oi lspill on pigeon guillemots in Prince William Sound, Alaska. MARINE ECOLOGY PROGRESS SERIES 241:287-304.

Grau, C., Roudybush, R. T., Dobbs, J. & Watben, J. (1977). Altered yolk structure and reduced hatchability of eggs from birds fed single doses of petroleum oils. Science, 195, 779-81.

Hays GC. 1995. Ontogenetic and seasonal variation in the diel vertical migration of the copepods *Metridia lucens* and *Metridia longa*. Limnol. Oceanogr. 40(8):1461-1465.

Heintz RA, SD Rice, AC Wertheimer, RF Bradshaw, FP Thrower, JE Joyce, JW Short. 2000. Delayed effects on growth and marine survival of pink salmon Oncorhynchus gorbuscha after exposure to crude oil during embryonic development. MARINE ECOLOGY PROGRESS SERIES 208:205-216.

Hicken CE, TL Linbo, DH Baldwin, ML Willis, MS Myers, L Holland, M Larsen, MS Stekoll, SD Rice, TK Collier, NL Scholz, JP Incardona. 2011. Sublethal exposure to crude oil

during embryonic development alters cardiac morphology and reduces aerobic capacity of fish. PNAS 108(17):7086-7090.

Hoffman, D. J. (1978). Embryotoxic effects of crude oil in mallard ducks and chicks. ToxicoL AppL PharmacoL, 46, 183-90.

Hoffman, D. J. (1979a). Embryotoxic and teratogenic effects of petroleum hydrocarbons in mallards (Anas platyrhynchos). J. ToxicoL Environ. Health, 5, 835-44.

Huang X-D, DG Dixon, BM Greenberg. 1995. Increased polycyclic aromatic hydrocarbon toxicity following their photomodification in natural sunlight: Impacts on the duckweed *Lemna gibba* L. G-3. Ecotoxicology and Environmental Safety 32:194-200.

Incardona JP, CA Vines, TL Linbo, MS Myers, CA Sloan, BF Anulacion, D Boyd, TK Collier, S Morgan, GN Cherr, NL Scholz. 2012. Potent phototoxicity of marine bunker oil to translucent herring embryos after prolonged weathering. PLOS One 7(2):13.

Incardona JP, TK Collier, NL Scholz. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. Toxicology and Applied Pharmacology 196:191-205.

Khan, R. A. & Ryan, P. (1991). Long term effects of crude oil on common murres (Uria aalage) following rehabilitation. Bull. Environ. Contam. Toxicol., 46, 216-22.

Kooyman G, R Gentry, B McAlister. 1976. Physiological impact of oil on pinnipeds. US Department of Cemmerce, National Oceanic and Atmospheric Administration.

Lambert G, DB Peakall, BJR Philogene, FR Engelhardt. 1982. Effect of oil and oil dispersant mixtures on the basal metabolic rate of ducks. Bulletin of Environmental Contamination and Toxicology 29:520-524.

Lipscomb TPH, R.K.//Rebar, A.H.//Ballachey, B.E. 1996. Pathological Studies of Sea Otters. Exxon Valdez Oil Spill State/Federal Natural Resource Damage Assessment - Final Report:1-16.

Martinez-Abrian A, A Velando, D Oro, M Genovart, C Gerique, MA Bartolome, E Villuendas, B Sarzo. 2006. Sex-specific mortality of European shags after the Prestige oil spill: demographic implications for the recovery of colonies. Marine Ecology Progress Series 318:271-276. Available: http://www.int-res.com/abstracts/meps/v318/p271-276/ (January 2015).

McIntosh S, T King, D Wu, PV Hodson. 2010. Toxicity of dispersed weathered crude oil to early life stages of Atlantic herring (*Clupea harengus*). Environmental Toxicology and Chemistry 29(5):1160-1167.

McKnight A, KM Sullivan, DB Irons, SW Stephensen, S Howlin. 2006. Marine Bird and Sea Otter Population Abundance of Prince William Sound, Alaska: Trends following the T/V Exxon Valdez Oil Spill, 1989-2005 Anchorage, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management.

Monson DHD, Daniel F.//Ballachey, Brenda E.//Johnson, Ancel//Bodkin, James L. 2000. Long-term impacts of the Exxon Valdez oil spill on sea otters, assessed through age-dependent mortality pattterns. PNAS 97(12):6562-6567.

Murphy SM, RH Day, JA Wiens, KR Parker. 1997. Effects of the Exxon Valdez Oil Spill on Birds: Comparisons of Pre- and Post-Spill Surveys in Prince William Sound, Alaska. The Condor 99(2):299-313. Available: http://www.jstor.org/stable/1369936 (January 2015).

Parsons TR, CM Lalli. 1988. Comparative oceanic ecology of the plankton communities of the subarctic Atlantic and Pacific oceans. Oceanography and Marine Biology Annual Review 26:317-359.

Pelletier MC, RM Burgess, KT Ho, A Kuhn, RA McKinney, SA Ryba. 1997. Phototoxicity of individual polycyclic aromatic hydrocarbons and petroleum to marine invertebrate larvae and juveniles. Environmental Toxicology and Chemistry 16(10):2190-2199.

Peterson CH, SD Rice, JW Short, D Esler, JL Bodkin, BE Ballachey, DB Irons. 2003. Long-Term Ecosystem Response to the Exxon Valdez Oil Spill. Science 302(5653):2082-2086. http://www.sciencemag.org/content/302/5653/2082.abstract (January 2015).

Piatt JF, CJ Lensink, W Butler, M Kendziorek, DR Nysewander. 1990. Immediate Impact of the 'Exxon Valdez' Oil Spill on Marine Birds. The Auk 107(2):387-397. Available: http://www.jstor.org/stable/4087623 (January 2015).

Schwacke LH, CR Smith, FI Townsend, RS Wells, LB Hart, BC Balmer, TK Collier, S De Guise, MM Fry, LJ Guillette, SV Lamb, SM Lane, WE McFee, NJ Place, MC Tumlin, GM Ylitalo, ES Zolman, TK Rowles. 2013. Health of Common Bottlenose Dolphins (Tursiops truncatus) in Barataria Bay, Louisiana, Following the Deepwater Horizon Oil Spill. Environmental Science & Technology 48(1):93-103. http://dx.doi.org/10.1021/es403610f (January 2015).

St. Aubin DJ. 1990. Physiologic and toxic effects on polar bears. In editor. Sea Mammals and Oil: Confronting the Risks. Academic Press.

Stephenson R, CA Andrews. 1997. The effect of water surface tension on feather wettability in aquatic birds. Canadian Journal of Zoology 74:288-294.

Stephenson R. 1997. Effects of oil and other surface-active organic pollutants on aquatic birds. Environmental Conservation 24(2):121-129.

Taylor MK, DP DeMaster, FL Bunnell, RE Schweinsburg. 1987. Modeling the sustainable harvest of female polar bears. Journal of Wildlife Management 51(4):811-820.

Trust KA, D Esler, BR Woodin, JJ Stegeman. 2000. Cytochrome P450 1A induction in sea ducks inhabiting nearshore areas of Prince William Sound, Alaska. Marine Pollution Bulletin 40(5):397-403.

White, D. H., King, K. A. & Coon, N. C. (1979). Effects of No. 2 fuel oil on hatchability of marine and estuarine bird eggs. Bull. Environ. Contain. Toxicol., 21, 7-10.

Yamato O, Goto, Ikuo//Maede, Yoshimitsu. 1996. Hemolytic Anemia in Wild Seaducks Caused by Marine Oil Pollution. Journal of Wildlife Diseases 32(2):381-384.

[Windward] Windward Environmental LLC and ERM. 2014. The Biological Assessment of the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases (Unified Plan) Final, 23 January 2014. Anchorage. Prepared for: United States Coast Guard, Seventeenth Coast Guard District, and United States Environmental Protection Agency, Region 10 Alaska. 1-820.

To: Matthiessen, Craig[Matthiessen.Craig@epa.gov]
From: Principe, Vanessa
Sent: Thur 4/23/2015 6:25:23 PM
Subject: FW: From LAEO: Your Comment Submitted on Regulations.gov (ID: EPA-HQ-OPA-2006-0090-0409)
LAEO Public CommentFF.pdf
ATT00001.htm

FYI

From: Diane Wagenbrenner [mailto:dianesue3@att.net]
Sent: Wednesday, April 22, 2015 10:38 PM
To: Principe, Vanessa
Cc: Diane Wagenbrenner
Subject: From LAEO: Your Comment Submitted on Regulations.gov (ID: EPA-HQ-OPA-2006-0090-0409)

Hello Vanessa,

I have tried to attach LAEO's public comment pdf doc in the .gov site three times. It keeps replacing it with a 'sample letter' document. In order to ensure there is a record that I did

submit our comment (15 pages of a pdf document) by the deadline cut off, I am attaching it herewith. Thank you for providing this opportunity. Please see below:

LINK:
http://protectmarinelifenow.org/wp-content/uploads/delightful-downloads/2015/04/LAEO-Public-CommentFF1.pdf

I would appreciate it if you confirmed receipt.

Thanks Much,
Diane

Begin forwarded message:

From: "Regulations.gov" <no-reply@regulations.gov>
Subject: Your Comment Submitted on Regulations.gov (ID: EPA-HQ-OPA-2006-0090-0409)
Date: April 22, 2015 at 10:24:44 PM EDT
To: dianesue3@att.net

Please do not reply to this message. This email is from a notification only address that cannot accept incoming email.

Your comment was submitted successfully!

Comment Tracking Number: 1jz-8ig2-yl5y

Your comment may be viewable on Regulations.gov once the agency has reviewed it. This process is dependent on agency public submission policies/procedures and processing times. Use your tracking number to find out the status of your comment.

Agency: Environmental Protection Agency (EPA)
Document Type: Rulemaking
Title: Comment submitted by The Lawrence Anthony Earth Organization (LAEO)
Document ID: EPA-HQ-OPA-2006-0090-0409

Comment:
Dear EPA: This is Diane Wagenbrenner, VP Operations, Lawrence Anthony Earth Organization. I have submitted our public comment twice consisting of attaching a 15 page document. The system is not receiving this document under my comment, therefore, I am resubmitting it a 3rd time as a LINK here to ensure it does in fact get received.

Here it is: [URL REMOVED]

Thank you.

Uploaded File(s):
No files uploaded

For further information about the Regulations.gov commenting process, please visit http://www.regulations.gov/#!faqs.

*** For security purposes, URLs were removed from this receipt but not from your comment on Regulations.gov.**

Diane Wagenbrenner
VP Operations & Public Information
Lawrence Anthony Earth Organization
diane@theearthorganization.org
Ph: 858-531-6200

We would love for you to become a Member!
∞
Because None Survive Alone

www.theearthorganization.org

Campaign Coordinator: www.ProtectMarineLifeNow.org
Change Oil Spill Response Global Alliance Member

Helping members of our planetary ecosystems who cannot speak for themselves

PRIVILEGED AND CONFIDENTIAL -- All information transmitted hereby is intended for the use of the addressee(s) named above. If the reader of this message is not the intended recipient of the employee or agent responsible for delivering the message to the intended recipient (s), please note that any distribution or copying of this communication is strictly prohibited. Anyone who receives this communication in error should notify the sender by telephone and destroy/delete the original message.

EPA Docket Center (EPA/DC)
Docket ID No. EPA-HQ-OPA-2006-0990
1200 Pennsylvania Avenue NW
Washington, DC 20460

Re: RIN 2050-AE87, Docket ID No. EPA-HQ-OPA-2006-0990, LAEO Public Comment/Recommendations – Proposed Rules – 40 CFR Parts 110 and 300 National Oil and Hazardous Substances Pollution Contingency Plan

We would like to begin by recognizing and acknowledging the immense amount of work by many well-intentioned individuals and professionals involved in this rulemaking revisions project and thank you for all that you are doing towards the goal of safeguarding our oceans and living eco-systems.

While these regulations are intended to help enforce and support the U.S. Clean Water Act the original sections and some of the newly proposed changes do not effectively address many of the most concerning issues we have experienced in working within the NCP system to implement improvements in spill **removal** technologies.

While intended to provide guidance in spill remediation, much of the current NCP is still based on outdated science with very complicated bureaucratic layers making it difficult for responders to navigate the system. Most concerningly, are the possibly unintended but nevertheless evident in practice, open door policies allowing undesirable chemicals to be used on oil spills while hampering innovative technologies that can in fact completely *remove* hazardous chemical spills from our waters and oceans. The true test of regulations lies in proof of whether or not they in fact achieve a desirable end result in actual practice.

That said, while many of the proposed changes are based on sound judgment and lessons learned, there remain several sections which contain elusive and/or ambiguous language that provide easy pathways for hazardous chemicals to enter our oceans and waters and, again, we emphasize—while constraining the use of better technologies for cleaning and protecting the Gulf of Mexico and the critically important waters of Alaska and the Arctic and the thousands of toxic spill sites throughout Earth's lands and waters.

By way of example, mandates for setting strict monitoring *requirements* on dispersant use would be an excellent and most needed revision, but when stipulated as *activated* when

"100,000 U.S. Gallons of these chemicals are used over a 24 hour period borders on preposterous, given that the ingredients of these agents have proven to be unacceptably lethal to marine and human life. Albeit dozens of *'BP Spill Aftermath'* science studies pouring out continue to be controversial. But even if the science is contended, the level of uncertainty should put all use of chemical dispersants on hold until we are certain.

The Lawrence Anthony Earth Organization most strongly advocates that *more testing* of chemical dispersants, which contain well known toxic constituents, is not the answer. And, instead of millions of tax payer dollars spent on dispersant studies, monitoring, etc., said rule changes should lead to **equal scientific resources and effort being applied to identifying safe and non-toxic oil spill cleanup technologies to replace those with undesirable trade offs that are ineffective at removing toxic and other harmful elements of a spill.** The NCP should be a living document that reflects best available technology and science, but there are no mechanisms in place to incentivize this.

Further, the NCP should be viewed as an **integrated system** with interrelated tools. It should not leave critical adjudications of what response method is ***appropriate*** for use on a given spill in the hands of unqualified decision makers operating in high stress emergency conditions. Looking at a response method in a single view without regard to how these chemical and biological agents work within an integrated system is problematic as well as dangerous. Why we say this will be further explained and detailed in our recommendations that follow.

****

An Urgent Call for a Twenty-First Century Solution in Oil Spill Response

The Lawrence Anthony Earth Organization and its Science and Technology Advisors have fully reviewed the EPA's proposal.

LAEO encourages regulations that help industry to expand and evolve ethically, taking into account and enhancing the survival potential of all stakeholders potentially impacted by their activities. However, no company has any business drilling, mining, fracking, transporting oil or other hazardous chemical products without spill contingency plans in place that will factually and completely remove spills from the environment.

The Clean Water Act standard and expectation of *complete removal of hazardous waste and toxic pollutants from the environment* governs the basis for our position and comments.

Below are three sections with proposed changes within the NCP, Subpart A, Subpart J and Appendix C to part 300. EPA Revisions are indicated in normal font and LAEO Comments are summarized in Orange with expanded comment/information in blue.

*****

EPA Proposal

SUBPART A: Subpart A is the preface to the NCP. It contains statements of purpose, authority, applicability and scope. It also explains abbreviations and defines terms that are used in the NCP.

1. Definitions

The Agency is proposing revisions to § 300.5 that amend the definitions for Bioremediation agents, Burning agents, Chemical agents, Dispersants, Sinking agents, and Sorbents. The Agency proposes to revise the term Surface washing agent and amend its definition. Additionally, the proposal includes new definitions for Bioaccumulation, Bioconcentration, Biodegradation, Biological agents, Bioremediation, Herding agents, Products, and Solidifiers. Finally, the Agency is removing the definitions for Miscellaneous Oil Spill Control Agent (MOSCA) and Surface collecting agents.

<u>LAEO Comments on (a) Revised Definitions</u>

The President of the United States under the **Clean Water Act (CWA)** and the **Oil Protection Act (OPA)** amended § 311, is mandated to take action to ensure:

"effective and immediate removal of a discharge, and mitigation or prevention of a substantial threat of a discharge of oil or a hazardous substance."

In any document of law, ***words and definitions matter***.

The President is mandated to take action to ensure the effective and immediate ***removal*** of a ***discharge***, and ***mitigation or prevention*** *of a substantial threat of a discharge of* ***oil*** *or a* ***hazardous substance."***

Oil or hazardous substance (which today can also refer to: oil and/or an oil dispersant mixture) comes specifically after the word ***mitigate***. This is a glaring problem. By definition this word, which is derived from the Latin verb *mitigare*, can mean both "to make less severe" or "to appease or pacify." There are few words in the lexicon of regulations in the United States that have been so misused and misunderstood. ***We cannot afford words in legislation that can in any way minimize or misdirect the intent of the law.***

The word ***Removal*** also plays a critical role in these defining terms. We cite these as examples of words that imply one thing but can be interpreted as another. Such is the quandary of regulations and law making as demonstrated in the example below:

311(a)(8) of the CWA: ***Remove or removal*** refers to containment and removal of oil or hazardous substances from the water and shorelines or the taking of such other actions as may be necessary to minimize or mitigate damage to the public health or welfare including

United States...

But ***Removal,*** can actually happen is several different ways:

Removal, of oil from the surface through ***collection,*** i.e. skimmers, herding agents, sorbents (which are very ineffective and dependent on surface conditions)

Removal, of oil from the surface by ***in,situ,burning,*** (which will simply transfer it in an even more toxic form of PAH's (poly aromatic hydrocarbons) into the atmosphere)

Removal, of oil from the surface by the use of ***dispersants,*** (which will simply transfer the oil in an even more toxic form into the water column and eventually the seafloor)

Removal, of oil from the surface through ***bioremediation*** (which in the case of at least one agent type we know of could actually ***fulfill,the,letter,of,the,law,and,remove,100%,of,oil, from,the,water,*** leaving only Co2 and water)

With the frequency and quantity of oil that is being extracted from greater depths and traveling across greater distances than ever before in history, mitigation or removal through transference to another location, cannot be a viable interpretation of this law. ***We, must,elicit,*** the **original intent** of the law and seek to achieve ***100%,removal,*** of all toxic hydrocarbons from the spill environment. There are advances in spill remediation today that have proven capable of this goal. They need only the regulatory pathway to be opened in order to take a position in the front lines of spill remediation technology.

AAAA

Therefore any definitions used to define chemical or biological agents and their related terms used in the context of oil spill response regulations must clearly state the following:

1. Its *purpose*
2. Its ***mechanism,of,action,***
3. Its ***integration*** into the overall system

No assumption can be made that an NCP listed spill response tool/agent *REMOVES* oil from the environment unless specified in its definition. Care and attention needs to be paid to ensuring there is a clear and transparent expression of said agent's function and/or mechanism of action in the overall scheme of the complete spill response system. This must be part of Subpart A definitions. Chemical Dispersants are mitigating agents and must be represented as such, or Bioremediation Enzyme Additive Category per NCP should be correctly designated as a removal agent.

$

$

$

EPA (a) Revised Definitions

Bioremediation Agent—The Agency is proposing to revise the definition of bioremediation agents to identify as such biological agents and/or nutrient additives.

LAEO Comment: Definition for *Bioremediation Agent* must be broken down for the 3 Types of Bioremediation because they are distinctly different from one another and should not be lumped in as one. [See corrected mode of action definitions at http://protectmarinelifenow.org/wp-content/uploads/delightful-downloads/2015/04/Bioremediation-for-Oil-Spill-Response-Oct2014.pdf] This document provides the precise definitions and modes of action for each of the three bioremediation categories.

For instance there are huge differences in applicability and appropriateness for applications of bioremediation agents that contain Microbes = Microbiological Cultures (MC) Category and Enzyme Additive Bioremediation Category that do not contain live microorganisms. Lumping them together is like combining together chemical dispersants and surface washing agents—just entirely different types of agents with different purposes. For example MC type can't be used on open water spills but only in contained environments that have no chance of releasing non-indigenous invasive species into our streams, rivers and oceans—which means their use is too high a risk for negative environmental consequences.

EPA Proposal

Chemical agents—The Agency proposes to revise the definition of chemical agents to identify as such those elements, compounds, or mixtures that are designed to facilitate the removal of oil.

Dispersants—The Agency is proposing to revise the definition of dispersants to identify them as those agents that promote the formation of small droplets of oil in the water column by reducing the oil-water interfacial tension. Dispersants are proposed to be defined as typically mixtures of solvents, surfactants (including biosurfactants), and additives. The proposed definition specifically addresses the process through which these agents assist in mitigating the consequences of a discharge, clarifying for manufacturers which testing requirements they will be subject to when seeking to list a product on the NCP Schedule.

LAEO Comment: LAEO concurs with these definitions for Chemical Agents and Dispersants providing it is emphasized that chemical dispersants have no removal function and do not remove oil from the environment, nor do they detoxify the oil.

==========

LAEO believes it is important to put toxicity assessments in perspective and viewed against all other rule revisions. Therefore LAEO is addressing this critical aspect first in order of importance.

EPA Rule Change: Appendix C to part 300: Revise the requirements for product testing protocols and summary test data including new dispersant baffled flask efficacy and toxicity tests; new standard acute toxicity tests for bioremediation agents, surface washing agents, herding agents, and solidifiers; and revised bioremediation agent efficacy test.

EPA's stated goal: Ensuring chemical and biological agents have met efficacy and toxicity requirements.

LAEO's Comment/Recommendation:

The acute toxicity thresholds should be set at 100ppm or greater to meet the standards of *virtually non-toxic*.

Additionally, any chemical dispersant or biological agent when mixed with oil it is intended to remediate must not increase toxicity levels. If toxicity does increase when respective agent is applied to a spill, this is not a passing grade for its use. Until there is scientific evidence and certainty that 10-100 ppm thresholds which are deemed as slightly toxic [used as criteria during the 2010 BP spill] can be deemed factually safe, this EPA proposed standard violates the Clean Water Act.

In real life situations, the new EPA rules for oil spill response chemicals and agents cannot break the law they were intended to enforce.

Therefore, EPA rules in **Section 300.915** and **Appendix C Testing Protocols** *must* include:

- **Pass or Fail** criteria for chemical agents to be listed on the NCP Schedule that stipulate:
  - That toxicity and efficacy test requirements include mixing the proposed chemical or biological agent with both fresh and weathered crude oil per manufacturers' recommended ratios and, if so mixing thereby results in increasing the LC 50 toxicity factor, the product be denied listing.
  - Any product by itself should not have an LC 50 less than 100 and ideally should be (by extrapolation taken from the grading system used for pesticides) at the level of 2000 ppm or greater, reflecting toxicity tolerances for mammals. [EPA's suggested NCP Product Schedule threshold of 10-100ppm graded as "slightly toxic" proved to contain many uncertainties in the application of *Coexists* to the BP spill – why, then, would we use the same benchmark?]
  - NCP listed agents must not inhibit hydrocarbon-degrading bacteria present in the environment of a spill. Given that a recent Naval

Research Laboratory scientific study indicated that chemical dispersants might be lethal to important microbes communities that degrade oil, efficacy and toxicity testing of chemical dispersants must identify negative impacts on hydrocarbon degrading bacteria, especially since the use of dispersants has a stated primary purpose of enabling oil eating microbes to degrade a spill (A)) DO AXIT AD95 C 6 6 2 6 D H 1 L J H . 4B C F50

- Section 300.915 should specifically state: *If required toxicity testing shows that a submitted product when used with a dispersant raises the toxicity over a 24 hour period in a given intended use target environment, or that it diminishes the population and capacity of hydrocarbon degrading bacteria to degrade oil, then it should not be listed or used.*

- The pre authorization criteria and OSC decision making process should also include this clause.

LAEO Comment re: Bioremediation E/A Type: Appendix C:

- Proposed rules and testing should be applicable to all chemical agents and not be set to debar or selectively eliminate specific classes of agents. Setting testing standards at 95% reduction of aliphatics and 70% reduction of aromatics in 28 days for saltwater/seawater bioremediation tests would eliminate most bioremediation products currently on the NCP list. This is conspicuously out of balance with chemical dispersants efficacy test protocols, which require absolutely no oil oil reduction levels of any kind. !!! Therefore, if the bar is going to rise to this almost unattainable height for bioremediation agents, then an equally high bar must be set for oil reduction level testing when chemical dispersants are used. We realize that dispersants have a different purpose as a mitigating agent designed to give oil eating bacteria a head start in degrading the oil, but a 28 day measure for how a given dispersant product achieves that should likewise be required. (see above comment with citation A)) DO AXIT AD95 C 6 6 2 6 D H 1 L J H . 4B C F50
- Another glaring flaw to the proposed test procedures for bioremediation product EA type "**5.4.9 For other non living products (EA), do not add nutrients or the EPA culture as the inoculum as they are not needed.**" All testing should be conducted with the original medium in mind i.e. seawater and/or fresh water EA and all other bioremediation types should be tested in aqueous solutions closest to

the original environment in which these products were intended for use. Therefore, test procedures involving bioremediation agents, should allow for microbes or nutrients, which are naturally occurring in nature, to be added at the manufacturer's discretion.

300.915 Product Schedule

The Product Schedule is a list of agents that have undergone required testing to be listed on the NCP. Inclusion on the Product Schedule does not mean a product is authorized for use , which is in itself problematic.

EPA Proposal: "Product Use: Recommended procedures, including product concentrations, application ratios, types of application equipment, conditions for use, and any application restrictions. The procedures must address variables such as weather, water salinity, water temperature, types and weathering states of oils or other pollutants, and product and oil containment, collection, recovery and disposal, and include supporting documentation and standard methods used to determine them."

LAEO Comment: Product Use submissions should also be a reflection of and contain language for pre authorization plans (if so indicated as appropriate) and/or be an expression of the product's workability in relationship to other legacy tools used in oil spill response within the context of the NCP. Submission Templates should be provided to ensure adequate information for OSC's, RRTs and Area Committees responsible for planning.

EPA Proposal: "(5) *Recommended product use procedures*. The Agency is proposing to revise the requirement for providing information on the recommended application procedures. While the proposal is maintaining the specific elements included in the current requirement, the supporting documentation and information on the standard methods the product manufacturer used to establish the procedures is requested. EPA believes that providing detailed information on the recommended product use procedures is necessary to inform the OSC when authorizing these products. This supporting documentation and specific information on the methods and standards used to establish them will inform OSCs and other response personnel in selecting products that can be effectively used under the operating conditions encountered for any given incident. The Agency requests comment on the revised data requirement, and whether there are other elements that should also be included to ensure the proper use and application of the products."

LAEO Comment: We are pleased to see this EPA revised data requirement agree with (5) Recommended product use procedures and would like to add 22

The EPA has expressed that they want to "ensure that the planning and response community is equipped with proper information to authorize and use the products in a judicious and effective manner.

The NCP Product Schedule should be the central information point for accessing information on spill response chemicals and agents for decision makers.

- We strongly recommend that the EPA cease putting the final chemical decision responsibilities in the hands of OSCs and people who are not scientists, untrained and/or unqualified to make such decisions when they do not have access to all data required to make such decisions. OSCs who are often in the middle of a high pressure, emergency response when having to make these vitally important decisions, should only do so with reliable and best available decision making tools. The buck should stop with Science and Technology Committees with adequate multi agency representation with centralized database kept under NCP EPA Management.

- The NCP List must reflect science based information that will tell the OSC, Regional and Area Committees what is safe and effective to use, under what conditions and circumstances, in what types of environments. If all information on the NCP list is 'conditional' and 'tentative', as a *disclaimer protection* no standard can be held. The NCP product schedule should list all test information, toxicity and efficacy test results and measures submitted on a *key decision making matrix* to enable OSCs and oil spill response professionals to see all data on side by side comparison basis so as to enable informed planning and preauthorization choices. This would all be based on certified laboratory third party data, with no vested interest, industry influenced data or opinions.

- Chronic/longer term toxic effects identified and reported would be added to NCP Product Schedule matrix information as a living document based on active/ongoing monitoring programs. For instance a peer reviewed study recently released found Corexit 9500 to have a negative impact on deep water corals. An ongoing, living central data depository must be kept for this type of information otherwise, accurate decision making is hampered. It should be represented on the *key decision making matrix* kept by NCP Product Schedule Managers at EPA.

- The public depends on our Natural Resource Trustees and the Environmental Protection Agency to protect our health and the health of all waters and environments. Why is the NCP Schedule not a reflection of those protections? If a specific product doesn't meet standards, this will clearly be seen if put on a *key decision making matrix* that includes real spill response use monitoring data, as such becomes available. If comparative analysis does not give a good grade to a respective listing, so be it. Any manufacturer will be incentivized to a) correct information if inaccurate, b) do further testing and/or c) select less toxic ingredients and upgrade toxicity and efficacy results. The door should always be open for recourse and relisting once required information is provided. Industry/Manufacturers must be held accountable for meeting information requirements but also not be subject to random arbitraries or stipulations imposed by multiple layers of agency NRT, RRT and Area Committee level members.

- The training, integrity and ethics of the NCP List Managers would be a crucial part of the list being a reliable information source for OSCs and all stakeholders.

- As currently worded, the EPA is not held accountable for the decisions made regarding what chemical agents to use during a spill emergency on US navigable waters. This is designated as solely the responsibility of the US Coast Guard On Scene Coordinator housed in the Department of Homeland Security. The EPA is merely *listing information* without regard for *appropriateness* or for making any science based recommendations. In real life, the buck doesn't stop anywhere, but appears to rest with potentially unqualified decision makers (OSCs) who are advised by other agencies, but who are unable to judge the accuracy of such consultation. Some of this may be due to peer reviewed science and information having no central depository and summations.

- Pre Authorization or Pre Emergency Planning should already be in place for every Region and Area regards chemical agent use *prior* to future spills occurring. Otherwise, decision-making is subject to grave errors and mishaps due to time constraints. OSC's should enforce the NCP, its product list and best available science for spill response based on Pre Planning where chemical agents are concerned.

EPA Proposal: "(6) *Environmental fate information*. The Agency is proposing to request any known and available measured data and supporting documentation on the persistence, bioconcentration factor, bioaccumulation factor, and biodegradability of the product and all of its components. The Agency currently has no restriction on use of persistent bio-accumulative products."

LAEO Comment: Any manufacturer of oil spill response agents and/or delivery systems should be encouraged to submit long term fate and all possible information regards their products and systems. Encouraging more information for decision makers adjudicating how to best address a hazardous chemical spill, would serve all stakeholders and represent fair and effective market competition, innovation and deliver more effective, less toxic and higher quality products or services for the greater good of the environment. If the published NCP list had options for filling in such information as it becomes available (as covered above re key decision making matrix) this would be a far more workable system.

NCP Listing minimum pass or fail requirements with added optional information fields would not preclude new innovative technologies from entering the system but rather encourage transparency and incentivize that type of behavior. Manufacturers who have to resort to cherry picking science reports and masking undesirable data about their product(s) be detected and vetted out.

EPA Proposal: "*Authorization of Use*. Revise to clarify planning and preauthorization responsibilities, establish limitations and prohibitions on the use of certain agents, establish

requirements for storage and use of agents, clarify authorities for requiring supplemental testing, monitoring and information on agents, establish requirements for agent recovery from the environment, and establish reporting requirements for agent use."

Contingency Planning and Authorization of Use

"The proposed amendments are intended to ensure that On-Scene Coordinators (OSCs), Regional Response Teams (RRTs), and Area Committees (AC) have sufficient information to support agent preauthorization or authorization of use decisions."

LAEO Comment: Bioremediation Pre Authorization and First Response Usage Adjudication:

- Stop discouraging the use of all bioremediation agents as equal in their efficacy, mechanism of action, toxicity information—and cease relegating this vital and useful technology to being merely polishing off agents in the NCP plan The GOM BP spill is an example of this policy in action. Even now, five years later, irreducible minimum action is taken to "polish off" the clean up. It is very evident that the NCP has built in bias on bioremediation. LAEO Science and Technology Committee has found there are real solutions within this field of technology that are truly non toxic and effective at removing oil from the environment. If you have questions about the efficacy of the thousands of successful applications that have taken place throughout the world, at the least, support and encourage your Science and Technology Committees to look at this technology carefully as a first response spill clean up candidate for their Area Contingency Plan tool kits. And facilitate the receipt and examination of new information.

2

- Further, make Pre Authorization plan development involving the use of chemical agents take into account and compare Bioremediation Enzyme Additive Category to chemical dispersants and other response options. A proven non toxic means of removing oil from sensitive shorelines and salt and fresh water habitats that is already on the NCP Product Schedule and that has been successfully used in a variety of other countries should be a priority for consideration in the U.S. Any revisions to the NCP should take into account and find out why good technology is being blocked from use—this is a system and policy failure!!
!
- EPA National HQ level should not block or prevent Regional or Area Science and Technology Committees from looking into better spill plan options. An example is what was done in Alaska where Regional Response Team members were ordered to disregard our submissions and requests for consideration of EA Type Bioremediation as an alternative to chemical dispersants. We have documentation showing the complete series of events indicating the National Response Team Chairman directed Alaska RRT to ignore our submission and move forward on their chemical dispersant pre authorization planning for Alaska over the strong objections of Area Committee members and citizens groups.

- Until the National Response Team's 15 year out of date *Bioremediation Fact Sheets* is corrected, do not disseminate this information to OSCs or other stakeholders without a cover memo indicating that research is out of date and exploring best available science and information is therefore encouraged. Currently any alternatives to chemical dispersants are wholly blocked from use on US navigable waters simply because US Natural Resource Trustees and government science advisors are not educated or are ill informed on bioremediation technology. This is not an excuse or reason to employ obsolete or harmful hydrocarbon based chemicals and solvents to spills. Sub Part J should have allowances for and clauses that do not preclude updated science and information from being used in the OSC or Pre Authorization decision making process, particularly when a product is already on the NCP Product Schedule.

- Where Pre Authorization Plans are developed by Area Committees and Regions for Bioremediation use, such are subject to final approval up through the NRT. Regulations should require that these must be reviewed within a 90 day time frame, or otherwise stipulate that they cannot be blocked from being used by an Area or Region. Any pre authorization plan disapprovals must be put in writing with clear cut, scientific reasons given for the disapproval with citations of peer reviewed literature and statistical measures that can be used to train and guide better Pre authorization planning.

EPA Proposal: (9) *Certification that bioremediation agents do not contain, at levels that exceed the National Ambient Water Quality Criteria lowest density value, bacterial, fungal, viral or opportunistic pathogens*. While providing information on these product contaminants is currently required for bioremediation agents, there are no threshold levels for product listing; a positive result for any of the above pathogens may raise concern, but would not prevent the product from being listed on the Schedule.

LAEO Comment: This rule should only apply to bioremediation agents under the MC category-Microbiological Cultures – other categories of Bioremediation that do not contain any live microbes and have a completely different mechanism of action. [Ref: **http://protectmarinelifenow.org/wp-content/uploads/delightful-downloads/2015/04/Bioremediation-for-Oil-Spill-Response-Oct2014.pdf**]

EPA Proposal: "(b) Dispersant Testing and Listing Requirements

The Agency is proposing revisions to the efficacy and toxicity testing protocols, as well as establishing new thresholds for listing dispersants on the Schedule in § 300.915(b). The Agency proposes to define dispersants as typically mixtures of solvents, surfactants, and additives that promote the formation of small droplets of oil in the water column by reducing the oil-water interfacial tension. These droplets are driven into the water column by wave action. Emergency response personnel need to know whether a dispersant or any other type of chemical or biological agent on the Schedule could have negative environmental impacts relative to the oil

ED_001324_00007743-00012

before decisions are made about its use in a particular oil discharge situation. Consequently, it is essential to consider comparative information about the efficacy and the toxicity of these products."

LAEO Comment: As you are already aware, LAEO's Science and Technology Committee review of the toxicity and efficacy of chemical dispersants indicate current NCP listed agents do not pass Clean Water Act requirements. Spill mitigation (not removal) using dispersants have too many environmentally harmful trade offs based on peer reviewed scientific studies.

Complete details with citations are contained in A Call for a Twenty First Century Solution in Oil Spill Response – 2014 Updated Research Paper. This can be downloaded at: **www.protectmarinelifenow.org (http://protectmarinelifenow.org/wp-content/uploads/delightful-downloads/2015/04/LAEO-Oil-Spill-Response-Research-Paper.pdf)**

EPA Proposal: "*Dispersant and Dispersant-Oil Acute Toxicity Threshold*. Using the EPA toxicity classification scheme,[41] LC_{50} values ranging from 10 ppm to 100 ppm are classified as slightly toxic and above 100 ppm substances are considered acutely nontoxic to aquatic organisms. For both *M. beryllina* and *A. bahia*, the Agency is proposing as the threshold value the lower bound of the LC_{50} 95% confidence interval (CI) greater than or equal to 10 ppm for all toxicity tests to qualify a dispersant to be listed on the Schedule."

LAEO Comment: The threshold should be 100 ppm or above to meet a *non toxic* score. Additionally, any chemical dispersant or biological agent mixed with bil it is intended to mitigate must not result in a higher toxicity score. If toxicity increases when the agent is applied, this is not a passing test score but a red flag. Until there is scientific evidence and certainty that 10 100 ppm thresholds of *slightly toxic* are actually safe, this standard violates the Clean Water Act.

EPA Proposal: "(d) Bioremediation Testing and Listing Requirements…the Agency is proposing to revise the efficacy testing protocols, to establish toxicity testing protocols, and to establish both efficacy and toxicity listing thresholds in § 300.915(d).

… The protocol tests the bioremediation agent for microbial activity and quantifies the disappearance of saturated hydrocarbons and PAHs in weathered oil; for purposes of the proposal the Agency tested the protocol using ANS 521.[56] The sample preparation

LAEO Comment: This efficacy testing procedure applies to MC bioremediation category but not entirely to Enzyme Additive Category. By testing on weathered crude oil, it is suggested that efficacy is being gauged for secondary/polishing off uses of bioremediation.

When testing efficacy of a bioremediation product for *First Response* use, which should be on fresh crude oil, ANS 521 method will not produce adequate efficacy information.

ED_001324_00007743-00013

EPA Proposal: "2) Bioremediation Agent Toxicity

Current Requirements: The Agency currently has no bioremediation agent toxicity testing requirements for purposes of listing these agents on the Schedule. Section 5 of Appendix C is reserved for this purpose. The Agency has, however, on a case-by-case basis, requested manufacturers to test bioremediation agents for toxicity if the product contains surfactants or other ingredients that may be harmful to the environment.

Proposed Revisions: The Agency is proposing an acute toxicity testing protocol for bioremediation agents to include both fresh and saltwater. The Agency will use these testing results to determine listing eligibility on the Schedule. The proposed testing protocols for bioremediation agents are detailed in Appendix C. The proposed acute toxicity test protocol for bioremediation agents is based on EPA's protocol, *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters for Freshwater and Marine Organisms*. The Agency proposes to require bioremediation agents be tested for acute toxicity for the product alone using fresh water species *Ceriodaphnia dubia* and *Pimephales promelas,* and saltwater species *Americamysis bahia* and *Menidia beryllina*. The concentration of test product causing 50% lethality to the test organisms (LC_{50}) lower and upper 95% confidence intervals (LCI_{95} and $ULCI_{95}$) are calculated at the end of the exposure period. To be listed on the Schedule, bioremediation agents must demonstrate an acute lethal concentration for 50% of the test species (LC_{50}) at the lower 95% confidence interval greater than 10 ppm in either fresh or salt water, consistent with the acute toxicity thresholds proposed for dispersants. EPA's toxicity classification scheme [59] classifies LC_{50} values ranging from 10 ppm to 100 ppm as slightly toxic, and values above 100 ppm substances are considered practically nontoxic to aquatic organisms."

LAEO Comment: We!would!like!clarification!on!why!the!aquatic!organism!species!have!been!revised!from!previous!requirements!and!why!test!species!are!different!than!those!required!to!be!used!for!chemical!dispersants?

It!is!also!unclear!why!toxicity!testing!appears!to!be!more!stringent!for!bioremediation!products!than!for!chemical!dispersants!when!previous!regulations!did!not!even!require!toxicity!testing!for!bioremediation!agents,!which!generally!have!proven!to!be!virtually!nonA toxic.!!LAEO!agrees!that!toxicity!testing!should!be!a!requirement!for!biological!agents!because!we!have!seen!numerous!biological!agents!listed!that!are!even!more!toxic!than!Corexit!in!one!case.!Therefore!all!agents!no!matter!their!type,!should!be!required!to!have!been!given!toxicity!pass!or!fail!scores!before!being!listed!on!the!NCP!product!schedule!and!before!being!considered!for!use!by!OSC.!

Additionally,!we!recommend!that!if!EPA!does!not!want!to!revise!their!threshold!for!NCP!requirements—that!would!be!okay!with!LAEO!if!a!threshold!of!100!ppm!or!greater!were!set!for!any!agents!used!under!a!*PreAuthorization2Plan*!!This!would!be!a!comfortable!and!realistic!safeguard.!!!

==========

$

LAEO General Comment: As a general comment, we would like to ensure that attention is paid to the complete recommendations made in our original research paper *A Call for a Twenty First Century Solution in Oil Spill Response Sept 2014 Updated Edition*. We are listing here and officially filing the applicable sections of our paper as key documents that contain the necessary citations to back up our official public comment herein.

Educational Links and Documents:

1. **Optimizing Oil Spill Identification and Assessment Methods for Contingency Planning**
2. **Corrected Definitions for Bioremediation Key Data for Open Water Spill Use Enzyme Additive Category**
3. **Chemical Dispersants and the Clean Water Act**
4. **A Twenty First Century Solution in Oil Spill Response – A Lawrence Anthony Earth Organization Science and Technology Research Paper**
5. **Previous LAEO Comment Documents to National Response Team Officials:**
   - **LAEO Public Comment to Alaska Regional Response Team**
   - **LAEO Sign On to Alert Project's EPA Petition**

All this material is still applicable to the clarifications and changes in Clean Water Act NCP Sub Part J protections that LAEO has been requesting for more than 3 years.

Copies of all this material can be downloaded in our NCP Revisions Information Center at: **http://protectmarinelifenow.org/take action**

Thank You

ED_001324_00007743-00015

To: Tirrell, Rebecca[Rebecca_Tirrell@sra.com]
From: Principe, Vanessa
Sent: Thur 4/23/2015 1:49:24 PM
Subject: FW: From LAEO: Your Comment Submitted on Regulations.gov (ID: EPA-HQ-OPA-2006-0090-0409)
LAEO Public CommentFF.pdf
ATT00001.htm

FYI – Just in case this LAEO entry really does not show the attachment. Let me know if it doesn't to see how we can go in and correct it. Lets give it a week to process thru regulations.gov.

Thanks, V

From: Diane Wagenbrenner [mailto:dianesue3@att.net]
Sent: Wednesday, April 22, 2015 10:38 PM
To: Principe, Vanessa
Cc: Diane Wagenbrenner
Subject: From LAEO: Your Comment Submitted on Regulations.gov (ID: EPA-HQ-OPA-2006-0090-0409)

Hello Vanessa,

I have tried to attach LAEO's public comment pdf doc in the .gov site three times. It keeps replacing it with a 'sample letter' document. In order to ensure there is a record that I did

submit our comment (15 pages of a pdf document) by the deadline cut off, I am attaching it herewith. Thank you for providing this opportunity. Please see below:

LINK:
http://protectmarinelifenow.org/wp-content/uploads/delightful-downloads/2015/04/LAEO-Public-CommentFF1.pdf

I would appreciate it if you confirmed receipt.

Thanks Much,
Diane

Begin forwarded message:

From: "Regulations.gov" <no-reply@regulations.gov>
Subject: Your Comment Submitted on Regulations.gov (ID: EPA-HQ-OPA-2006-0090-0409)
Date: April 22, 2015 at 10:24:44 PM EDT
To: dianesue3@att.net

Please do not reply to this message. This email is from a notification only address that cannot accept incoming email.

Your comment was submitted successfully!

Comment Tracking Number: 1jz-8ig2-yl5y

Your comment may be viewable on Regulations.gov once the agency has reviewed it. This process is dependent on agency public submission policies/procedures and processing times. Use your tracking number to find out the status of your comment.

Agency: Environmental Protection Agency (EPA)
Document Type: Rulemaking
Title: Comment submitted by The Lawrence Anthony Earth Organization (LAEO)
Document ID: EPA-HQ-OPA-2006-0090-0409

Comment:
Dear EPA: This is Diane Wagenbrenner, VP Operations, Lawrence Anthony Earth Organization. I have submitted our public comment twice consisting of attaching a 15 page document. The system is not receiving this document under my comment, therefore, I am resubmitting it a 3rd time as a LINK here to ensure it does in fact get received.

Here it is: [URL REMOVED]

Thank you.

Uploaded File(s):
No files uploaded

For further information about the Regulations.gov commenting process, please visit http://www.regulations.gov/#!faqs.

*** For security purposes, URLs were removed from this receipt but not from your comment on Regulations.gov.**

Diane Wagenbrenner
VP Operations & Public Information
Lawrence Anthony Earth Organization
diane@theearthorganization.org
Ph: 858-531-6200

We would love for you to become a Member!
∞
Because None Survive Alone

www.theearthorganization.org

Campaign Coordinator: www.ProtectMarineLifeNow.org
Change Oil Spill Response Global Alliance Member

Helping members of our planetary ecosystems who cannot speak for themselves

PRIVILEGED AND CONFIDENTIAL -- All information transmitted hereby is intended for the use of the addressee(s) named above. If the reader of this message is not the intended recipient of the employee or agent responsible for delivering the message to the intended recipient (s), please note that any distribution or copying of this communication is strictly prohibited. Anyone who receives this communication in error should notify the sender by telephone and destroy/delete the original message.

To: Semeniuk, Michael[Semeniuk.Michael@epa.gov]
From: Principe, Vanessa
Sent: Thur 4/9/2015 8:32:16 PM
Subject: RE: Your Message
EO12866_Subpart J_2050-AE87_NPRM_RIA_REDLINED_20141203_REF_20150402.pdf

Michael:

The attached document should be posted in place of the one pending with the "draft – do not cite" header. Left you a voice mail. Not certain of how to make this change in FDMS, or whether this is something that at this time is best for you guys to replace.

In the office for a bit longer, and working at an alternate location tomorrow. Hope you don't get tired of me thanking you for all your help, and for keeping me out of trouble!

V

From: Semeniuk, Michael
Sent: Thursday, April 09, 2015 3:44 PM
To: Principe, Vanessa
Subject: RE: Your Message

The document includes this header. Please confirm whether or not it should be posted. Thank you.

EO12866_Subpart J_2050-AE87_NPRM_RIA_REDLINED_20141203
***E.O. 12866 Review – Draft - Do Not Cite, Quote, or Release During Review

Michael Semeniuk

OCSPP & OSWER Docket Manager

EPA Docket Center, Operated by ASRC Primus

202-566-0219

semeniuk.michael@epa.gov

3337E EPA West, MC 28221T

From: Principe, Vanessa
Sent: Thursday, April 09, 2015 2:50 PM
To: Semeniuk, Michael
Subject: RE: Your Message

Hi Michael:

Thanks for getting back to me. I did upload it as Metadata ready – found the "cheat sheets" in fdms.info. Did remember it was not pending-post (messed that up last time) – what I was not sure of was if it was supposed to be draft.

This is a posting for a reformatted version of a redline-strikeout document already in the docket. We do not need to remove the original one, but at the direction of OGC wanted to reformat so that changes would be apparent. Hoping this will not take long to post, as the comment period for this docket ends April 22. Let me know if you have any questions on this.

Another question for you. During the comment period we have met with several stakeholders, and want to document those meetings as part of the docket. Would these be considered supporting documents? If so, do I need to upload them into the docket prior to the comment period closing?

Again, thank you so much for getting back to me so quickly. Always appreciate that I can count on your assistance.

V

From: Semeniuk, Michael
Sent: Thursday, April 09, 2015 2:33 PM
To: Principe, Vanessa
Subject: Your Message

Hi Vanessa. Set the status of new supporting documents to Metadata Ready when you're ready to release them for docket center processing. Never set them to pending post; if you do they are liable to be posted without being processed by us.

Cheers,

Michael Semeniuk

OCSPP & OSWER Docket Manager

EPA Docket Center, Operated by ASRC Primus

202-566-0219

semeniuk.michael@epa.gov

3337E EPA West, MC 28221T

PUBLIC SUBMISSION

As of: 5/14 2:54 PM
Rec Apr 22, 201
Stat Post
Pos Apr 24, 201
Tra No. 1jz-8ifv 7j9z
Con
Due Apr 22, 201
Sub Typ API

Docket: EPA-HQ-OPA-2006-0090
Revisions to the National Oil and Hazardous Substances Pollution Contingency Plan; Subpart J Product Schedule Listing Requirements

Comment On: EPA-HQ-OPA-2006-0090-0010
National Oil and Hazardous Substances Pollution Contingency Plan

Document: EPA-HQ-OPA-2006-0090-0510
Comment submitted by Shanna Devine, Government Accountability Project

---

Submitter Information

Submitter's Representative: Shanna Devine
Organization: Government Accountability Project

General Comment

The Government Accountability Project public comment is attached in the form of two documents that detail its multi-year investigation into the devastating impacts of Corexit use throughout the Gulf. The investigation documented lessons learned by whistleblowers from the BP disaster response, who should be the pioneer witnesses providing a foundation for this effort.

Attachments

GAP 2015 Addendum Report

GAP 2013 Report

Addendum Report to

"Deadly Dispersants in the Gulf: Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups?"

Public Comments on EPA Proposed Rule to Subpart J of the National Oil and Hazardous Substances Pollution Contingency Plan that Governs the Use of Dispersants

By:
GAP Investigator and Legislative Director
Shanna Devine
&
GAP Legal Director
Tom Devine

April 22, 2015

GAP GOVERNMENT ACCOUNTABILITY PROJECT
Truth be told.

Acknowledgements

Deep appreciation is due to all the whistleblowers and community activists who were the driving force of this addendum report. Special thanks to The ALERT Project, the Louisiana Environmental Action Network, and Ecorigs, which have been invaluable partners throughout GAPs investigation, and to Dr. Michael Robichaux, the savior for so many whistleblowers abandoned by the conventional medical community.

This report is dedicated to Rick Piltz, a devoted environmental whistleblower and founder of GAP's Climate Science Watch program. Rick passed in 2014, yet his impact on the world will continue to be felt through the future generations of activists that he has mentored to shed light on reckless government policies, including the use of toxic dispersants.

Table of Contents

1. **Introduction** **1**

2. **Human Health Impacts** **4**
   a. Health Symptoms 5
   b. Vulnerable Populations 9
   c. Medical Response 11
   d. Is the Gulf Toxic? 14

3. **Ecological Impacts** **16**
   a. Oil Not Gone 17
   b. Seafood Devastation 18

4. **Dispersant Reform** **23**
   a. Public Left in the Dark 26
   b. Workers Misinformed and Exposed 27
   c. After the BP Disaster Response 28

Glossary .....

Appendix: Whistleblower Witness List and Affidavits .....

1. Introduction

The 2010 Deepwater Horizon disaster was the largest U.S. oil spill, and second largest in world history. Even worse, evidence suggests that the use of the dispersant Corexit to "cleanup" the spill was more destructive to human health and the environment than the spill itself. On the third anniversary of the Deepwater Horizon disaster, GAP released the report "Deadly Dispersants in the Gulf, Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups?"[1]

As we enter the fifth anniversary of the worst environmental disaster in U.S. history, this addendum provides updated evidence that has emerged over the past two years and reinforces original report findings pertaining to Corexit impacts. In the wake of the BP spill "cleanup", the oil industry has declared toxic dispersants its tool of choice for s pill response efforts. If this vision becomes reality, long-term destruction to our health and environment will expand exponentially. Widespread human tragedies documented by Gulf whistleblowers will become the norm after significant spills.

An unprecedented nearly two million gallons of Corexit were used during the BP disaster response. When this product is mixed with oil, a deadly synergy occurs that becomes 52 times more toxic than the oil alone.[2] The only so-called advantage of Corexit is the false impression that the oil disappears – in reality, the more toxic chemical mixture spreads throughout the environment, or settles on the seafloor.

As offshore drilling expands off U.S. coasts, it is inevitable that other incidents will occur. BP has declared it will continue to use the deadly dispersant as long as the government does not stop it. Notwithstanding grave warnings from the Exxon Valdez disaster and lessons learned from the BP spill, Corexit remains a listed dispersant on the National Contingency Plan (NCP) – the federal government's blueprint for responding to oil spills and hazardous substance releases. However, the Environmental Protection Agency (EPA) is in the process of updating outdated and inadequate dispersant regulations. GAP's report illustrates the imperative for the EPA to implement responsible dispersant regulations that limit human health and environmental impacts.

GAP's evidence comes from those whistleblowers who experienced the cleanup's effects firsthand. For its original report, GAP investigators interviewed 25 whistleblowers from Alabama, Louisiana and Mississippi, conducted extensive Freedom of Information Act requests, and off-the-record interviews with government employees. GAPs latest evidence comes from more than one dozen whistleblowers impacted by Corexit. Witnesses range from cleanup workers and fishermen, to scientists and residents. Together, their accounts produce a frighteningly consistent picture of health and ecological devastation that is starkly at odds with official BP and government statements that Corexit is no more dangerous than Dawn dishwashing soap. GAP worked closely with The ALERT Project and the Louisiana Environmental Action Network to conduct this investigation[3].

The updated evidence included in this addendum is consistent with, and in some cases more severe than, the following findings documented in 2013 –

ED_001324_00007753-00004

Existing Health Problems

- Coined "BP Syndrome," all GAP witnesses experienced spill-related health problems. Furthermore, 95% report that they continued to experience spill-related health problems as of April 2013, and more than 50% living in affected areas reported that their children and/or grandchildren's health has deteriorated.
- Select effects include: blood in urine; heart palpitations; kidney & liver damage; migraines; multiple chemical sensitivity, including hyper-allergies to common household cleaners; neurological damage resulting in severe IQ loss and memory loss; hyper-allergies to processed foods, causing extreme weight loss; exhaustion and loss of stamina for routine activities; respiratory system & nervous system damage; seizures; skin lesions throughout the body; and temporary paralysis.
- Victims also are extremely concerned about recognized long-term health effects from chemical exposure, such as reproductive damage and cancer.
- Blood test results from a majority of GAP interviewees showed alarmingly high levels of chemical exposure – to Corexit and oil – that correlated with experienced health effects. These chemicals include known carcinogens.

Failure to Protect Cleanup Workers

- Contrary to warnings in BP's own internal manual, BP and the government misrepresented known risks by asserting that Corexit was low in toxicity.
- Despite the fact that the Occupational Safety and Health Administration (OSHA) has developed a highly-lauded safety training program for cleanup workers, the workers interviewed reported that they either did not receive any training or did not receive the federally required training.
- Federally required worker resource manuals detailing Corexit health hazards (according to a confidential whistleblower) were not delivered or were removed from BP worksites early in the cleanup, as health problems began.
- BP and the federal government, through their own medical monitoring programs, each publicly denied that any significant chemical exposure to humans was occurring. 90% of workers and community residents interviewed by GAP reported contact with Corexit or Corexit based chemicals, and blood test results revealed high levels of chemical exposure.
- BP and the federal government believed that allowing workers to wear respirators would not create a positive public image. As a result, OSHA permitted BP threats and retaliation against workers who insisted on wearing this protection. Nearly half of the cleanup workers interviewed by GAP reported that they were threatened with termination when they tried to wear respirators or additional safety equipment on the job. Many received early termination notices after raising safety concerns on the job.
- All workers interviewed reported that they were provided minimal or no personal protective equipment on the job.

ED_001324_00007753-00005

Ecological Problems & Food Safety Issues

- A majority of GAP witnesses reported that they found evidence of oil or oil debris after BP and the U.S. Coast Guard (USCG) announced that cleanup operations were complete.
- BP and the federal government reported that Corexit was last used in July 2010. A majority of GAP witnesses cited indications that Corexit was used after that time.
- The oil-Corexit mixture coated the Gulf seafloor and permeated the Gulf's rich ecological web. GAP witnesses have revealed underwater footage of an oil-covered barren seafloor, documenting widespread damage to coral reefs.
- The Food and Drug Administration (FDA) grossly misrepresented the results of its analysis of Gulf seafood safety. Of GAP's witnesses, a majority expressed concern over the quality of government seafood testing, and reported seeing new seafood deformities firsthand. A majority of fishermen reported that their catch has decreased significantly since the spill.

Inadequate Compensation

- BP's Gulf Coast Claims Fund denied all health claims during its 18 months of existence. Although a significant precedent, the subsequent medical class action suit excluded countless sick individuals (less than 2,000 Louisiana residents qualified), bypassed the worst health effects resulting from exposure to dispersant and oil, offered grossly inadequate maximum awards compared to medical costs, and did not include medical treatment.

ED_001324_00007753-00006

2. Human Health Impacts

Five years after Corexit was used throughout the Gulf, the overwhelming majority of original and new witnesses continue to experience adverse health impacts associated with dispersant and oil exposure. The phenomenon has been coined the "BP Syndrome" or "Gulf Coast Syndrome." Consistent with initial reports, symptoms include, but are not limited to: blood in urine and rectal bleeding; seizures; hyper-allergies to processed foods; violent vomiting episodes that last for hours and result in rapid weight loss; weakness and fatigue, at times leading to depression; migraines; abdominal pain attacks; skin irritation, burning and widespread lesions; rashes; inability to withstand exposure to sun; Multiple Chemical Sensitivity, resulting in new sensitivities to everyday household cleaning products or petroleum based products (plastic water bottles); neurological damage resulting in memory loss and severe IQ drop; impotence; heart palpitations; and hypertension. Witnesses have begun reporting long-term health effects, including reproductive damage (such as genetic mutations), endocrine disruption, and cancer.

There remains a dearth of research around human health impacts resulting from dispersant exposure. However, several significant peer-reviewed studies have been released since 2013 that support initial and updated investigatory findings.[4]

A study conducted by the University Cancer and Diagnostic Centers and published in the American Journal of Medicine found Gulf spill cleanup workers are at an increased risk for blood-related disorders, including cancer, as a result of their exposure to dispersants and oil.[5] The study acknowledged that, "COREXIT used as a dispersant is currently banned in the United Kingdom because of its potential health risks to clean-up workers."[6] Similar to the methodology employed by LEAN, it examined the blood tests of more than 100 spill workers in Louisiana who were exposed to oil and dispersant with to the blood test results of 130 unexposed individuals. Based on high levels of chemical exposure in the test results for the former group, it concluded, "This oil spill and use of massive amounts of dispersant has the potential to affect human health" and concluded that "clean-up workers exposed to the oil spill and dispersant experienced significantly altered blood profiles, liver enzymes, and somatic symptoms."[7]

A 2015 study conducted by the University of Alabama found that Corexit can cause serious damage to human lungs as well as marine life.[8] It found that Corexit exposure can damage tissue, and ultimately result in an "obstruction of the airways in humans with exacerbation of pre-existing respiratory diseases such as asthma."[9] Senior author Dr. Veena Antony stated "There were some 48,000 workers involved in the cleanup operations, and it is possible that workers were exposed to Corexit via inhalation." Similarly, the study reported "Cough, shortness of breath and sputum production" among symptoms reported by spill workers.[10] Dr. Antony concluded, "Unfortunately, the likelihood of another oil spill is high, and the need to use dispersal agents will remain."[11]

Additionally, LEAN conducted an extensive sampling effort following the BP disaster. Its sampling, combined with the growing health concerns resulted in the creation of the Gulf Coast Health Alliance: Health Risks Related to the Macondo Spill (GC-HARMS). GC-HARMS is a 5 year, NIEHS funded collaborative research project utilizing community-based participatory research.[12]

ED_001324_00007753-00007

Whistleblower Record

a. Health Symptoms

I have had the pleasure and frustration of working with a group of ill people who were involved with the Deepwater Horizon oil spill in 2010. I have formally treated over 100 of these victims and have advised or managed about 100 more. WITHOUT A DOUBT, there is a large number of individual who were rendered ill by chemicals involved in the spill and many of them remain ill to this day. Their illnesses were, and often continue to be, severe and different from anything I had encountered in over 40 years of being a physician. While I am not qualified to definitely identify the causes of their illnesses, it appears that the dispersant Corexit is likely responsible for the medical problems we have encountered." (Dr. Michael Robichaux, 1)

"I continue to see and treat innocent citizens who were rendered ill from the oil spill and their illnesses have continued, largely unabated, to this time. Several of these previously healthy citizens are currently on social security and more are requesting the same. Most of these individuals are young and were in excellent health at the time of the spill." (Dr. Michael Robichaux, 1)

"I heard from other residents that when a dispersant plane was flying over Perdido Key it wouldn't close its 'sprayers'. I learned this firsthand. On March 11, 2011, I was sprayed around 8:00 pm. I went to get groceries out of my car and heard a plane. It couldn't have been more than a few hundred feet above me, and the sprayer was wide open. I felt something spray onto my arm, and once it happened, I almost immediately realized what was occurring and held my breath. I ran into my home and instantly threw up … My arm was red and sensitive as my skin was exposed. I remained sick throughout the night, and I couldn't eat or keep water down." (Lani Kaiser, 2)

"One VOO boat captain (Vessels Of Opportunity – independent boats contracted to help BP clean the oil) I know had 10 workers helping him, and a bi-plane flew over them in the summer of 2010. At the time, he was a big guy almost 300 pounds. When I first met him in 2012, he weighed 200 pounds and was really sick. You could tell from his eyes. He said he decided to work on the cleanup, but BP and the government were basically killing them by the exposure. He can no longer be a captain or swim in the Gulf of Mexico. It scared me because when I saw photos of him before the cleanup, he was a large man at six and a half feet tall, but now he looks like a walking skeleton." (Lani Kaiser, 3)

"I'm experiencing severe health problems now – problems in my blood, the weaknesses, the falling out, the respiratory problems, the nausea, the fact that I can't stand in the sun for 10 minutes. It used to take me two hours to cut all of my grass. I have to do it in days now. I cut a part of the grass and then I have to sit down for the rest of the day and go out the following day and cut some more. My weight constantly fluctuates. During the cleanup I would be in the hospital for one to two weeks and lose a lot of weight due to nausea and violent vomiting episodes." (Andre Gaines, 7)

"My whole team and I were sprayed in late June 2010. We were in a fleet of 20 vessels in a line a plane flew over us as it was spraying Corexit and went along the whole beach line spraying. The wind carried the dispersant and it blew back on us; it looked like a hundred people were smoking

ED_001324_00007753-00008

cigarettes in a straight line and there was smoke in the air. I really got the brunt of it because as a supervisor, I was standing off to the side as everyone else was pulling boom out of the water on the other side. After I got sprayed, I told my crew 'This is burning, you all better move.' It felt like somebody threw some hot coffee on my arm. The burning stopped, then it started back up 20 minutes later, and then it started itching." (Andre Gaines, 7)

"[A]fter I got sprayed it all went downhill. My employer said in the beginning that the dispersants were not harmful and would not hurt you. But Corexit is banned from several countries. If it's banned in other countries why would it be OK here? I may not be the smartest person in the world, but I don't get this … Out of the three [crew members] that I know personally, we have all had the same health problems. Three days after we were sprayed, my skin and eyes started burning, and I was coughing. In early July 2010 I had sores, and in between my fingers stuff was pussing out. I tried to figure out what was going on. The puss bumps and rashes were on my arms, my stomach, my back and the back of my legs. They looked like little tennis balls. Since we put cream on it, it looks like a whole lot of bumps. The ones on my arms looked the worse, which is why I try to cover them with tattoos." (Andre Gaines, 7)

"My weight was readily dropping every time I would go back to the dock. When I began I was muscular, and close to 230 pounds. By the end of working on the cleanup, I weighed 175 pounds. Now, if I stand in the sun too long or in the heat too long, anything I do for too long, I'm falling over weak and dizzy and I can't breathe. I don't know how to say it, but it's terrible." (Andre Gaines, 9)

"I have become intolerant of chemical smells that have never affected me before. For instance, I cannot stand the smell of perfumes, air fresheners, cleaning products or anything that comes out of aerosol cans; I have to remove myself from the smells. I can no longer wear cologne or even burn a scented candle, because anything that releases a strong smell repulses me, as if my body is rejecting it. I never had those reactions before I worked on the cleanup." (Randy Varney, 1-2)

"I have also noticed myself forgetting a lot … I did not have memory problems before the spill, but now I have good days and bad days. I went to Ohio for a week in the summer of 2013, and I felt much better; my symptoms began to subside. When I returned home I felt the way that I had felt when I left; the symptoms began to come back … I don't know what is wrong with me. I feel like I have been poisoned, almost as if I'm dying. It is one thing to have symptoms for a week or a month, but I have been through years of ineffective treatment. It's as if the doctors are treating me for something that I don't actually have." (Randy Varney, 1-2)

"I am not the only person who has had health problems since the spill, but it seems to affect people in different ways. When I was a captain, I had a deckhand in his mid-thirties. He would bag the oil and unload it onto other boats. Since working on the spill he has developed heart problems. People who I've known for years and were in fine health prior to the spill are now using breathing apparatuses. One of my friends now has brain cancer. One man who I used to go trolling with for years is now breathing out of his throat through a breathing tube, and the doctors don't know what is wrong with him. He never smoked." (Randy Varney, 3)

"The marina supervisors told me that I did not have to wear safety equipment because I was the

ED_001324_00007753-00009

captain and therefore I was not supposed to come in contact with the oil and dispersants. However, that was not true. For instance, when my deckhands were handling the oil boom it would splash on me. I would also inhale the chemicals … Once my deckhands became HAZWOPER trained they would wear safety equipment, such as rubber boots and tyvek suits, at times, but their faces were not covered and they did not have respiratory protection. One of the deckhands complained to me about the chemical smell, and often my workers complained of headaches and discomfort. Regularly water splashed us in the face." (Richard Russell, 2)

"I regret that no one informed me of the health risks that came with the job. Since working on the cleanup my symptoms range from a constant sore throat to nausea, difficulty breathing, violent vomiting and cramps at the same time. I have stomach problems now, and I never know when they are going to occur … Now my bones are real sore, and I am in chronic pain. I am achy in my arms and my legs all the time. Before the spill I was in good health and I did not have any of these symptoms." (Richard Russell, 3)

"Whenever we finished for the day we put our equipment away and tried to get out of the oiled areas so that we didn't drift into the dispersant at night. Despite my best efforts, we often couldn't escape it and had to sleep over patches of oil and dispersed oil. After the frequent dispersant sprays, I developed a skin rash, blurred vision, headaches and dizziness." (David Hill, 3)

"The odor from the oil and dispersant was constant. I was the first one exposed to the fumes, because I was located in the front of the boat. The vessels are only a few feet off the water, and I could detect the odor before anyone else. The crude oil had more of a petroleum smell, whereas the dispersant had more of a sharp foul rotten type smell, similar to H2S gas. It would take our breath away and fill our lungs … I noticed that we had stronger headaches, sickness and nausea when we stayed around the dispersed oil than when we were in the presence of un-dispersed oil." (David Hill, 5)

"In the beginning I had pneumonia-like symptoms, staph infections, and an infected lymph node in my left armpit. I was admitted me into the hospital, and the doctors removed my lymph node … In January 2011 I was admitted again with pneumonia, and my white blood cell count plummeted to near death. It was at 100, and I had no immune system. I had an infection in my neck that swelled up to the size of a softball." (David Hill, 7)

"Currently I am experiencing chronic itching all over my body, and I have scratched myself so much that my skin is raw in some areas. I have skin blisters that randomly appear, and then they burst and heal. I deal with a tremendous amount of pain. I don't like complaining about how much I hurt, but my bones are constantly aching. It is getting increasingly difficult for me to walk because of something that is going on below my waist, as if a large horse kicked me and the pain won't go away. When I lie down in bed I feel a sharp stabbing pain, and the pain is so acute that I scream. There is no swelling or redness, but when I twist or turn a certain way it results in an unbearable pain. This is just the latest health problem … I am on disability now." (David Hill 8-9)

"My long-term memory seems to still be intact; however, my short term memory has vanished. I have notebooks sitting beside me right now, because throughout the day I have to make a record of

my actions. Otherwise, I will not remember what I did or still need to do. I even have to refer back to my notes to remember people's names. I rely on my wife a great deal to help me remember things. I never used to have that problem. I used to pride myself on my strong memory, and now I can't even remember a conversation from a few days ago." (David Hill, 9)

"What will happen to us? Prior to the spill, my friend had cancer of the stomach but the doctors had removed it all. After the spill he developed it again and passed away. Another friend found out that he had cancer six months ago and they will bury him today. There are so many people on our bayou dying from cancer. A 40 year-old mother who is a neighbor of mine developed rare cancer of the appendix after the spill. The doctors told her that the cancer is ongoing and there is no cure. She goes into remission and then the cancer comes right back. In addition to rising cancer rates, we have so any allergy problems ... Most people in our community are also living with awful sinus problems and migraines now. These problems were not common during previous oil spills or prior to the Deepwater Horizon disaster; they became widespread in the aftermath of the BP oil spill." (Confidential Whistleblower, 3)

"We've been impacted health wise down here, me and the rest of the people here, and you still have a lot of people here because our entire community is either in the oil field or commercial fishing. The problem is that a lot of the families are in both. A lot of them will never say anything like, 'since the spill I've been sick', whether they have become diabetic or are on heart medicine because of the heart palpitations that we all dealing with. I still deal with them today. They will never point the finger at the oil spill because they are so tied to the oil industry. The oil companies don't play. You fight them, they fight back and they fight dirty. They lay everybody off."(David Arnesen, 1)

"One of my other friends died in December 2014 at 36 years old. Last year one of my other friends had to have her thyroid cut out. Another friend eight months after her had to have her thyroid cut out. My mom just fought cancer ... Before the spill it was never the situation where every weekend you have to decide which funeral to go to, because there are now two to three funerals almost every weekend. My girlfriend who died in December at age 36 has three kids. She wasn't even sick beforehand; she woke up to a heart attack and died. She didn't smoke or drink. My other friend Carla just died of a heart attack as well ... Another friend of mine shot himself after his son was diagnosed with a terminal illness. His son died a month after his suicide from brain cancer. Another friend of mine just died of cancer eight months ago, and I didn't go to his service or their sons' services. They all lived in this community. It's like waiting for the other boot to drop. Who's going to be diagnosed next?" (Kindra Arnesen, 5)

"After my health problems escalated, I finally broke down and went to the doctor in late July of 2010. My wife chose a doctor out of the phone book. My memory was really bad so I made a list of symptoms and it probably included 20-25 issues on it. My skin crawled and tingled all the time as if my hands and feet were asleep, I was extremely weak. I never needed glasses before the spill, and now I have blurred vision and I have to wear glasses. I get chills too. I developed a rash that to this day only occurs when I come in contact with certain things. Anything from soap to deodorant would set me off, and fabric softener is really bad. I can't wear cologne or aftershave, and I can't even have hairspray in the house." (Rocky Meadows, 3)

ED_001324_00007753-00011

"My memory became very sketchy. I knew that I was losing my mental capabilities. I would get confused, and eventually it evolved to the point where I couldn't drive my own car. I couldn't focus and I forgot what if a red light meant stop or go. It got so bad that I couldn't use my phone to call someone when I got lost and didn't know how to get back home. I couldn't watch TV in color; I had to watch black and white shows because they were simple, and I couldn't follow stories. Mentally I was destroyed. It was the worst in November 2013; that is when I bottomed out. I was sitting on my couch and I called my wife to tell her what my final arrangements were to be. Fortunately, it hasn't come down to that." (Rocky Meadows, 3)

"I have always had migraines, however, immediately following the oil spill and Corexit spraying the intensity of my migraines became greater, my breathing suffered, and I developed severe insomnia. My lung capacity was not nearly as low before the spill. Urgent Care told me that I had bronchitis, and my oxygen level was at 96 percent. I have always had an inhaler but never used it every day. After the spill, I've had to use a breathing machine … Now I feel like my body is constantly tired, but it comes in waves. My white blood cell count elevates every time I don't feel well, and my stomach is always upset. I never had stomach problems as severe as they are now. Every time I eat now, I must remain close to a restroom or else I am in trouble, and I have lost 40 pounds since 2010. (Lani Kaiser, 3-4)

"During the spill, my sister lived in Peninsula a resort golf club area in Gulf Shores, Alabama. It consists of nice homes and condos directly on the Gulf of Mexico and Mobile Bay. As bi-planes sprayed, dispersants were distributed along Mobile Bay. The planes would fly across the Peninsula resort, and several homes/condos were exposed. Since the spill, my sister has been very sick with severe lung problems, although she was never a smoker. She has been hospitalized several times over the past few years, and her immune system is low. Several people in Peninsula are still sick from the exposure." (Lani Kaiser, 3)

b. Vulnerable Populations

"Within days of when I began working, when I would come into the house our son would swell up immediately … When my wife went to the doctor they asked what he was exposed to and she explained my job and they said, 'That's probably the problem.' A friend of mine's son who I worked with had problems too. He would break out in hives and when he went to the hospital, they treated him for scabies. It's still bothering him. It itches and irritates him real bad." (Andre Gaines, 11)

"I would hang a lot of my clothes in my mother-in-law's room because there was space … My mother in law died in February of 2011. My wife later discussed whether some of the chemicals that I wore home on my clothes could have affected her, so we had an autopsy done. We got her autopsy back, and they said there were chemical and breathing and respiratory problems. She already was on oxygen sometimes and had some breathing problems, but she was living well for the most part and was fine. Then instantly after I got my oil spill job she would start coughing, almost choking, and we never even thought about a possible connection. Then out of the blue she passed." (Andre Gaines, 11-12)

ED_001324_00007753-00012

"The first week or so in July 2010 we had unusually strong breezes off the Coast blowing toward us. In early July 2010 I was in my front yard with another man named Carl, when we were overcome by a cloud of chemicals ... We made eye contact with each other like 'What just happened?' We both dropped immediately down to the ground. Carl remained on the ground in pain. He was holding his stomach and vomiting profusely. He forgot who he was or where he was right after that. I ran inside to my bathroom immediately and I was sick everywhere ... We eventually got Carl home, and his family carried him to the emergency room. He stayed in the hospital for four days. The doctors could not point to anything other than to say that they thought he had stomach ulcers. The man had never had ulcers on his life, however. He never fully recovered, and he eventually died. Carl was in his 70s." (Rocky Meadows, 1-2)

"My in-laws and I were located southeast toward the blowout, and we could see Corexit and oil in the water. At least it looked as if it were Corexit, because it made a brownish beige foam. [My wife's] dad didn't want to take the boat in it, so we headed back in as it was getting toward the evening. During the return, we ran over something and the boat got stuck. I had to continually dive into the water to try and unwind some metal material from around the wheels ... During the period of time that I was unraveling the boat, they were spraying the Gulf with what we believed to be Corexit. Our boat got sprayed and [my wife's] parents got sprayed ... They both got sick on the boat and had severe headaches. They told me that they were feeling nauseas and dizzy, so we had to get back as fast as possible. After we returned to the dock, my mind went blank for a few days." (Rocky Meadows, 2)

"Both of my in-laws have since passed. Within about three months of us going out on the boat, my mother-in-law began to show signs of mental impairments. Within six months she had Alzheimer's ... Her rapid deterioration surprised all of us, because she had been in good health before the spill. My father-in-law seemed to be in perfect health before the spill. He was one of those guys who never even needed to go to the dentist. He had donated a kidney to someone a few years earlier, and the only kidney he had began to shut down." (Rocky Meadows, 2)

"[My daughter] Aleena started to get sick in September of 2010. We put her through the detox program, as well as our entire family, and my headaches and sinus problems got better. Aleena seemed to get better and then it came back all over again. With my son David, almost every time I turn around he has a sinus headache and tells me 'I don't feel good'. My mom barely made it through cancer last year. I have been to eight funerals in the last six months. My concern now is what does this hold for their future? Am I going to take them into the doctor for their headaches and the doctor says, 'Well, Aleena needs a CT scan and oh, she has brain cancer or bone marrow cancer or lung cancer.' You get scared to go to the doctor. These are my fears for my children." (Kindra Arnesen, 5)

"I thank god on a daily basis for the health that my family does still have. I pray for my husband's health and I pray for us financially, but I also pray for these other kids in our area and these families that are struggling with these illnesses, some of these kids are much sicker than mine ever got. The one little girl, who is the sickest I found on the Gulf Coast who is still alive, has been sick like this for five years. She is only 10 years old, and she does not recall what it was like to be well. She does not remember what it was like not to be scared from head to toe and her hair falling out and her skin

ED_001324_00007753-00013

seeping out and her body scarred from head to toe, and not being able to breathe. She does not recall what it was like to live a normal life before the spill. She lives two streets over. Her grandmother had to go on two inhalers since all of this happened, and she died in November of 2014 at age 52. She was one of my closest friends, and she was raising this little girl. The kids are back with their mom now, and the little girl's health remains bad." (Kindra Arnesen, 5)

"My two daughters have also had health impacts problems since the spill, although both of them rarely ever got sick before the spill. They are only 28 and 30 years old. My 28 year old was 23 at the time of the spill, and she was living with my wife and me. At the time her daughter was one years old, and she is often sick now as well. My younger daughter has one health problem after another. She is on medication to balance out a hormonal imbalance that developed after the spill, and she has had reproductive problems. She is also on medication to stimulate her mind, because she now experiences mental fatigue. Before the spill, she had never been on medication. My older daughter's son was born about a year after the cleanup, but he was born prematurely. Some of the doctors think that the Corexit may have impacted him. His lungs and vision were not fully developed." (Rocky Meadows, 1)

"We don't know if it's from the oil, the dispersant, or the combination of the two. But you can only fill a glass so full before it overflows, and the human body is the same way; you can't take that much chemical exposure and be ok with it … When is it going to go from primarily the adult size casket to a kid's casket? We already have too many sick kids, with brain tumors and cancer. There is another young girl who was a published author at 13 years old, she is about to be 18 now. Right after the spill her eyes started rolling back in her head she got a brain tumor. Her mom is sick, the middle child in her household had to stop playing football because of heart problems, and the little one has nose bleeds, hair falling out, stomach aches and headaches. It's everywhere down here, but you can't convince people that it's related to anything to do with the oil field. Physicians are just diagnosing the illness and treating the illness, they aren't treating the cause." (Kindra Arnesen, 5)

c. Medical Response

"One of the things we can do to assist these individuals is to have them go through a self-detoxification program by using a sauna with niacin and exercise. One of the fathers of a victim recently wrote back to me explaining that his son has experienced a very objective improvement with what he was doing. His son had worked the spill." (Dr. Michael Robichaux, 1)

"[After I was sprayed by Corexit] I kept throwing up, and my mom asked if I wanted to go to the hospital. However, I already knew people who were sick, and the hospital wasn't helping them. So I didn't know what to do. By that point, my sister was already sick, and each time she went to the hospital someone looked at her like she was crazy. I told my mom I would wait it out. The next day I was fairly sick, so I called 'in sick' to work. I stayed home and slept drinking lots of liquids. The area on the left side of my upper forehead would swell. It became so bad the following day that I went to a primary care doctor in Perdido Key. He said that my white blood cells were crazy. The doctor asked if I had an inflammation disease. My mom looked at him and said, 'No, last night she was exposed to Corexit' and he replied, 'Well what does that have to do anything?' … This was almost a

ED_001324_00007753-00014

year since the spraying, and the doctors still didn't believe there were any health problems associated with exposure to Corexit." (Lani Kaiser, 2-3)

"I've been to two different neurologists, and both said I have migraines with nausea and stomach issues. I found a holistic doctor in Orlando who took an MRI and found that I had four transient ischemic attacks (TIA), mini-strokes located on the left side of my head. In the beginning the left side of my forehead would swell, my left eye would twitch, and tremors would be frequent. If I take high concentrations of Niacin, B-6, B-12, and Vitamin C, they help to relax the symptoms. My migraines and stomach seem to be connected. If my head hurts then I will have nausea. Smoothies and coconut water help lower the intensity levels." (Lani Kaiser, 4)

"I saw a toxicologist in Baltimore, Maryland about three years ago when I was living in Auburn, Alabama. A friend had contacted me to explain that the toxicologist was creating a health database related to the spill. The lab where he worked is associated with John Hopkins, and they are creating a database of people involved in the spill or who have been exposed to chemicals from the spill. He wanted to track my medical symptoms about once a year. During our last call in 2012, he was direct and said that he wanted to tell me something that most doctors may not say. He warned me that in the next five to ten years things would change for me. He said he couldn't pinpoint it, but he was concerned that my health may domino or get worse. The best advice he could give me is to make as much money as I can now because I may soon be at the point of having to take disability. He told me this as my body feels worn out and tired." (Lani Kaiser, 4)

"The woman at Ocean Springs Hospital asked … me about my breathing and listened to my lungs. She said 'Oh, it sounds like you have asthmas or bronchitis.' I've never had respiratory problems before in my life, until working on the cleanup. She asked if I smoked cigarettes and I responded that I didn't. She said 'Your lungs sound like you smoke 10 packs a day.'" (Andre Gaines, 8)

"I told [the hospital] about the conditions that I had been working in during the cleanup, and about being sprayed. They did not treat me for chemical exposure, however … They kept saying my problem was viral and will go away tomorrow. However, it never went away the next day; it went on for weeks … They finally took my blood and said that I had benzene poisoning in my blood in high levels." (Andre Gaines, 8, 9)

"[D]uring the one year anniversary of the Deepwater Horizon explosion, I went to DC for PowerShift, an environmental conference. I met with Lisa Jackson, the head of the EPA, Stacy Elmer of Health and Human Services, and an admiral from the Coast Guard … I asked the HHS representative why the doctors are not treating me beyond my symptoms when I go to the hospital? … She responded, 'No one is coming forward – the workers are not coming forward…' And I've got all of this paperwork, and I was coming forward. Then I asked the admiral toward the end of our meeting about the use of respirators … His response to me was, 'Since the heat is so tremendous down on the Coast, they would rather not provide respirators, because you would take it on and off of your mouth and you run the risk of contaminating your digestive track with oil.' As if breathing it is ok? … With my lungs I will continually breathe in these chemicals." (Andre Gaines, 13)

ED_001324_00007753-00015

"I had all types of doctors coming by my bedside to study why I could not produce white blood cells. I had a blood transfusion and a toxicologist removed bone marrow twice. He couldn't figure out what was wrong with me either … my right leg turned red and it was incredibly painful. It looked like it had been in a deep fryer, and it has blisters all over it. I thought I was going to lose my leg. They removed my gallbladder and later did surgery on my groin and removed an infectious material from that area. They also gave me foot medication because they were concerned that I had Stevens-Johnson syndrome, which is a potentially fatal skin disorder … I also became anemic after working on the spill." (David Hill, 7)

"National Institute of Environmental Health and Sciences contacted me about their 10-year Gulf Study. They took blood, toenail, fingernail, hair, skin and urine samples. They said they would be contacting me every three months; however, I have not heard from them. Supposedly they want to monitor me for 10 years to study what the health implications are for those of us who worked on the cleanup. However, they are not offering treatment." (David Hill, 9)

"The doctor I met with explained that my liver probably is not functioning correctly and my gull-bladder needs to be removed immediately. I may also have a problem with my pancreas. My tonsils are inflamed and probably need to be removed as well. He explained that my nasals and ear cavities are inflamed. One of my tonsils is bigger than the other with bumps all over it. He said it was a possibility that I was exposed to chemicals while working on the spill. He could notice that my eyes looked drained and aged as well. I used to look and feel much healthier. It worries me because I am only 45 and I have never had a history of poor health … I do not have a regular doctor because I cannot afford one, so I just live with my symptoms." (Richard Russell, 4)

"When we first brought Aleena to Children's Hospital we said we were from Venice, and we shared the history and our concern about being chemically exposed. Kindra said, 'We would like to have a Volatile solvent profile done so that we can see what she is exposed to.' That doctor replied that if we felt like we'd been exposed then that is where we would have to start. She wrote the prescriptions for Aleena to be tested for the Volatile Solvent Profile, and when we called the lab for the results they said the order has been cancelled by hospital administration. This was in 2011. All four of us had the blood tests done and our results were high in Benzene, Xylene and Ethylbenzene" (David Arnesen, 6)

"Before I had the blood tests done, they had that Eco Gulf Restoration Task Force meeting in Pensacola. They provided a print out that explained you could get [VOC] chemicals in your blood by pumping gas, smoking cigarettes, and so forth and I'm like, wait a second, how did my eight year old at the time get [chemicals] in her system?" (Kindra Arnesen, 6)

"Before my father-in-law passed he was in the VA hospital in Jackson, Mississippi, and his doctor was a real nice man. He asked me if my father-in-law had helped out with the spill with his boat. I explained that he didn't help with the spill, but he was down there every weekend on his boat. The doctor said, 'That's what I thought,' and that was the end of the conversation." (Rocky Meadows, 3)

"The office in Mobile did extensive blood work on me. The first time I met the specialist doctor he was reviewing my bloodwork. He said 'My god', and then he put my paperwork down and said, 'You

ED_001324_00007753-00016

need a lawyer, son.' I said that I thought I needed a doctor. He said, 'You need a lawyer.' He told me that my liver is 29 percent full of chemicals and I had been exposed to something … After a year or so of seeing the specialist, I was not getting better so he sent me to a very well known and respected forensic psychologist named Dr. Daniel Koch in Mobile, Alabama. The specialist wanted Dr. Koch to evaluate me for more than one reason." (Rocky Meadows, 3-4)

"Dr. Koch ran every test imaginable, and he reported the findings back to the specialist. He wrote a letter explaining that he believed I have health impacts from the oil spill. He had other patients like me, and some had the same chemicals in their body and symptoms as me. Dr. Koch wanted me to get a lawyer, and he wanted to offer to be an expert witness for me. He was known to fight and go to court on situations where other doctors would not want to represent you in court. One doctor explained to me, 'Whatever I was to say, BP would have 10 doctors saying that it's ignorant and I'm stupid, and I just can't go through all of that.' The specialist explained that he needed to be seeing patents, not a judge or a jury. But he knew that Dr. Koch would fight it. Unfortunately, after I began seeing Dr. Koch he had a stroke, and he can't practice anymore." (Rocky Meadows, 4)

d. Is the Gulf Toxic?

"Tomorrow is not promised to anybody, but BP is speeding up my death and thousands of others. I know people who didn't even work down there, but … they lived by the water, and the dispersants were being sprayed over their homes … I know a woman who had a house 50 feet from the beach. She said that she was scraping the dispersants off the top of her car with a butter knife into piles. If you look at a picture from last year of another woman I know, she was obese. You look at her this year and she is skinnier than 120 pounds. Now she has tumors and blood bleeding from her lungs and all of this kind of stuff, but BP and the government are still saying that there was nothing wrong with Corexit, just as the government said Agent Orange was ok to use." (Andre Gaines, 17)

"During the cleanup there were frequently strong winds at 25 to 30 miles per hour. I believe that we were exposed to the Corexit, because the chemicals from it became airborne or got into the water. I frequently detected a chemical detergent smell on the days that Corexit was sprayed … To my knowledge, BP and the government were only supposed to spray Corexit offshore, not inshore, but it looked like there was dispersed oil inshore. The foamy water would spray the other workers and me in the face. I would come home with my shirt covered in brown spots from where the water splashed me. Shorty after those experiences - within the first month on the job - I started to feel abnormal, as if had a bad cold." (Randy Varney, 1-2)

"During the cleanup my eyes often burned and my nose bothered me. The chemical smell was the most difficult part of the job; it was strong and constant. My dad lives on a lagoon on Gulf Shores and to this day you can smell it from his house. I was coughing all the time and it was difficult to breathe out there because it was hot and I constantly smelled the chemicals from the spill. It smelled like something in the air was burning. I didn't think to ask for safety equipment, however. We were focused on cleaning the oil, and I was told that I did not need any protections." (Richard Russell, 3)

"I am hesitant to even come in direct contact with the Gulf water, and I know we have tourists down

ED_001324_00007753-00017

here who swim in the Gulf. BP did not want to warn the public of the ongoing public health dangers resulting from the spill … I'm concerned that people who do not know any better will swim in it and get sick and possibly get cancer later down the road. I do not go swimming unless it is in a pool." (Richard Russell, 4)

"They were spraying dispersants everywhere around us because this is what the mayor, Robert Craft, wanted. He was convinced this was the quickest way to make the oil disappear. He was a proponent of Corexit because he didn't want to see any oil in the Gulf of Mexico. I felt like it was too soon to open the water only three or four months after the spill. However, Gulf Shores and Orange Beach generate close to 50 percent of sales and lodging tax for Alabama. In 2010, we didn't visit the beach after the spill, but we had family members that did. I have a first cousin who sat on the Gulf Shores public beach the first day after it re-opened. A year later, she developed a brain tumor. It doesn't mean it's necessarily related to the spill, but we are concerned because we know she swam in the water." (Lani Kaiser, 1)

ED_001324_00007753-00018

4. Ecological Impacts

The more toxic Corexit/oil mixture coated the Gulf seafloor and permeated the Gulf's rich ecological web and food chain. Whistleblower reports, empirical evidence, and peer-reviewed scientific research all have shown far greater damage than the government predicted at the time of the BP spill when it authorized unprecedented dispersant use. Moreover, rather than "cleanup" the oil, Corexit dispersed it into the water column and sunk it to the seafloor. In 2014 as much as 10 million gallons of oil were found buried in the Gulf seafloor, and dormant oil continues to be unearthed in the aftermath of storms and hurricanes.[13] Coral, which are sensitive to environmental changes and play a central role in the Gulf ecosystem, continue to experience widespread damage and unprecedented mortality five years after the spill. Gulf fishermen, divers and coastal residents continue to witness the devastation of dispersant use on a daily basis. Corexit not only disrupted an entire ecosystem, but a way of life for coastal communities that recreate in the Gulf and survive on seafood for commercial and subsistence fishing.

A 2013 study by GAP witnesses found that polycyclic aromatic hydrocarbon (PAH) levels in Gulf seafood far exceeded EPA permissible threshold for human consumption when the fisheries were reopened. It also documented high PAH levels in Gulf sediment, seawater and biota.[14] In 2013, research by the Society for Experimental Biology found, "though chemical dispersants may reduce problems for surface animals, the increased contamination under the water reduces the ability for fish and other organisms to cope with subsequent environmental challenges."[15] A 2014 study found that "methane-derived carbon entered the food web through small particles" in the years following the BP spill.[16] Consistent with those findings, GAP witnesses explained how marine life uptake of small dispersed oil droplets would contaminate its catch and result in oiled seafood. Whistleblower from the fishing industry reported that 2013 and 2014 have been their worst years for fin fish and crab yields.

The damage on Gulf coral is arguably the most devastating and revealing of impacts documented in the five years since the BP spill. Corals, comprised of hundreds of individual animals known as polyps, are sensitive to environmental changes and help to assess the full impact of the disaster. Moreover, deep-sea coral provide habitat for many other life forms, including fish and invertebrate communities.[17] Like other marine life, coral often pray on microscopic organisms found in the water column such as the contaminated zooplankton. In addition to the 2013 report conducted by GAP witnesses that found visible signs of polyp mortality in the majority of coral colonies collected off the coast of Grand Isle, Louisiana[18], a 2015 report cautioned that "[l]ittle is known about the stress response of these foundation species yet they are increasingly exposed to anthropogenic disturbance as human industrial presence expands further into the deep sea. A recent prominent example is the Deepwater Horizon oil-spill disaster and ensuing clean-up efforts that employed chemical dispersants."[19] During its examination of coral, it found that higher concentrations of dispersant alone and the oil dispersant mixtures resulted in more severe health declines than exposure to the oil alone.[20]

ED_001324_00007753-00019

Whistleblower Record

a. Oil Not Gone

"Days before the fourth of July [in 2010], BP increased its cleanup crew numbers to try and make the beaches look clean in time for the holiday … Instead of cleaning the oil, however, beach cleanup crews were instructed to survey the beaches and cover tar balls with sand … I started dumping sand over the giant tar ball like he told me to do. He had me cover it as much as possible, but I tried to leave spots open so people could see the tar ball was there … I thought to myself, wow, who do you tell when things like this happen?" (Andre Gaines, 4)

"It hurts me to now see the kids digging in the sand, because in many cases the beach cleanup workers covered up the oil with sand. The workers made videos of this practice and posted them online, and I also saw reports of it on the news." (Randy Varney, 4)

"Dispersing the oil into the water column was the worst thing that BP and our government could have ever done to our environment. Even when they had the boats there to pick the oil up and they had the equipment on a beautiful slick calm day, the boats would locate big patches of oil and then they would be sent away so that the planes could come to spray it with dispersant, rather than remove the oil mechanically." (Kindra Arnesen, 4)

"Our job was to find the 'workable' oil - oil that had not dispersed yet. We could not collect the oil in locations where dispersant was sprayed, because it just made a long sheen of miles of little orange and purple droplets and bubbles floating everywhere." (David Hill, 2)

"When we came back from inshore and could only find dispersed oil, we went to ground zero at the site of the Deepwater Horizon explosion. Dispersant was being injected at the wellhead, and we saw a lot of dispersed oil. When the oil was dispersed at the seafloor, it went through different currents in all different locations." (David Hill, 3)

"My sister and I are avid seafood eaters and beachgoers, but neither of us would eat the seafood, go to beach, or swim in the water after the spill. My sister is now living in Seaside, Florida. When there have been bad storms in Seaside, the beach and water become covered in oil. It only takes one good storm to wash the oil back along the shore which is strange for this area." (Lani Kaiser, 3)

"I believe the difference is that when the oil is floating on top, it's like bamboo, so it's not penetrating on the top. When you sink the oil into the roots, it kills it … The dispersed oil came in from the Gulf and went into the vegetation. It looked like you had sprayed RoundUp into the marsh for 60 feet of our coastline. It killed Catfish Bend and Jackass Bay in the surrounding shoreline, and it has increased coastal erosion. Later we came across oil floating during hunting season from another spill. The oil was not dispersed, however. When we went back to the same area this year, the vegetation and shoreline was still there. The oil itself doesn't kill the vegetation, but when they disperse and sink it, it kills it." (David Arnesen, 1)

ED_001324_00007753-00020

b. Seafood Devastation

"[S]ince 2011 we have been catching shrimp that are deformed. I have worked in these bayous and canals my whole life and I never saw shrimp like this before the spill, especially inshore where the shrimp are born and raised. Some look like they had acid dropped on their shell, or they have black gills and tar. Some of the shrimp have sores and tumors on both sides of their heads and discoloration, as if they are rotten but still alive. I only come across a few shrimp without eyes, but some shrimp have eyes that are clear and not fully developed. If you take the heads off the shrimp often look fine, but if you take the heads off and put them in a bag and let the gook ooze out then it turns your stomach." (Randy Varney, 3)

"Just like the beaches, I don't know if the shrimp are safe. The government said it has tested the public beaches and seafood for chemicals, but how am I supposed to feed the shrimp to people when I am catching deformed shrimp?" (Randy Varney, 4)

"As a tour guide I occasionally fish, but I am scared that the water is still contaminated with dispersants and oil. It is difficult not to avoid coming in contact with the water as a guide, however. At times I get small cuts on my hands and then the open wounds are exposed. I'm concerned about touching the water due to the dispersants … Now I do not know whether or not the Gulf seafood that we catch is contaminated." (Richard Russell, 4)

"Until recently, I helped run a seafood restaurant in Louisiana. [The owner] and I decided to close the restaurant after we realized that the seafood we served was contaminated by oil. I could not bear to serve other people's children and grandchildren a product that I did not want my own children to eat. Gulf seafood is being shipped all over the world. Who is going to take care of those made ill by contaminated seafood?" (Confidential Whistleblower, 1)

"We specialized in boiled seafood, and offered boiled crabs, shrimp and seafood platters … One night in June 2012 when we were serving boiled crabs, a patron was eating the crabs and said that she couldn't get a black substance off of her hands, even when she scrubbed it with a napkin. She showed me that when she opened the back side of the crab and squeezed it, a black oil-like substance came out of it. I asked if she would mind if I documented it, in the event that she got sick … I proceeded to give her a wet paper towel with Dawn dish washing liquid and the black substance on her hand came off right away. She then proceeded to keep eating the crabs, at which point I panicked and said, 'Let me get you some fresh crabs.' I had never seen anything like that before the oil spill; I was shocked." (Confidential Whistleblower, 1)

"After the patrons complained about the soft shell crab we decided to stop selling them; we were scared of someone getting poisoned. Folks weren't complaining about hard shelled crabs at that time, but we started findings problems with them as well. After the first oiled crab incident we started paying closer attention and noticed more crabs that looked like they were contaminated with oil. We also started looking more closely at the shrimp; to our surprise, they frequently had no eyes and their heads contained a thick black substance. I didn't know what it was but [the owner] explained that it must be oil." (Confidential Whistleblower, 2)

"[The owner] wanted to figure out what was wrong with the crabs. He put them in a tank and

ED_001324_00007753-00021

placed 10 gallons on cooking oil into the tank. Within days, the cooking oil had disappeared. I believe that the crabs were exposed to Corexit and the Corexit is responsible for this. If the Corexit is going to eat the oil that fast, what is it going to do to a person? [The owner's] processing plant was peeling crabs and he wanted to make sure they weren't contaminated. He contacted the Louisiana Department of Health and Hospitals, and it told him to get a black light to identify any contamination. [He] has photos of the crab under a black light that identifies chemicals, and the crab meat and shrimp are a neon blue color under the black light." (Confidential Whistleblower, 2)

"In 2011 we found black sludge in the fish. In 2012 we found tumors and sores in the livers and stomachs in a percentage of our catch offshore, along with holes penetrating the flesh of the fish. We saw visible signs of oil and damage to the fish in as high as 30 to 35 percent of our offshore catch at one point. As the years progressed the fish began to die off. By 2013 we saw almost a complete devastation in some species. We could find almost zero bait on the water's surface, no matter where we went in our area of the Gulf. In 2013 our mangrove snapper collapsed. In 2012, 2013 and 2014 we have seen a collapse in the king mackerel and amberjack, both of which we fish. Normally when we catch a greater amberjack it is a big fish, anywhere between 35 and 95 pounds. It's normally a head and a really big body that bows out. Now, its head is bigger than its body because they are so under weight. People don't understand that the reason the fish are under weight is because the bait source has been compromised. When you start pulling links out of a chain of life in a body of water, it has a ripple effect." (Kindra Arnesen, 3)

"Now we're not seeing the black sludge or sores that we saw before, but the population has decreased. Fishing is where I make the most money. Yet, BP paid the least amount of money to compensate for fin fish." (David Arnesen, 3)

"Our season last year and the year before were devastated. We had very few king mackerel. They are migratory fish and they won't stop if there is nothing to eat. They will keep going until they find a bait source that they can live on. That is the reason that we always had a lot of king mackerel and now we don't have them." (David Arnesen, 3)

"Here in Louisiana, our shrimp on average before the spill was about 100 million pounds a year. In 2013 Kindra called and asked the docks how many pounds they were down. On average they were about 51 percent down; that is approximately 51 million pounds of shrimp that is not being caught. That's a lot. I shrimp and I know everyone here who shrimps, and we know our catch is down by about half in pounds." (David Arnesen, 3)

"In 2012 I was fishing amberjack in January and February. We caught 10,000 to 12,000 pounds and they were full of roe. From March through May fishing was closed, and the remaining quota we have left over after the January opening then reopens in June. When we started back in June, they still had roe. When you have an entire spawning that doesn't happen then it will really impact the fish stock. The fish are having severe reproductive problems. Even in south Florida in 2012 the mullet roe did not mature, so there was a Gulf wide impact in the spawning process." (David Arnesen, 4)

"It really makes you sad looking at our government agencies and our government itself. Those are the people who are supposed to be in place to protect us and our environment. After the spill we

ED_001324_00007753-00022

realized that they are the people attacking us from every direction. It was just like when they told us that we had to go back to work and catch the seafood. We were worried about contamination, so we went to one of the large meetings with EPA and FDA. There are not many docks between here and Grand Isle, maybe 10. We suggested that they put mobile units on the docks. When the boat comes in, we could pull a couple shrimp out and run a chemical test. If they are good then we could sell them. If they're not good then BP should buy them. They responded that the technology and equipment was not available for them to do mobile testing. Did you see the sniff test? Come on." (David Arnesen, 6-7)

"About two years ago a friend of ours went out shrimping, and he came in with a whole bunch of shrimp that has blisters on them and no eyes and black gooey stuff and he wanted them tested. He explained that he didn't know who to call or what to say. So we sat at my table and I called the FDA on speaker phone. We asked them, 'Who do we send this product to in order to have it tested and to make sure it is safe? Do you have someone to test this product?' They responded that it is up to the boat owner and the processor and manufacturer to make sure that the product they are selling is safe. They explained that the FDA is not required to test our product." (Kindra Arnesen, 7)

"I have always been one of those people that if I wouldn't eat the fish off my boat then I'm not going to sell it. We're catching less now, so I go to the middleman now to try and get a better price to try and make the money that I was making with less fish. When I started going to these guys, they were so impressed with how well I take care of our seafood that they wanted me to do Skype videos … They wanted to document the whole process that occurs within 24-hours, because we provide such a high quality product and that is what we strive for. When I'm catching these fish, if I could see anything wrong with them then I would throw them back. No one paid me for a third of my catch that I was throwing back. Worse off, you can't necessarily see the chemical exposure." (David Arnesen, 7)

"In 2011 when we were gutting some of our fish, their entire gut was full of the black sludge, the oil. Some had consumed so much of the oil through the bait fish that it had passed through the stomach wall, through the entire cavity through the meet, and you could see the oil under the scales. This is after the fisheries were open. Up to a third of my catch was like that. We arrive at the dock and the NOAA biologist is there. I gut the fish and we put them in a bucket, and she explains that Louisiana State University does the testing for NOAA and she would take them there. We waited and waited and waited and were eventually told that they disappeared." (David Arnesen, 8)

"We normally have two operations. Bayou Side is the live crabs and raw product. Cajun Crab is the factory that provides our boiled and cooked product. We haven't had enough crabs to operate Cajun Crab since November. That's really odd, because normally we will go until the middle or end of January before we start shutting it down. Crabs this year and last year have been two of the worst years for crab amounts that we've ever seen. It's as simple as that. Crab amounts in this area, from Morgan City all the way to the East, are the worst they have ever been. The last two years have been the worst. Everyone has been changing the way they do things around here in order to survive. They have been cutting back here, cutting back there." (Eric Blanchard, 1)

"Usually at this time a year we ship at least 30 to 40 boxes a day. Yesterday we shipped five boxes

ED_001324_00007753-00023

total. Early spring is when crabs start coming, but you can see that the numbers are not there. They have huge differences in the production, from Morgan City eastward. Everyone is complaining, and the key indicator for me that something is wrong is the number of crabs. The landing data for crabs has to be off, because I see it here. The biggest concern is the lack of seafood production." (Eric Blanchard, 1)

"If BP would look at the money made by these companies that would say everything is back to normal, but it's not. Even though fishermen made some money last year, it was because the price of oysters and crabs are high. It hurts our company because we make our revenue from volume, not price. Now a number one crab, the large male crabs, is $5 a pound. That is unheard of. The highest they got before the spill was in the $2 range. Number two males are $3.75. They were in the $1 range before the spill. Females barely got above the dollar before the spill, and now they're at $3.50. For me to buy oysters I have to pay $45 a sack. Before the spill I would pay $20 to $25 for a sack. The oysters aren't doing that great. That is the situation we're in; everyone has to alter their way or doing things in order to survive. And unfortunately, we are in survival mode. "(Eric Blanchard, 1)

"I have been in business since 1980. That is when I started crabbing and started selling crabs … I started a crab factory, and my idea was to keep growing … The crabs here are the same color as the Chesapeake Bay blue crabs … From Lake Charles to Venice, they all sell their crabs to Baltimore … A lot of people don't understand that these crabs go to Baltimore and the East Coast. Most people don't know that they are eating polluted crabs. They are sold as Chesapeake Bay crabs but they're from Louisiana. The Baltimore truck was here earlier to pick them up, but they didn't come today because we didn't have enough crabs. The worst part is in Baltimore, because they steam the crab. They add the spices and people eat the crab with their hands. That's the most dangerous because the shell is contaminated and people touch it and then eat it. It's the same with the shrimp; most people don't remove the black line, but that part is the most dangerous because it is the feces. BP sank the oil to in the bottom of the ocean now, so the shrimp and crab and are eating the dispersed oil. When the seafood eats it, the people also eat it. You don't have to be a scientist to understand that." (Ollen Blanchard, 2)

"In July of 2014 we took approximately 2,000 crabs. These crabs are from Cocodrie's outside edge, but we brought them in from Chauvin. We put the crabs, I was working with a man who has a soft shell crab system … The filters were set up and running several weeks in advance to make sure that the water chemistry was stable. We put them in and only two crabs made it in six days. I was shocked. We lost 250 pounds in the first day and then proceeded to lose about 50% a day for the next several days. I was trying to replicate my coral depuration to see what came out of them. Similarly, a brownish foam with black spec condensate came out. It was a thicker and heavier compound that came out and sat on top of the foam. As the crabs were dying I took them out and placed them in buckets of water to see if something was leeching out of them. A rainbow sheen leached out." (Scott Porter, 1)

"We are seeing those tentatively identified compounds in the test results. The benzene rings don't disappear easily, however. If there were chemicals digested or brought in by the crab, chances are that they won't look exactly the same after they have been metabolized. That is what we're trying to determine, and that is really the hard part. The government should be doing this, because they have

the money to run the analysis and see what the results are … They did find benzene rings in the crab samples, which I understand to be an indicator of oil exposure. Benzene symptoms include reproductive damage and it can make you lethargic." (Scott Porter, 1)

5. Dispersant Reform

The government must reform dispersant policy so that we are not faced with the same public health dilemma during the next oil spill. It can take immediate action by banning the use of toxic dispersants, including Corexit. The more fundamental reform is to control and prevent future damage until the research on dispersants has been fully developed. In honor of Earth Day, Congressman Jerrold Nadler (D-NY) reintroduced the Ban Toxic Dispersants Act of 2015, which would require a temporary moratorium on the use of dispersants until rulemaking and a study to ensure their safety is complete. Rep. Nadler cautioned: "Recent studies have shown that exposure to Corexit may have been worse than the oil itself. We must follow the lead of Britain, and ban the use of dispersants that threaten the health of people, fisheries, marine mammals and their habitats."[21] To commemorate the BP disaster's fifth anniversary, Gulf community groups declared April 15 the End Toxic Dispersant Use Day of Action.[22]

After mounting public pressure, in January 2015 the EPA released a proposed rule to amend parts of the National Contingency Plan (NCP) that govern use of dispersants, other chemical and biological agents, and other spill mitigating products, when responding to oil spills in salt water and fresh water in the United States. According to the EPA, the proposed rule incorporates lessons learned from the federal government's experiences in the Gulf, as well as recommendations on agent use by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President.[23]

Although the proposed rule does not ban the use of toxic dispersants, it includes several improvements to dispersant regulations to control its use, including consideration of a product's toxicity, long-term environmental impacts, endangered species protection, and human health concerns. It also strengthens controls on planning requirements for dispersant use authorization, toxicity thresholds, and advanced monitoring techniques. Yet, the EPA is receiving considerable pushback from the oil and gas industry, and the current proposal does not go far enough in many areas.

For instance, while it includes human health and environmental standards for EPA to "delist" dispersants, the EPA still has too much discretion on when it must act to remove dispersants from the NCP. Moreover, the proposed rule still relies on manufacturer science rather than independent research to evaluate product safety and efficacy. Further, the revised toxicity testing standards are still too weak to prevent the listing of dispersants and other products that may harm human health and the environment.

This section will identify strengths in the current proposal, and make additional recommendations, as they pertain to human health and the environment. Recommendations incorporate lessons learned by whistleblowers, who should be the pioneer witnesses providing a foundation for this effort. Throughout GAP's investigation whistleblowers provided clear warnings and practical solutions that could have greatly reduced the disaster's health and environmental impact. They began by warning not to treat chemicals with chemicals, a premise that was ignored.

ED_001324_00007753-00026

The ALERT Project and the Prince William Sound Regional Citizen's Advisory Council have developed comprehensive technical comments.[24] While GAP is generally supportive, many go beyond the scope of this investigation or GAP's area of expertise. However, several recommendations that pertain to dispersants and product safety are incorporated below.

Testing Requirement

The proposed rule would "revise the toxicity testing requirements for dispersants, including the testing protocol and the use of the test results. The proposal would require acute toxicity testing for the dispersant alone, and the dispersant mixed with both oils used for efficacy testing."[25]

The EPA adjustments to testing requirements are a step in the right direction. For instance, as demonstrated by revelations that the oil/Corexit combination becomes 52 times more toxic than the oil alone, it is significant that the proposal accounts for the combined toxicity of the oil and dispersants. However, the proposed requirements are not sufficiently stringent to prevent the listing of dispersants and other products that harm human health and the environment. The EPA should require maximum toxicity test standards and minimum effectiveness standards for all agents, including potential adverse endocrine, immune, or developmental effects to human populations or the environment[26] [27]

Further, the proposed rule still relies on manufacturer science for product efficacy and toxicity. At a minimum, the EPA should require a controlled sample of independent testing to verify industry science and data. Specifically, the EPA should audit or independently vet studies to ensure fairness and transparency. It should require independent science or rigorous peer review of all studies conducted by the spiller or product vendor or manufacturer.[28] [29]

Removal of a Product from the Schedule

Among other criteria, the proposed rule would clarify that the EPA can remove a product from the Schedule if there is "[m]isleading, inaccurate, or incorrect statements within the product submission to EPA or to any person or private or public entity regarding the composition or use of the product to remove or control oil discharges, including on labels, advertisements, or technical literature; or Alterations to the chemical components, concentrations, or use conditions of the product without proper notification to EPA [or]; ...New or previously unknown relevant information concerning the impacts or potential impacts of the product to human health or the environment."[30]

This is a significant measure for disclosure, but not for the ensured protection of human health or the environment. The EPA should have a pro-active duty to enforce standards, not limit enforcement action to false statements. The EPA should remove all products that contain known or suspected human health hazards or proprietary or secret ingredients that would prevent public disclosure of the chemicals in the product being used. Further, the EPA should add specific criteria for product removal such as product discontinuation, monitoring studies that find unanticipated consequences to the environment and/or human health, or changes in community acceptance especially in areas where product is being or was used.[31]

ED_001324_00007753-00027

Authorization of Use

The proposed rule would "clarify planning and preauthorization responsibilities, establish limitations and prohibitions on the use of certain agents, establish requirements for storage and use of agents, clarify authorities for requiring supplemental testing, monitoring and information on agents, establish requirements for agent recovery from the environment, and establish reporting requirements for agent use."[32] Under the proposed rule, the scope of preauthorization plans would be increased. In areas without preauthorization plans, it would take into consideration agent use parameters, including but not limited to quantity limitations, duration of use, distance to shore, and proximity to people.[33]

While it is important to clarify the scope of the preauthorization plans and to establish response measures for where there are gaps, it should include provisions to protect human health and the environment and ensure that committed decision makers are chosen accordingly. [34] During the BP disaster response, USCG asserted authority over the EPA regarding the use of dispersants, and then acted collusively with BP to thwart environmental enforcement. The EPA should clarify its authority under the Clean Water Act to make the final call on any product use. Further, the proposed rule should require that OSHA and the Department of Human Health and Services (DHHS) review the Area Contingency Plans. [35] Throughout the preauthorization process the EPA should prioritize consultation with scientific experts and natural resource trustees.[36]

Monitoring the Use of Dispersants

The proposed rule would "[e]stablish monitoring requirements for dispersant use in response to major discharges and/or certain dispersant use situations," including subsurface dispersant use and dispersant use over an extended period of time. Specifically, the proposed rule would require the responsible party to monitor the environmental impacts and efficacy of the dispersant being used.[37]

The monitoring of environmental impacts is a significant requirement. But it is only half the problem. The EPA should also require *human health* monitoring, and monitoring should take place for as long as is deemed necessary to understand a product's long-term impacts on humans and the environment.[38] In addition, the responsible party should not be in charge of conducting the monitoring due to an inherent conflict of interest. The natural resource trustees should conduct monitoring for wildlife and ecosystem impacts, and OSHA and DHHS should conduct monitoring for human health impacts. Monitoring should be funded by the Oil Spill Liability Trust Fund. [39]

Distribution of Safety Data Sheet

The proposed rule rightfully acknowledges "chemical and biological agents may contain substances that could cause harm to oil spill responders who, if unaware of the product's formula, may not wear the proper personal protective equipment." The proposed rule would require that the Safety Data Sheet (SDS) of a product be provided to both On-Scene-Coordinators and responders when authorizing and using a dispersant or other product. [40]

The requirement for greater dissemination of a product SDS is an essential lesson learned from the

ED_001324_00007753-00028

BP disaster. It is a prerequisite for responders to know the health risks associated with exposure to Corexit or other toxic products. Tragically, SDS warnings were virtually absent during the BP spill response. 100 percent of GAP witnesses who worked on the cleanup reported that they were provided minimal or no personal protective equipment. They were exposed without warning. Nearly all witnesses reported that they were not aware of available safety literature on the job site. The EPA should ensure that the public has access to this information, as GAP witnesses who did not work on the cleanup frequently reported direct exposure to Corexit and dispersed oil.

Further, the EPA should require that the submitter provide all additional information on potential adverse human health effects based on the product's formula and application methods not captured in the SDS. As demonstrated by BPs failure to ensure its employees had access to Corexit SDS during the spill response, the spiller cannot be trusted to warn workers and the public of human health impacts associated with dispersants. The SDS and all additional information should be displayed prominently on the EPA, OSHA and DHHS websites. The EPA should require that it be distributed to all responders by OSHA personnel *prior* to product use, through HAZWOPER and other worker safety trainings.

Implement Public Notification Policy for Dispersant Use

There is currently no requirement for the government or oil companies to notify the public when a dispersant is used. If dispersants continue to be used, the public has a right to know when and where through public notice and warnings. Many residents and workers believe that dispersant use continues today. As long as it remains a legal option for industry, those fears are warranted. During a meeting at BP headquarters in 2012, BP stated the company will continue to consider Corexit for use, except when stopped by the government. *The proposed rule does not prevent residents from being blindsided by poison again.* This is flatly unacceptable. The public has a right to know when their families are exposed to dispersants whose health impact may range from nightmarish illnesses to death.

Whistleblower Record

a. Public Left in the Dark

"My feelings on this matter are that it would be an abomination for us to continue to allow this chemical (Corexit) to be used in light of the likelihood that is was responsible for the horrendous illnesses that have been experienced by my patients. Unfortunately, these illnesses have been cleverly hidden from public recognition and most of the suffering of my patients has been unrecognized and ignored." (Dr. Michael Robichaux, 1)

"My wife and I, along with two representatives from the GAP (the Government Accountability Project) who arranged the trip, met with BP representatives at their U.S. headquarters in Houston. We petitioned the company to discontinue using this chemical in any future oil spills because of our suspicions that it had been responsible for most of the serious illnesses we had been observing. They declined to make that commitment to us, and when we requested that they notify us before

using the chemical in the future, they said they would get back to us with their decision on this matter. We have not heard from them since that time." (Dr. Michael Robichaux, 1)

"[W]e would see planes flying but I had no idea that they were spraying the dispersants in order to sink the oil. The dispersant planes would fly right over me a few times a day. It seemed like they would go from the North side of the bridge from Jack Edwards Airport out toward the Gulf where there remained a concentration of oil. Often the planes spraying the dispersant were Coast Guard planes." (Richard Russell, 3)

"Last year we accidently found this big spill. We were just trying to film the marsh and infrastructure, and I took the kids because we weren't going into the Gulf and it was a nice day. When we arrived, we accidently found this huge spill in the state wildlife reserve. The people here were never notified. They don't notify us about anything. If we don't accidently come across an oil spill or dispersant use then we don't know about it. If there is a spill and toxic chemicals within an ears shot of me then I'd like to know." (Kindra Arnesen, 1)

"The news said that they weren't going to spray Corexit at night, but they were still spraying during that time. The news was also telling us that Corexit wasn't dangerous. You could see the oil spill workers walking along the beach, and they didn't have protective clothing on, so initially we didn't think twice about it. There is a lady who lives about a mile from my home, and she tried to take a photo of the planes spraying at night. Her whole family is so sick, they are practically dead. She can't even talk anymore; she is just a vegetable." (Rocky Meadows, 2)

b. Workers Misinformed and Exposed

"We all would monitor a particular marine VHF radio channel and we could hear the airplanes that were spotting the oil … The dispersant planes knew what channels we were monitoring, and when they were going to spray they would communicate with us through our channel and ask us to vacate the areas immediately. The closest a dispersant plane got to our vessel was three miles away. I could see it spraying dispersant. The plane was north of me and the wind was blowing from the north shore, so it drifted toward us." (David Hill, 3)

"At all of the safety and HAZWOPER meetings the instructor would say, 'Oh, the tar balls are safe once they sit in the water for 48 hours,' and that anything harmful would dissipate. It felt like anybody could run these safety meetings, because we were given such little educational material … I didn't learn anything about chemical exposure until I started taking safety classes on my own by OSHA, paying out of my own pocket … They didn't give out any safety training materials – not a booklet, not a pamphlet." (Andre Gaines, 2)

"In the future, oil spill cleanup workers should receive HAZMAT training and be fully informed of the potential health risks associated with the chemicals that they will be exposed to, before they begin working … We have a right to know what we are being exposed to." (Randy Varney, 4)

"During my second job on the VoO program I became the captain of a large supply boat for about one month. I do not remember receiving any safety information or literature when I worked as a captain … My third job on the VoO program involved pulling boom with one of my large vessels …

ED_001324_00007753-00030

We were pulling boom between our boats, and my boat was regularly sitting in the dispersed oil. The dispersant looked like bubbly white foam." (Richard Russell, 1-2)

"While working on the cleanup, I received no safety training, no safety equipment, no briefings and no safety meetings. However, from training in my earlier occupations I knew that any occupation's safety regulations were required to be kept on the vessel. There was nothing in the regulations book on our vessel that warned of chemicals or hydrocarbons or dispersants." (David Hill, 1)

"I understand now that my crew and I were bound to have health problems, with inadequate protective equipment and chronic chemical exposure. However, during most of our time on the job we never had a conversation about our health; we weren't thinking about it. We were too focused on cleaning up the oil." (David Hill, 4-5)

c. After the BP Disaster Response

"Dispersant is being used a lot more I believe now than before the disaster. Apparently they deemed that it worked so well for the BP oil spill that they've chosen to put [dispersant sprayers] on the jack up barges now. They put the hose into the pipe and let it rip, and the dispersants are right there. This is occurring more inshore from what I have witnessed." (Kindra Arnesen, 1)

"We have a spill here 365 days a year, from one to three every day. Three cleanup companies down here work every day of the week … They rigged up flat boats, jack up barges, and everything has dispersants on it now. They sprayed in the Mississippi Sound last in August, September and October of 2014. Those are the only three months I work out there. There is not more than 20 feet of water anywhere in the Sound and they have terrible spills, because that is an old [oil] field out there. There were miles of oil out there and they dispersed all of that. One man I worked with on the BP spill still works for Oil Mop now, and their flat boat had the tank and pump to spray dispersants. I said, 'Man, you all aren't wearing masks?' and he said 'That stuff's no more dangerous than Dawn dishwasher soap; it's not going to hurt you.' They're convinced that dispersants are not dangerous." (David Arnesen, 1)

"One thing that needs to change is who is in control of the cleanup when it occurs. You shouldn't have the companies that caused the spill then running and operating the cleanup; you won't get an honest outcome when they are also responsible for footing the bill of the oil that is picked up. The company should still foot the bill, but someone else has to control the operation." (Kindra Arnesen, 4)

"I personally believe that there are other dispersants that are more effective and less harmful to the environment and its human inhabitants. I also believe that using a safe and effective dispersant is preferable to allowing huge quantities of oil to saturate our coastline." (Dr. Michael Robichaux, 2)

"We should ban any and all toxic forms of dispersant. If it's banned to begin with then it can't be readily available because it won't be here. There are safe ways to disperse of the oil that cannot be mechanically collected. Let's make something readily available that is not so toxic, such as a bioremediation product. Currently there are less toxic forms of dispersants that can be used, but even those should only be used as absolute last resort. When there is a mechanical way to pick up

ED_001324_00007753-00031

oil, that is the way it should be done. You can't sink oil that is picked up and put it 'out of site, out of mind.'" (Kindra Arnesen, 4)

"It is critical that an objective assessment of the National Contingency Plan be undertaken. Every conceivable effort should be made to prevent the errors of judgment that resulted in the environmental disaster that we are still experiencing. BP and its cohorts have had their day and their way and the results have been devastating to our environment. It is time for honest and intelligent decisions to made by honest and intelligent individuals." (Dr. Michael Robichaux)

---

[1] Government Accountability Project, Deadly Dispersants in the Gulf: Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups? (2013), *available at* www.whistleblower.org/GulfTruth.
[2] Roberto Rico-Martinez et al., *Synergistic Toxicity of Macondo Crude Oil and Dispersant Corexit 9500A to the Brachionus Plicatilis Species Complex (Rotifera)*, Environmental Pollution (Feb. 2013), *available at* http://www.sciencedirect.com/science/article/pii/S0269749112004344.
[3] The ALERT Project (a Project of Earth Island Institute) Home Page, http://alertproject.org/ (last visited Apr. 17, 2015); Louisiana Environmental Action Network Home Page, http://leanweb.org/ (last visited Apr. 17)
[4] On Earth, a magazine of the Natural Resources Defense Council, has published a series, "The Gulf Disaster, Five Years later", that documents ongoing health and ecological impacts reported by many of the whistleblowers in GAPs investigation; OnEarth, The Gulf Disaster, Five Years Later, http://www.onearth.org/gulf (last visited Apr. 17, 2015).
[5] Mark A. D'Andrea and G Kasava Reddy, *Health Consequences Among Subjects Involved in Gulf Oil Spill Clean-up Activities*, The American Journal of Medicine (Sep. 2013), *available at* http://www.amjmed.com/article/S0002-9343%2813%2900494-4/fulltext.
[6] *Id.*
[7] *Id.*
[8] Fu Jun Li et al., *Heme Oxygenase-1 Protects Corexit 9500A-Induced Respiratory Epithelial Injury across Species*, PLOS ONE (Apr. 2015), *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0122275.
[9] *Id.*
[10] *Id.*
[11] *Id.*
[12] Louisiana Environmental Action Network, Five Years Since the BP Oil Disaster and We Haven't Felt the Same Since (Apr. 20, 2015), https://leanweb.org/public-health/5-years-since-the-bp-oil-disaster-and-we-havent-felt-the-same-since/?utm_source=E-Alert+List&utm_campaign=57e088f74c-E_Alerts11_18_2014&utm_medium=email&utm_term=0_fc47f1c350-57e088f74c-257203797.
[13] Jeffrey Chanton et al., *Using Natural Abundance Radiocarbon To Trace the Flux of Petrocarbon to the Seafloor Following the Deepwater Horizon Oil Spill*, Environmental Science and Technology (Dec. 2014), *available at* http://pubs.acs.org/doi/abs/10.1021/es5046524?journalCode=esthag.
[14] Paul W. Sammarco et al., *Distribution and concentrations of petroleum hydrocarbons associated with the BP/Deepwater Horizon Oil Spill, Gulf of Mexico*, Marine Pollution Bulletin (Nov. 2013), *available at* http://www.sciencedirect.com/science/article/pii/S0025326X13002762.
[15] Science Daily, Treating oil spills with chemical dispersants: Is the cure worse than the ailment? (Jul. 5, 2013), http://www.sciencedaily.com/releases/2013/07/130705212219.htm

ED_001324_00007753-00032

[16] J. Cherrier et al., *Fossil Carbon in Particulate Organic Matter in the Gulf of Mexico following the Deepwater Horizon Event*, Environmental Science and Technology Letters (Dec. 2013), *available at* http://pubs.acs.org/doi/abs/10.1021/ez400149c.
[17] National Oceanic and Atmospheric Administration, Ocean Exploration and Undersea Research, http://www.research.noaa.gov/oceans/t_deepseacorals.html (last visited Apr. 15, 2013).
[18] Steve Kolian et al., *Depuration of Macondo (MC-252) Oil Found in Heterotrophic Scleractinian Corals (Tubastrea coccinea and Tubastrea micranthus) on Offshore Oil/Gas Platforms in the Gulf of Mexico*, Gulf and Caribbean Research (Apr. 2013), *available at* http://www.ecorigs.org/CoralDepurationBPoil.pdf.
[19] Danielle M. DeLeo et al., *Response of deep-water corals to oil and chemical dispersant exposure*, Science Direct (Mar. 2015), *available at* http://www.sciencedirect.com/science/article/pii/S0967064515000740.
[20] *Id.*
[21] Press Release, For Earth Day, Nadler Proposes Ban on Toxic Dispersants Used in Oil Spills (Apr. 21, 2015),
[22] Gulf South Rising, Gulf Coast Week of Action April 15 – 22, https://www.facebook.com/events/1562556280663219/permalink/1567050473547133/ (last visited Apr. 20, 2015)
[23] National Oil and Hazardous Substances Pollution Contingency Plan, 80 Fed. Reg. 3379 (proposed Jan. 22, 2015) (to be codified at 40 CFR 110 and 40 CFR 300), *available at* https://www.federalregister.gov/articles/2015/01/22/2015-00544/national-oil-and-hazardous-substances-pollution-contingency-plan.
[24] The ALERT Project, 10 Key Points on the New Rules for the National Contingency Plan, http://alertproject.org/ten-key-points-on-the-new-rules-for-the-national-contingency-plan/ (last visited Apr. 17, 2015).; Prince William Sound Regional Citizens Advisory Council, Summary Comments on Subpart J, *available at* http://www.pwsrcac.org/wp-content/uploads/filebase/programs/environmental_monitoring/dispersants/Key%20Issues%20and%20Summary%20Comments%20on%20Subpart%20J.pdf.
[25] National Oil and Hazardous Substances Pollution Contingency Plan, 80 Fed. Reg. 3379 (proposed Jan. 22, 2015) (to be codified at 40 CFR 110 and 40 CFR 300), *available at* https://www.federalregister.gov/articles/2015/01/22/2015-00544/national-oil-and-hazardous-substances-pollution-contingency-plan#p-261.
[26] The ALERT Project, 10 Key Points on the New Rules for the National Contingency Plan, http://alertproject.org/ten -key-points-on-the-new-rules-for-the-national-contingency-plan/ (last visited Apr. 17, 2015)
[27] Prince William Sound Regional Citizens Advisory Council, Summary Comments on Subpart J, *available at* http://www.pwsrcac.org/wp-content/uploads/filebase/programs/environmental_monitoring/dispersants/Key%20Issues%20and%20Summary%20Comments%20on%20Subpart%20J.pdf.
[28] The ALERT Project, 10 Key Points on the New Rules for the National Contingency Plan, http://alertproject.org/ten-key-points-on-the-new-rules-for-the-national-contingency-plan/ (last visited Apr. 17, 2015)
[29] Prince William Sound Regional Citizens Advisory Council, Summary Comments on Subpart J, *available at* http://www.pwsrcac.org/wp-content/uploads/filebase/programs/environmental_monitoring/dispersants/Key%20Issues%20and%20Summary%20Comments%20on%20Subpart%20J.pdf.
[30]National Oil and Hazardous Substances Pollution Contingency Plan, 80 Fed. Reg. 3379 (proposed Jan. 22, 2015) (to be codified at 40 CFR 110 and 40 CFR 300), *available at* https://www.federalregister.gov/articles/2015/01/22/2015-00544/national-oil-and-hazardous-substances-pollution-contingency-plan#p-53.
[31] The ALERT Project, 10 Key Points on the New Rules for the National Contingency Plan, http://alertproject.org/ten-key-points-on-the-new-rules-for-the-national-contingency-plan/ (last visited Apr. 17, 2015)
[32] National Oil and Hazardous Substances Pollution Contingency Plan, 80 Fed. Reg. 3379 (proposed Jan. 22, 2015) (to be codified at 40 CFR 110 and 40 CFR 300), *available at* https://www.federalregister.gov/articles/2015/01/22/2015-00544/national-oil-and-hazardous-

substances-pollution-contingency-plan#p-53.

[33] The ALERT Project, 10 Key Points on the New Rules for the National Contingency Plan, http://alertproject.org/ten-key-points-on-the-new-rules-for-the-national-contingency-plan/ (last visited Apr. 17, 2015)

[34] *Id.*

[35] *Id.*

[36] Prince William Sound Regional Citizens Advisory Council, Summary Comments on Subpart J, *available at* http://www.pwsrcac.org/wp-content/uploads/filebase/programs/environmental_monitoring/dispersants/Key%20Issues%20and%20Summary%20Comments%20on%20Subpart%20J.pdf.

[37] National Oil and Hazardous Substances Pollution Contingency Plan, 80 Fed. Reg. 3379 (proposed Jan. 22, 2015) (to be codified at 40 CFR 110 and 40 CFR 300), *available at* https://www.federalregister.gov/articles/2015/01/22/2015-00544/national-oil-and-hazardous-substances-pollution-contingency-plan#p-amd-19.

[38] The ALERT Project, 10 Key Points on the New Rules for the National Contingency Plan, http://alertproject.org/ten-key-points-on-the-new-rules-for-the-national-contingency-plan/ (last visited Apr. 17, 2015)

[39] *Id.*

[40]National Oil and Hazardous Substances Pollution Contingency Plan, 80 Fed. Reg. 3379 (proposed Jan. 22, 2015) (to be codified at 40 CFR 110 and 40 CFR 300), *available at* https://www.federalregister.gov/articles/2015/01/22/2015-00544/national-oil-and-hazardous-substances-pollution-contingency-plan#p-226.

ED_001324_00007753-00034

Glossary

Boom: A temporary floating barrier used to control the spread of oil to reduce the possibility of polluting shorelines and other resources, as well as to concentrate oil in thicker surface layers, making recovery easier

C-130: A four-engine military transport aircraft, used to spray dispersants during the BP spill response

Contingency plan: A document that describes a set of procedures and guidelines for containing and cleaning up oil spills

Corexit: The chemical dispersant used during the BP spill response

Detoxification: Also known as "detox", the physiological or medicinal removal of toxic substances from the human body

Dispersant: Chemicals that are used to break down spilled oil into small droplets

DHHS: U.S. Department of Human Health and Services

EPA: U.S. Environmental Protection Agency

FDA: U.S. Food and Drug Administration

On-Scene Coordinator (OSC): Coordinates all federal containment, removal, and disposal efforts and resources during an oil or hazmat incident

HAZMAT: An abbreviation for hazardous materials

HAZWOPER: Hazardous Waste Operations and Emergency Response

Safety Data Sheet (SDS): An important component of product stewardship and occupational safety and health, it is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner

National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President: A bipartisan presidential commission, established by Executive Order 13543 to examine the root causes of the Deepwater Horizon explosion and develop options to guard against, and mitigate the impact of, future oil spills associated with offshore drilling

National Contingency Plan: The federal government's blueprint for responding to both oil spills and hazardous substance releases

National Institute of Environmental Health and Sciences (NIEHS): A research institute housed under the National Institute of Health, HHS

NOAA: U.S. National Oceanic Atmospheric Administration

Oil plumes: Underwater globules of oil that do not float to the surface of the ocean. The heavy use of chemical dispersants, which breaks up surface oil, is said to have contributed to the formation of these plumes

Oil Pollution Act (OPA): A law designed to prevent oil spills, ensure cleanup if they happen, and restore natural resources injured by these spills

OSHA: U.S. Occupational Safety and Health Administration

Polycyclic aromatic hydrocarbons (PAH): A family of chemical substances that are found in many types of oil, and include known carcinogens

Personal protective equipment: Equipment worn to minimize exposure to a variety of hazards

Sediment: Loose particles of sand, clay, silt, and other substances that settle at the bottom of a water body

Sheen: A very thin layer of oil floating on the water surface

Tar balls: Dense, black sticky spheres of hydrocarbons; formed from weathered oil

Toxicity: The inherent potential or capacity of a material to cause adverse effects in a living organism

Tyvek suit: A suit used to protect people from chemical hazards and contamination

Volatile organic compounds (VOCs): Include a variety of chemicals that evaporate quickly and can cause nerve damage and behavioral abnormalities in mammals when inhaled

Volatile solvent profile: A blood test used to help identify a patient's prolonged exposure to the most commonly found volatile solvents that have been shown to cause serious health problems

Vessels of Opportunity (VoO) Program: Created to employ local boat operators during the cleanup, it extended to near shore and offshore activities such as identifying oil, working with boom and skimming.

Water column: A conceptual column of water from surface to bottom sediments

USCG: U.S. Coast Guard

Appendix

Whistleblower Witness Statements

(Presented in alphabetical order)

Whistleblower Witness List*

David Arnesen: Louisiana expert fisherman

Kindra Arnesen: Louisiana resident and community activist

Eric Blanchard: Director of Operations for Louisiana seafood processing plants

Ollen Blanchard: Owner of Louisiana seafood processing plants

Andre Gaines: Supervisor during the cleanup

David Hill: Vessels of Opportunity captain

Lani Kaiser: Florida resident

Alton "Rocky" Meadows: Mississippi resident

Dr. Michael Robichaux: Louisiana physician

Scott Porter: Diver, coral and oyster biologist

Richard Russell: Vessels of Opportunity captain

Randy Varney: Captain and cleanup worker during the cleanup

Confidential Whistleblower: Partner of a former Louisiana seafood restaurant

* Affidavits are included in the appendix. Statements and interviews can be provided by the Government Accountability Project upon request and with the permission of the witness.

DH

AFFIDAVIT

My name is David Hill. I am submitting this statement without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I was born in Mobile, Alabama (AL) and raised in the fishing village Bayou La Batre. I am 53 years old. As a fourth generation fisherman in the Gulf of Mexico all my life, I was very concerned about what was happening in the aftermath of the Deepwater Horizon explosion. I wanted to do all that I could to help clean up the oil. For approximately nine months I worked as a captain on the cleanup with three different companies. There are no limitations on the use of this statement.

1. FOURTH GENERATION FISHERMAN

I am a fourth generation fisherman on both sides of my family. I began working with my father and catching shrimp at age seven. During high school and after I graduated, I worked in the fishing industry as a boat captain. I have spent at least three quarters of my life working in the fishing industry, offshore in the Gulf of Mexico. I continued in the fishing industry until I was 40 years old, and then I went to Houston Marine in New Orleans for maritime training. In 2005 I received my Coast Guard 100 ton master near coastal captain's license. I also received a 200 ton ITC international mate license. In 2007 I upgraded to a 200 ton master and 500 ton mate captain's license. I immediately went to work on a utility vessel in the offshore oil field. I spent 10 years working in that field, with different companies.

DH

2. VOO CAPTAIN; VIOLATIONS OF MINIMAL SAFETY PRECAUTIONS

I worked in the offshore oil field until April 2010, when the BP oil spill happened. I worked on the BP Vessels of Opportunity (VoO) program from May 2010 until November 2010, when the site that I was working from in Port Fourchon closed down. I went through an agency in Mobile and was placed with BP contractor KMJ Services, Inc. I was the lead captain for a 180 foot vessel that had functioned as an offshore supply vessel. The vessel was already outfitted for the VoO program. As the boat captain on a vessel of that size, there was a lot expected of me. I took over the vessel and quickly learned how to identify oil and catch it in skimming rigs and boom.

While working on the cleanup, I received no safety training, no safety equipment, no briefings and no safety meetings. However, from training in my earlier occupations I knew that any occupation's safety regulations were required to be kept on the vessel. There was nothing in the regulations book on our vessel that warned of chemicals or hydrocarbons or dispersants. The information involved standard safety protocol, such as to stay hydrated. It was my responsibility to relay the basic safety information to the crew during our daily safety meetings. Three employees from the BP contractor Ameri-Force stayed on the deck and handled the boom and skimming. The crane operator was also an Ameri-Force employee. There were two to three Coast Guard personnel on the vessel overseeing the project.

DH

ED_001324_00007753-00039

DH

The contractor Ameri-Force was hiring anyone who would work on the cleanup, even if they were unqualified. I was in close quarters with everyone on the boat. I worked side by side with them, ate dinner together and listened to their chatter, and ultimately I got to know my crew and their backgrounds. I also had a bird eyes view of the deck and could see a lot of them make rookie mistakes. These guys, like shoreline cleanup workers, found an avenue where they could get a job and go to work for $300 to $400 a day without education or extensive training.

3. OBSTACLES TO CLEANING UP DISPERED OIL

I was part of the response team Western Strike Force. We were located on the west side of the Mississippi River. The spill was on the east side of the river. As soon as it was light enough to see, we wanted to go to work. At one time the Western Strike Force had as many as 14 vessels of similar size or larger than my vessel. Our job was to find the "workable" oil - oil that had not dispersed yet. We could not collect the oil in locations where dispersant was sprayed, because it just made along sheen of miles of little orange and purple droplets and bubbles floating everywhere.

There were many different currents, so it was difficult to locate the oil. Often the current would carry the oil miles away from the wellhead before it surfaced. Our vessel's Coast Guard leader took orders from Houston on what to do and where to go to look for oil. They were using satellite imagery and airplanes to locate the oil. The Coast Guard representative would ask us to space our vessels out one mile apart; we were searching for oil collectively. When we found workable oil, he would tell us to deploy equipment and begin work at that time.

DH

My boat on the Western Strike Force was one of the first to be outfitted. I had 1,800 barrel capacity "mud tanks," which are tanks traditionally used for drilling fluids, but in this case they were used to contain the oil. We had on-board pumps as well. When the vessel skimmed the oil, it went through the pumps. The oil was so thick that it tore the pumps. I couldn't go faster than one mile an hour or else we would lose the oil that was contained in the boom. The workers would pull the soiled oil boom in by hand and pile the nasty mess on the boat. They wore Tyvex suits that did not sufficiently cover them, because the vessel was fairly low to the water and the oil would spray all over their faces and hair from the waves and wind. When oil got inside of the boat or upper decks I would have one of the vessel crew members clean it up so that it wouldn't track onto the boat. The oil was supposed to remain in the back of the boat.

Once we got the boat loaded at full capacity, I would usually have to wait three to four days alongside the barge to offload the oil. After a long wait, I would frequently be informed that the barge was inoperative and we would proceed to offload the oil inshore. It would take 15 tractor trailer trucks to unload our product at that point. The delay in offloading the product resulted in prolonged exposure to toxic fumes from the oil, such as benzene, toluene and xylene.

Most of my time on the cleanup was spent north of the spill. In May and June, my vessel worked in the Florida straight. At one point I got as close as 40 miles from Pensacola, Florida. As the oil

DH

drifted toward Alabama and Florida, we deployed to find it before it hit the shorelines. We wanted to be heroes and prevent the oil from reaching the Alabama and Florida beaches.

When we had foul weather we were sent inshore to a safe harbor. When the weather got better we began to look again in an area we had just left. After we went back out, I saw dispersed oil everywhere. There was no skimmable oil, nothing that my equipment would pick up. We all would monitor a particular marine VHF radio channel and we could hear the airplanes that were spotting the oil. We also could hear and see the planes that were going to spray dispersant. The dispersant planes knew what channels we were monitoring, and when they were going to spray they would communicate with us through our channel and ask us to vacate the areas immediately. The closest a dispersant plane got to our vessel was three miles away. I could see it spraying dispersant. The plane was north of me and the wind was blowing from the north shore, so it drifted toward us. On the second occasion the plane was seven miles from me and approximately 40 miles offshore from Pensacola.

We would work from sunrise to sundown. There was a lot of fatigue; it was tiresome. Whenever we finished for the day we put our equipment away and tried to get out of the oiled areas so that we didn't drift into the dispersant at night. Despite my best efforts, we often couldn't escape it and had to sleep over patches of oil and dispersed oil. After the frequent dispersant sprays, I developed a skin rash, blurred vision, headaches and dizziness.

4. CHEMICAL EXPOSURE, AIR MONITORS BROKEN

When we came back from inshore and could only find dispersed oil, we went to ground zero at the site of the Deepwater Horizon explosion. Dispersant was being injected at the wellhead, and we saw a lot of dispersed oil. When the oil was dispersed at the seafloor, it went through different currents in all different locations. We finally found oil to contain about four miles east of the rig. Workers were conducting in-situ burns in that area. They would contain the oil with two boats and then have a small boat throw a flare into the oil to light it on fire. They would continue to skim oil while the other oil was burning.

On July 10, 2010 the in-situ crews got close to our boat while burning the oil, and I was very concerned about my crew's safety. I asked them to turn around and they responded, but as they turned a huge black smoke plume from the in-situ burn engulfed my boat. It went from day to night. I had to call the Coast Guard, because one of our men – an Ameri-Force employee – passed out during that incident. He was lying on the deck and flopping like a fish, and we didn't have any medical equipment on the vessel to assist him. A nearby fast response vessel named Miss Lauren overheard what was going on. It had Coast Guard personnel and the necessary medical equipment, so its crew transferred my sick crew member from my vessel to the Miss Lauren. From there, the Coast Guard took him inshore to receive medical help. I did not receive any additional information about him or his health. However, it worried me because he was only in his late 20's and in good shape when the incident occurred.

ED_001324_00007753-00041

During that incident and throughout my time on the cleanup, we did not have respirators or defibrillators on board. We also did not have anyone on our boat that was medically trained in the event of an injury. Prior to working on the cleanup, I received respirator training and was test fitted to wear a respirator. The training course emphasized that if there is a hydrogen sulfide (H2S) gas outbreak, you must leave the area immediately. Otherwise, it can be fatal. There are warning signals available that can detect H2S gas and alert you to leave the area immediately. When I worked in the offshore oil field, often our vessels were outfitted with those devices. However, none of that was provided when I worked on the cleanup, and I later learned that we were exposed to dangerous levels of chemicals.

After our crew member passed out, I was concerned about the wellbeing of the crew. My Coast Guard representative directed me to return dockside for safety protocol. I didn't get inshore until around 2:00 AM. Early in the morning I woke up and realized that my whole crew had ailments, such as coughing and headaches. I contacted BP safety.

BP evacuated the boat, but first three neurologists came on board with chemical measuring instruments. I recall that they were concerned about the measurements they took. They told me the readings were abnormally high. They first took measurements in the cook's kitchen and attributed it to the frying pork chops. Then they went into sleeping quarters and the readings were still high. At that point they evacuated the vessel, opened all the doors and ventilated it. To my knowledge, that is all they did.

We always had one to three Coast Guard representatives on the vessel. They had their own chemical monitoring equipment. However, when the neurologists were taking the readings, I overheard my vessel's primary Coast Guard representative make the comment "our air monitoring equipment doesn't work." He proceeded to explain that it wouldn't even turn on. He had failed to inform anyone or correct the problem prior to that incident, however. When I learned that, I felt that he had no concern for my crew's safety. He was from Las Vegas, and I told him I was born and raised in the Gulf and it was my life. If he wasn't concerned for our well- being then he needed to leave. I spoke with his supervisor, who removed him from my boat. As the lead captain, I still had influence over who came on my boat and who didn't.

During the time that the boat was evacuated, my whole crew and I went inshore to a BP medical tent. BP didn't want us to go inshore, because media was there. The deck supervisor instructed us to stay in the tent until the media left. The whole process was very brief. The BP representatives took our names, but they did not ask us how we were, and we did not see doctors or receive physical examinations. Then they told us that we could return to the boat, which still had 1,000 to 1,200 barrels of oil on it.

I understand now that my crew and I were bound to have health problems, with inadequate protective equipment and chronic chemical exposure. However, during most of our time on the job we never had a conversation about our health; we weren't thinking about it. We were too

focused on cleaning up the oil. Our boat probably skimmed more oil than anywhere in the Western Strike Force, up to 1,000 barrels a day. There were four mud tanks on our vessel. Once they were full, it took four to five days to get the oil off of the boat. We didn't have a site gauge to monitor how full the tanks were, so we had to take the lid off and look inside of them. Fumes would pour out, and the person who checked the tanks did not have access to a respirator or anything to prevent chemical inhalation. I checked them at times, because I wanted to make sure that our tanks were as full as possible before we unloaded them. There was likely dispersed oil in the tanks as well, because sometimes the dispersed oil floated with the un-dispersed oil and it would get skimmed or boomed when it conjoined with the thick oil.

In addition to that direct exposure, we were regularly exposed to fumes on board. When we had limited wind and it was very hot, the sun would often melt the oil from the skimming equipment onto the deck, with nothing on the deck to contain the melted oil. This let off a sharp chemical odor that remained on the deck. The oil inside of the boat was ventilating out of the tanks as well. Our tanks had six to eight inch ventilation pipes located above deck. As the tanks were being filled and then sealed back up, they would ventilate through the ventilation tube and be released back onto the deck. The other ventilation system consisted of large high speed fans that forced the air into the engine room to keep it cool. The engine room where the tanks were located got very hot, so the ventilation system would blow air to cool it down. It was blowing fumes at the same time, however. The door to check the engine is in the galley inside the boat, and the draft from the door would release the fumes into the galley. There were bunkrooms located next to the engine door.

If I would have known that the air monitoring equipment by the Coast Guard was supposed to be available, I would have used it on a regular basis. The odor from the oil and dispersant was constant. I was the first one exposed to the fumes, because I was located in the front of the boat. The vessels are only a few feet off the water, and I could detect the odor before anyone else. The crude oil had more of a petroleum smell, whereas the dispersant had more of a sharp foul rotten type smell, similar to H2S gas. It would take our breath away and fill our lungs. When we did come into contact with strong odors, I could call my crew on the radio and warn them so that any unnecessary personnel could go inside and get off of the deck, since it only requires on man to run a mechanical skimmer. There were a few times that the smell was so strong we had to leave the area. It was extremely aromatic. All of a sudden I would come down with a headache and blurred vision. Once we didn't even wait to pull the boom in. I tore the boom up, rolled it in a knot first and we vacated the area as fast as we could. I noticed that we had stronger headaches, sickness and nausea when we stayed around the dispersed oil than when we were in the presence of un-dispersed oil.

I later learned that other boats had their tanks on deck, and that they had a better ventilation system than ours. I also learned that other crews could stay offshore for 10 days, but had to go inshore for four days. That wasn't the norm for my crew and myself; we stayed offshore for

lengthy periods at a time, but we were not made aware of the risks. I stayed offshore for 40 days straight without any breaks inshore.

5. FAST RESPONSE VESSEL

The first paycheck I received on the job was very small. I heard that other men in KMJ Services, Inc. had similar problems. My second paycheck bounced, and after the first part of the summer with the company I decided to switch companies. I secured employment as lead captain with Star Fleet Marine, which operates fast response vessels. My boat was called Wateree. My main duties were to service the fleets, primarily the Western Strike Force. Due to the speed of the vessels, I was exposed to more hydrocarbons with Star Fleet Marine. Often my vessel would run through miles of dispersed oil at 18 to 20 miles an hour in order to reach other fleets. There were few if any breaks between activities. In the oil field, speed is a necessity. It's a culture of, "If you can't get the job done, we'll get someone who can get the job done." I would pick up crews with soiled clothes, and speed through the areas where in-situ burns took place, or where there were large amounts of crude oil or dispersed oil.

I would have stayed actively on the job for as long as they needed, but by September BP began to understate the amount of oil that still needed to be cleaned and explained that we were no longer needed. We stayed dockside for a month, and in October we were shut down.

In May and June 2011 I took a job with GEO Shipyard out of New Iberia, Louisiana, as the captain for a 60-foot spud barge. They would load my vessel with equipment and I would travel through the Mississippi River marsh grass in order to get to Grand Isle. It was a shallow vessel, so I was able to move it through three to four feet of water and bring workers their supplies. I also would haul dead cut and oily boom from the marshes. During that job I was exposed to terrible gasoline fumes. BP would place 2,500 gallon gasoline tanks in my vessel and send me to fill them up and then return them to the barges. The vessel could carry three of those tanks at a time. A few times they overflowed, because we had no training on how to properly fill the tanks. When we filled them with gasoline, we did not realize that the tanks were full and the gasoline overflowed onto our vessel. There were times when we would have to stop for the night and the tanks would stay on our boat. The offshore barges used portable toilets as well. Human waste releases H2S gas. Again, I was not provided H2S respirators or air quality monitors.

6. RAPID HEALTH DETERIORATION

When I went to work on the spill cleanup I had the mentality of "I am going to work hard," and I was grateful to be a part of the response effort. I always excel at my jobs, and at this job I wanted to skim more oil than anyone else. I always wanted to be a good leader. As the lead captain, I consistently pay close attention to detail. It is my job to be alert, aware of my surroundings and to keep my crew as safe as I can. If I knew then what I know now, I never would have went out there. I didn't realize the health risks that were involved for my crew members and me. I recently

reconnected with the other captain of the first vessel that I worked on, and he told me that since working on the spill his esophagus has busted.

I first got noticeably sick in November 2010. Since then, I have had surgery six times. In the beginning I had pneumonia-like symptoms, staph infections, and an infected lymph node in my left armpit. I was admitted me into the hospital, and the doctors removed my lymph node. I was dismissed after eight to ten days. In January 2011 I was admitted again with pneumonia, and my white blood cell count plummeted to near death. It was at 100, and I had no immune system. I had an infection in my neck that swelled up to the size of a softball. The doctors put me into a glass room at the intensive care unit (ICU). The hospital told my wife that if she did not bring me to the hospital when she did, she may have found me dead that morning. They did a CT scan to see if the swelling was blocking my airway. If so, they were going to give me the trait, which is a hole in the throat that you breathe through. I had 40 to 48 percent airway still open and they provided me several medicines for the swelling to go down. It finally healed, and I did not need the trait. They also gave me Neupogen shots to boost my immune system. Neupogen is often used on cancer patients.

In March 2011 I went back to the hospital with pneumonia. They were bombarding me with antibiotics. I had all types of doctors coming by my bedside to study why I could not produce white blood cells. I had a blood transfusion and a toxicologist removed bone marrow twice. He couldn't figure out what was wrong with me either.

My oncologist had me come to her office for 30 consecutive days. She was very concerned and never charged me a dime. At first she thought I had leukemia, but she later ruled it out. She wanted to give me a diagnosis of cycling neutropenia – which is a disorder when someone cannot produce white blood cells. I was told that I would be highly susceptible to illnesses, so I needed to take additional precautions and not expose myself to sick people.

During that time I went to the hospital, because my right leg turned red and it was incredibly painful. It looked like it had been in a deep fryer, and it has blisters all over it. I thought I was going to lose my leg. They removed my gallbladder and later did surgery on my groin and removed an infectious material from that area. They also gave me foot medication because they were concerned that I had Stevens-Johnson syndrome, which is a potentially fatal skin disorder. When I got home I had severe diarrhea for several months. The hospital diagnosed me with clostridium difficile, which occurs when someone consumes too many antibiotics and depletes the good cells in the body. It was highly contagious and my wife contracted it, but we took her to the hospital early enough that she was able to treat it immediately. I also became anemic after working on the spill.

In early fall of 2012 I met with my attorney and a toxicologist who named different kinds of tests that I should take. He explained that the tests were expensive, and we needed to figure out who would pay for them. I couldn't afford to pay and never received the tests. He said he understood

that there were health risks involved with the BP cleanup, and he also knew other cleanup workers with similar health problems. He explained that without taking the tests, however, he couldn't pin point my health to my chemical exposure while on the job. He wouldn't put his reputation on the line without being able to determine that my exposure was the cause of my physical decline.

It is so hard to get doctors in the Gulf to admit that there is the possibility of chemical exposure. I believe that the physicians don't want to stick their neck out on a limb and say that someone has chemical exposure, because it may put them at risk to admit it. Or they may not have the education and tools available to properly diagnose me, and unfortunately there is little incentive to receive further education on the topic. When I mention the BP oil spill as a possible reason for my health problems, doctors immediately tell me they don't want to discuss it and leave the room, or they dismiss me as a patient. This has occurred at least half a dozen times. But what other explanation makes sense for the nightmare I'm now living, after I was previously healthy all my life?

7. WHOLE LIFE IMPACTED

The fear is the worst part; I have a real fear that I'm dying. I wasn't like this before the spill. I was very active and energetic. When I gave my crew instructions I also worked with them to get the job at hand done. I had a lot of stamina, and a 16 to 18 hour day was normal for me. Now I can't make it throughout the day without taking naps. I have lost the interest and energy to do most activities. When I take short walks or perform small tasks, I get winded very quickly - to the point where I have to find a strategic area to rest until I regain my breath.

Currently I am experiencing chronic itching all over my body, and I have scratched myself so much that my skin is raw in some areas. I have skin blisters that randomly appear, and then they burst and heal. I deal with a tremendous amount of pain. I don't like complaining about how much I hurt, but my bones are constantly aching. It is getting increasingly difficult for me to walk because of something that is going on below my waist, as if a large horse kicked me and the pain won't go away. When I lie down in bed I feel a sharp stabbing pain, and the pain is so acute that I scream. There is no swelling or redness, but when I twist or turn a certain way it results in an unbearable pain. This is just the latest health problem.

Prior to working on the cleanup, I had 20/20 eyesight and I never needed reading glasses. Now I need glasses to read, especially small print. I barely go outside because the sun bothers my eyes during the day and bright lights bother them at night. My focus is hazy. For instance, when I am driving I see three green lights or three red lights, one stacked over another. When I am on a highway, I often don't see an oncoming car until it is near to me, at which point I see two cars. My depth perception is off as well; a car will often look farther away than it is. I also can't hear as well as I could prior to working on the cleanup, because there is a constant ringing noise in my ear.

ED_001324_00007753-00046

My long-term memory seems to still be intact; however, my short term memory has vanished. I have notebooks sitting beside me right now, because throughout the day I have to make a record of my actions. Otherwise, I will not remember what I did or still need to do. I even have to refer back to my notes to remember people's names. I rely on my wife a great deal to help me remember things. I never used to have that problem. I used to pride myself on my strong memory, and now I can't even remember a conversation from a few days ago. I don't remember to take my medications in the morning, even if they are right in front of me. My wife has to bring them to me. She cries a lot, because she is concerned about my health.

I am on disability now. We live off of $1,225 a month in social security and life has certainly changed. We have to plan what we are going to do when we leave the house so that we use less gasoline, because it is expensive to fill the tank. I was making up to $400 to $450 a day working in the offshore oil field, and I lived on a 20-acre yard with a very comfortable life style. As I lost work after getting sick, we couldn't pay for these things and began to sell our items. They deteriorated so much that we bought a motor home, and we have lived in it for two and a half years. It is very crowded and things have gone downhill. There has been a lot of crying and arguing at home.

The mental health impacts are extremely difficult. I can't put up with loud people, and I don't feel like I have the drive to do the things I used to do anymore. My health problems have destroyed me mentally, and as a result I have been in four mental health facilities for depression and anxiety. I deal with it now better than I used to, because I don't want to show weakness to my wife. She is bipolar and can be easily influenced in a positive or negative manner. You can say happy things and she is happy, or you can say sad things and she is sad. I try to control my behavior so that she can have a better day. Every night when I lay in bed 1,000 different things go through my mind, and I wonder what is wrong with me. I never had these problems or thoughts prior to my work on the cleanup.

At first I felt like no one cared about the health impacts from the spill; I wanted to go to sleep and not wake up. I made several calls to the governor's office and federal government offices, and I kept getting the runaround. Nine months ago the National Institute of Environmental Health and Sciences contacted me about their 10-year Gulf Study. They took blood, toenail, fingernail, hair, skin and urine samples. They said they would be contacting me every three months; however, I have not heard from them. Supposedly they want to monitor me for 10 years to study what the health implications are for those of us who worked on the cleanup. However, they are not offering treatment.

My attorney informed me that there is no treatment available for my health problems. It scares me, because I have deteriorating health and there are days I wonder if I am going to make it. I live in more pain than anyone should have to deal with. I cannot find proper medical treatment, and I just suffer and suffer. I don't like being tired. I love being in the oil field and working on the boats, but I can't any longer. My mind and body can't take it anymore. I am trying to

understand if I will ever get better so that I can live in happiness, pain-free and without sickness. I am most concerned about that fact that my family lives throughout the Gulf Coast. My dad is a fisher. We are all exposed to the ocean and eat Gulf seafood. What will the impacts be on their health in the years to come?

ED_001324_00007753-00048

I have read the foregoing 10 page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on July 12, 2013.

Subscribed and sworn to before me
this 3RD day of December, 2013

William L. John #14013
NOTARY PUBLIC

R.L.R.

AFFIDAVIT

My name is Richard Lafayette Russell. I am 45 years old. I have lived my whole life in Gulf Shores, Alabama. Prior to the Deepwater Horizon disaster I had my own business since 2000. It was called Dolphin Express Cruises. When I was younger I ran the boat that my parents used to take people on dolphin tours. I have had my U.S. Coast Guard Master 100 ton near coastal captain license since I was 17. After I got married I bought a 40-foot pontoon boat and became certified to take dolphin tours. We would ride around in the bays looking at dolphins and talking about the area, conducting tourism. My wife at the time handled the books for the business, and we would make between $150,000 and $250,000 a year. During the BP oil spill I had to shut down my business due to the decline in tourism and the poor conditions of the Gulf.

Early in the spill I attended a Gulf Coast Claims Fund meeting and BP representatives told my community that they would "make us whole". They were also recruiting people to work for the Vessels of Opportunity (VoO) program through Zeke's Landing at Orange Beach, Alabama. They didn't share any of the health risks involved with working on the cleanup, however. I never would have agreed to work on the cleanup if I had known how much my health would be impacted.

1. WORKING FOR THE VOO PROGRAM

From May through July 2010 I worked on the VoO program. The cleanup operation was very unorganized; it was the most unprofessional operation that I have ever witnessed. Prior to beginning work I only received a boom class, which taught me how to lay oil boom in order to mechanically clean the oil. That was the only training I ever received. The only safety equipment I wore during the cleanup was a life jacket; we were not provided with significant protective equipment. I would wear jeans and a shirt. At one point our supervisors let us wear shorts for a week or so because it was hot. The BP contractor Parsons went through three or four different supervisors before it could figure out where to send our vessel on a regular basis.

During my first job on the VoO program I worked for a week as an oil observer, and the other workers on the vessel and I spotted some of the first oil from the spill. Dolphin Express II was the name of my boat. We were approximately a mile southeast of Perdido Pass. Our supervisors asked us to wait until someone responded, but after four to five hours no one ever came. We left the site because it was getting late, and we doubted that anyone would arrive. A boat next to me, the Jamie G, was another charter fishing boat working on the VoO program that witnessed the oil entering. We were not instructed to clean the oil that we identified, and to our knowledge no vessels arrived to clean the oil that we reported. The following day the oil came inside our pass at Alabama Point. The

R.L.R.

city of Alabama tried to put a big barricade in to stop the oil, but it did not prevent the oil from entering when the water was choppy. After the oil entered the pass it went into the Bayou St. John bay area.

During my second job on the VoO program I became the captain of a large supply boat for about one month. I do not remember receiving any safety information or literature when I worked as a captain. We would service the boats that were cleaning the oil and deliver different safety and cleanup equipment, such as hazmat suits, boom, and additional trash bags as requested. Our vessel had a safety worker certified in Hazardous Waste Operations and Emergency Response (HAZWOPER). He worked for Parsons, a BP contractor. If people needed a restroom break or were sick then they would get on our boat. Everyday at least one sick worker would board our vessel. At times the safety worker would evaluate the sick workers, and he would send them back to work the same day if he thought they were ok.

My third job on the VoO program involved pulling boom with one of my large vessels. We would pull heavier stuff, such as oiled boom, for a charter fisher boat called the Fishing Fool. We were pulling boom between our boats, and my boat was regularly sitting in the dispersed oil. The dispersant looked like bubbly white foam. I only performed that job for about a week.

My final job involved running a waste barge that would bag contaminated boom and send it to another barge to take the boom to the marina. The marina supervisors told me that I did not have to wear safety equipment because I was the captain and therefore I was not supposed to come in contact with the oil and dispersants. However, that was not true. For instance, when my deckhands were handling the oil boom it would splash on me. I would also inhale the chemicals from the oil. Most of the time I was up high in the vessel tower, about 30 feet off the water. It was windier up there than down below on the deck. The deck was unsafe as well, however. Once my deckhands became HAZWOPER trained they would wear safety equipment, such as rubber boots and tyvek suits, at times, but their faces were not covered and they did not have respiratory protection. One of the deckhands complained to me about the chemical smell, and often my workers complained of headaches and discomfort. Regularly water splashed us in the face.

They disbanded us after the tropical storm Bonnie in July of 2010. The VoO program informed us that they would call us back to continue the cleanup after the storm, since we were local workers. Therefore I took a course in post-oil spill cleanup and I received a purple card. It was supposed to allow me to continue working on the cleanup, since we did not have any income coming in after we were initially disbanded. However, we were never called back and they never explained why.

R. L. R.

While I worked for the VoO program I only received a few checks, but I had a hard time getting them. My wife and I had to keep faxing my work records because Danos and Curole kept disputing the time that I worked on the cleanup. I still do not know if I was fully paid for my work.

2. GULF COAST CLAIMS FUND

When I reflect on the oil spill it makes me mad because I had a great business and I lost it. After I stopped working on the VoO program I tried to get compensated for my losses through the Gulf Coast Claims Gund (GCCF), but I never received any payment. I also had oil in my motor from my work on the cleanup, which caused my boat to overheat. When I was a waste carrier I was tied up to the main barge, the Minnesota Barge, and I had a lot of damage and stress on my boat deck. My boat depreciated about $50,000 from working on the VoO program. BP said that it would cover the damage, however, the GCCF did not respond to any of the claims that I filed. Later I was guaranteed payment as part of the class action lawsuit. Claims Strategies, a claim support group, promised to try and help get me claims, but it has been nearly five years since the spill and I have not yet received compensation for my losses.

I was living out of my car for about six months in the spring and summer of 2012, because I could not afford to rent a home. I have two children, and my financial difficulties have been hard for the whole family.

3. HEALTH PROBLEMS, DISPERSANTS

During the cleanup my eyes often burned and my nose bothered me. The chemical smell was the most difficult part of the job; it was strong and constant. My dad lives on a lagoon on Gulf Shores and to this day you can smell it from his house. I was coughing all the time and it was difficult to breath out there because it was hot and I constantly smelled the chemicals from the spill. It smelled like something in the air was burning. I didn't think to ask for safety equipment, however. We were focused on cleaning the oil, and I was told that I did not need any protections. I regret that no one informed me of the health risks that came with the job. Since working on the cleanup my symptoms range from a constant sore throat to nausea, difficulty breathing, violent vomiting and cramps at the same time. I have stomach problems now, and I never know when they are going to occur. Prior to working on the spill I never had eye problems. I had 15/20 vision and never wore glasses. It could be due to age, but since working on the cleanup I have had trouble seeing up close. Now my bones are real sore, and I am in chronic pain. I am achy in my arms and my legs all the time. Before the spill I was in good health and I did not have any of these symptoms.

As for dispersant use, we would see planes flying but I had no idea that they were

R. L. R.

R.L.R.

spraying the dispersants in order to sink the oil. The dispersant planes would fly right over me a few times a day. It seemed like they would go from the North side of the bridge from Jack Edwards Airport out toward the Gulf where there remained a concentration of oil. Often the planes spraying the dispersant were Coast Guard planes. I was never sprayed directly, but my friend was sprayed by dispersants. She was not even in the water or working on the cleanup. She lived a few miles from the Gulf in Pensacola, Florida. A dispersant plane was spraying and flew over her house one evening when she was bringing groceries inside. Since the oil spill she has developed breathing problems, but they worsened after she was sprayed.

Since I lost my business I lost my health insurance. However, I have participated in the National Institute of Environmental Health and Sciences (NIEHS) 10-year Gulf Study program to monitor the health of BP cleanup workers. Right after the oil spill a lady with NIEHS came to my house to include me in the study. She was located in Georgia and assigned as a worker for my area. She said that my heart rate and pulse were real low. She called the main office to tell them what I was experiencing. They said they were going to send my information through the mail but they never did. A few months ago they called to speak with me and check in. They asked me questions about my health, and then they told me I would receive a certificate of sorts in the mail. The first time they sent me a $50 gift card and I just used it for groceries. My former wife's friend told me I should participate in the study since I worked on the cleanup. The NIEHS contact told me I was two or three weeks away from going into a coma due to my alarmingly low heart rate and pulse. She told me to be careful and monitor myself closely. She also advised me to let her know if anything got worse.

Through a letter in the mail I learned about a meeting with lawyers in June 2013 to help identify health problems experienced by cleanup workers. I did not know if working with them would result in compensation or medical treatment, but I was hoping I would receive treatment. At the direction and assistance of the lawyers, I went to a doctor located in Foley, Alabama. There is a medical class action lawsuit, but they usually do not result in much and the money will not cover medical expenses if you are not healthy. I would rather receive proper medical treatment then a settlement for my health impacts. In 2014 I attended a meeting where the charter boat captains from the BP cleanup were offered $60,000 for settlement. As part of the settlement terms, the lawyers take 20 percent and then the captain has to pay taxes on their settlement, so they are left with about $20,000.

The attorneys associated with the class action settlement arranged for cleanup workers such as myself to see a physician. The doctor I met with explained that my liver probably is not functioning correctly and my gull-bladder needs to be removed immediately. I may also have a problem with my pancreas. My tonsils are inflamed and probably need to be

R.L.R.

removed as well. He explained that my nasals and ear cavities are inflamed. One of my tonsils is bigger than the other with bumps all over it. He said it was a possibility that I was exposed to chemicals while working on the spill. He could notice that my eyes looked drained and aged as well. I used to look and feel much healthier. It worries me because I am only 45 and I have never had a history of poor health. I have never been a smoker, and before the spill I was in good health. The doctor wanted me to follow up but I do not have the money to do so. I do not have a regular doctor because I cannot afford one, so I just live with my symptoms.

4. MAKING ENDS MEET, FISH WITH LESIONS

Before the spill we had plenty of money and now I am just barely getting by. We are still surviving, but I can't give my kids all that they want. At my age it is difficult to change jobs; I have always relied on my captain license, and my livelihood was conducting fishing and dolphin tours. In order to make ends meet, I now work as a fishing guide. My captain's license makes me eligible for the job. At first I worked at Outcast Marina on the East side of Alabama Point Bridge, and I ran fishing and dolphin tours. They had a dolphin cruise boat and I would take people fishing. I was on standby all the time so that I could pick up work whenever it became available. When I go onto the water I notice that I cough more frequently than when I am on land, and my sore throat gets worse.

After the spill there were a lot of fish with lesions. Today I still see them but it is not as common. I do not think the fishing is back to normal yet. We have good fishing here, but the marine life is not as abundant as it was before the spill. If the fish do not have food then they will die, and a lot of the smaller fish and organisms that comprise the marine food web were severely impacted from the spill. During and after the spill a lot of dolphins washed up on the beach and died. A lot of the baby dolphins were stillborn as well. As a tour guide I occasionally fish, but I am scared that the water is still contaminated with dispersants and oil. It is difficult not to avoid coming in contact with the water as a guide, however. At times I get small cuts on my hands and then the open wounds are exposed. I'm concerned about touching the water due to the dispersants.

After the spill almost every fish that we would catch would have some kind of lesion. Now I do not know whether or not the Gulf seafood that we catch is contaminated. When I took people into the Gulf for fishing trips, I would clean the fresh fish that they caught. It made me feel uneasy, however. I would ask them if they wanted to eat them or throw them back, and they normally wanted to eat the fish. I often worried the people who consumed the seafood would get sick, but it was not even my business; I was working for other people. I was just trying to work to survive.

5. CONCLUSION

R.L.R.

I am hesitant to even come in direct contact with the Gulf water, and I know we have tourists down here who swim in the Gulf. BP did not want to warn the public of the ongoing public health dangers resulting from the spill. In the northern part of the country BP said "Oh come down and swim in the beach." I'm concerned that people who do not know any better will swim in it and get sick and possibly get cancer later down the road. I do not go swimming unless it is in a pool.

The government works with the oil companies because our economy is so dependent on oil, but unfortunately the government does not want to take care of the people. There are a lot of people who have been unfairly impacted by the BP spill, and they deserve compensation and medical treatment. My throat stays scratchy and sometimes I lose my breath. It is worse when I am out by the water. There are days that I am worse than others, but I just never know how I am going to be. I was hoping it would leave on its own but it has been nearly five years now.

I was finally able to sell my boat, and my mom warned me that it may be the only money I would receive. It has been nearly five years and BP still has not paid me for the damage that I incurred from working on the cleanup. I never wanted to work on the cleanup but I knew we would not have the revenue from my normal business due to the spill, so I joined the cleanup. Now all I want to do is to get back on my feet again and fully regain my health.

I have read the foregoing five page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on March 18, 2015.

Richard L. Russell

Subscribed and sworn to before me
this 18 day of March, 2015

R.L.R.

R.L.R.

Sandra Garcia

Notary Public

My Commission expires on: 10/03/2017

R.L.R.

AFFIDAVIT

My name is Randy Varney. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am 55 years old, and I was born and raised in Barataria, Louisiana. I started shrimping as a deckhand at age 11. I bought my first skiff boat more than 25 years ago, and I have always made a living off of shrimping. However, since the BP oil spill both shrimping and my health have declined. During the summer of 2010 I worked for BP contractor DRC Emergency Services, LLC (DRC) on the oil spill cleanup. At first I worked as a deckhand, then I provided supplies to boats working on the cleanup, and eventually I worked as a captain on the cleanup. Throughout that time I was provided minimal safety equipment and developed what are now chronic health problems. I would like to know what is compromising the health of my community and our seafood.

1. EXPOSED

Early in the job I received training for how to lay boom, a net used to contain and remove oil. However, I didn't receive the hazardous materials (HAZMAT) course until the end of my time working on the cleanup. The HAZMAT course was just a show, because you couldn't fail. The instructors gave us the answers for the final exam and everybody passed. They coached us through each question and said things such as, "If it's not answer choice A or B, it must be C."

During the HAZMAT course I learned that we were supposed to wear respirators and protective suits when we were cleaning up oil, because we could be exposed to chemicals such as benzene. The class also explained that exposure to different chemicals mixed together can be very dangerous. When we worked on the cleanup we did not wear proper gloves, respirators, suits, or any sufficient Personal Protective Equipment (PPE). I don't understand why we were sent to a safety course at the end of the job that told us how to protect ourselves, yet DRC did not provide us with the recommended safety equipment.

At one point I worked on a boat that was used to hold oil until it was collected by smaller boats. We had to sleep in close proximity to the oiled boom for four to five days, until it was removed. We had no choice. The boom was put into bags, but it would leak. We would put a mat on the deck, and then we would place the bags on top of the mat. We had to load and unload the boom, and it was heavy and oily. We had cheap rubber gloves and paper suits, but the oil would sink through them. Whoever ran the cleanup was focused on profits, not our health.

According to news reports, Corexit was often being sprayed on the same days that we were on our vessels. During the cleanup there were frequently strong winds at 25 to 30 miles per hour. I believe that we were exposed to the Corexit because the chemicals from it became airborne or got into the water. I frequently detected a chemical detergent smell on the days that Corexit was sprayed. At times I had to look for oil and oiled wildlife, such as pelicans. We would find oil inshore, behind Grand Isle and Barataria Bay. We would provide the coordinates where it was located to DRC, and DRC was supposed to send skimmer boats to those locations. When we would return to those locations the next morning there would be no oil, just foam. To my knowledge, BP and the government were only supposed to spray Corexit offshore, not inshore, but it looked like there was dispersed oil inshore. The foamy water would spray the other workers and me in the face. I would come home with my shirt covered in brown spots from

where the water splashed me. Shorty after those experiences - within the first month on the job - I started to feel abnormal, as if had a bad cold.

2. HEALTH PROBLEMS

Before I began working on the cleanup I took a physical, including urine samples and x-rays. There was nothing wrong with me at that time. I also felt like I was in good health. However, after the first month on the job I felt like I had a cold and it got worse as I continued to work. I went to Jefferson Medical Clinic, and they told me I had an upper respiratory infection. After a month into the job my ears started bleeding and I developed a sore throat. My eyes began to hurt and itch real bad, as if they had blisters. I didn't know the cause of my sudden health problems. My eye problems will not go away. The oncologist said he couldn't determine what was wrong with them. He prescribed me eye drops that cost $125 and they didn't last long. When I ran out, my eyes went back to burning and itching. My throat irritates me and is sore every day, and I often have bad headaches.

Since working on the cleanup I have developed a rash all over my chest and thyroids. I put the antibiotic cream on it for months and months. The rash consists of little bumps that spread from the bottom of my rib cage to my shoulders and under my chest and arms. It gets itchy when I don't have the cream. I must purchase the cream and anything else that the hospitals or clinics prescribe for my symptoms. I have noticed that the rash comes back the most when I go out on the water, and I feel worse when I get overheated.

I have become intolerant of chemical smells that have never affected me before. For instance, I cannot stand the smell of perfumes, air fresheners, cleaning products or anything that comes out of aerosol cans; I have to remove myself from the smells. I can no longer wear cologne or even burn a scented candle, because anything that releases a strong smell repulses me, as if my body is rejecting it. I never had those reactions before I worked on the cleanup.

I have also noticed myself forgetting a lot. It includes simple things, such as forgetting whether or not I have washed my hair in the shower. I put my shirt on and I can't remember if I put on deodorant. At times when I am driving I forget where I am momentarily, and then I suddenly remember. I don't forget how to drive, however. I did not have memory problems before the spill, but now I have good days and bad days. I went to Ohio for a week in the summer of 2013, and I felt much better; my symptoms began to subside. When I returned home I felt the way that I had felt when I left; the symptoms began to come back.

I don't know what is wrong with me. I feel like I have been poisoned, almost as if I'm dying. It is one thing to have symptoms for a week or a month, but I have been through years of ineffective treatment. It's as if the doctors are treating me for something that I don't actually have. I only feel better for a few days until I run out of antibiotics, eye drops and cream. When I go to different doctors they don't want to hear anything about the spill or being infected with oil and toxins. They don't want to look at the cause of these reoccurring problems or discuss their possible connection to the spill. They only treat the individual symptoms. Where is the doctor's concern for the patient? It is not right; I feel a doctor should try to help the patient no matter what.

In early December I went to one of the health clinics run by the Kennedy Center for Justice that is located on the bayou, and I saw a doctor who specializes in chemical exposure. He took a blood test and urine sample and checked my heart and gave me a complete examination. The results recently came back. He told me that I had an upper respiratory infection, but he did not explain what had caused it. My blood work came back fine, but the exam did not test for the chemicals found in the oil and dispersant.

I am not the only person who has had health problems since the spill, but it seems to affect people in different ways. When I was a captain, I had a deckhand in his mid-thirties. He would bag the oil and unload it onto other boats. Since working on the spill he has developed heart problems. People who I've known for years and were in fine health prior to the spill are now using breathing apparatuses. One of my friends now has brain cancer. One man who I used to go trolling with for years is now breathing out of his throat through a breathing tube, and the doctors don't know what is wrong with him. He never smoked.

Despite this onslaught of health problems in my community since the spill, over three years later no one is explaining what is the cause. Is it because of my old age, or due to chemical exposure? We live on a bayou, which is 100 yards from my backdoor where I keep my boat. Is my proximity to the water making me sick? We only hear about the health problems in other parts of the Gulf through Facebook, not on the news, because we are sharing what we know with one another. We also share what we are experiencing with our neighbors and fellow fishermen.

I am a commercial fisherman, so I'm on a boat during the summer. It's difficult now, because when I am outside in the sun and it starts to get hot, I feel like I am going to pass out or have a heat stroke. Before the spill I used to go trolling on my own without a problem, but I no longer go out alone or make as many trips. I used to go out for 20 days in a row. Now I can only go out for five days, and then I have to come in for five days to rest before I go back out. When I went trolling in the summer of 2013 the heat really affected my rash and depleted my energy. Sometimes the other fishermen and I saw oil in the current line – where the current makes a line and debris settles. In August and September 2013 I was not out that much because there were not a lot of shrimp.

3. SEAFOOD DEFORMITIES

When the season first opens in early May there is a rush of shrimpers. It usually lasts a few weeks. However, after the first week into the 2013 season ninety percent of the boats were tied up on the bayou. There are fewer shrimp where there used to be an abundance of shrimp before the spill. What do we do now? Worse yet, since 2011 we have been catching shrimp that are deformed. I have worked in these bayous and canals my whole life and I never saw shrimp like this before the spill, especially inshore where the shrimp are born and raised. Some look like they had acid dropped on their shell, or they have black gills and tar. Some of the shrimp have sores and tumors on both sides of their heads and discoloration, as if they are rotten but still alive. I only come across a few shrimp without eyes, but some shrimp have eyes that are clear and not fully developed. If you take the heads off the shrimp often look fine, but if you take the heads off and put them in a bag and let the gook ooze out then it turns your stomach.

Most people, including many of the fishermen, don't want to hear about the oil spill because they want the shrimp to be safe and to make a living. They don't want to stop doing what has been in

their family for generations. For decades Barataria Bay has been known for having some of the best shrimp in the world. We don't have other work; we live on the bayou, and fishing is what we do. Everything we have is tied up in the bay, because that is our living. Now I have to go to different locations then where I normally fish. Places that used to have shrimp, such as Barataria Bay and Little Lake, which is 20 miles west of Barataria Bay, are no longer as plentiful. I have noticed about a 60 percent decline in catch. At first most of the deformed shrimp were in Bay Jimmy and Barataria Bay, but now the impact appears to be spreading. I am catching them further up in Lafitte as well.

We are looking at thousands of shrimp, so it is difficult to go through every shrimp and pick out those with deformities. However, if I'm catching deformed shrimp, then other fishermen are catching them as well. We are selling the shrimp, and the idea of it making someone sick really hurts me. The seafood may be safe, I'm not saying it's not, but something is wrong. After the spill President Obama said that the seafood was safe and the beaches were clean. It hurts me to now see the kids digging in the sand, because in many cases the beach cleanup workers covered up the oil with sand. The workers made videos of this practice and posted them online, and I also saw reports of it on the news. Just like the beaches, I don't know if the shrimp are safe. The government said it has tested the public beaches and seafood for chemicals, but how am I supposed to feed the shrimp to people when I am catching deformed shrimp?

4. CONCLUSION

We felt good about our lives and communities prior to the spill. But after it occurred, people have been out of work and their health is declining. At that point it is easy to become depressed. Fortunately I own my boat and my house, and I have excellent credit. I don't have an education, but I have always known how to make money. I have been selling seafood all of my life. I lay in bed now and ask myself, what am I going to do? I do a lot of pacing from the back door to the front door. I am 55 years old; I am too old to start looking for a new career. I had a part-time job in the winter at a bait shop, but now it is gone. Since the oil spill there aren't too many people fishing, and not a lot of people want to buy shrimp now. I used to sell shrimp to local establishments that would then re-sell the shrimp, but as consumer demand went down so did my sales.

I think that everyone needs to know what really happened during the oil spill cleanup and what the impact has been on our communities. In the future, oil spill cleanup workers should receive HAZMAT training and be fully informed of the potential health risks associated with the chemicals that they will be exposed to, before they begin working. Further, our communities and the public should not have to question whether or not government seafood testing is reliable or how much seafood we can safely consume. We have a right to know what we are being exposed to.

I have read the foregoing four page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on December 16, 2013.

Subscribed and sworn to before me
this 10 day of March, 2014

Vicky L Pollard

Notary Public
My Commission expires on: Dea 4n

VICKY L. POLLARD
LBN 24606
STATE OF LOUISIANA
UNION · JUSTICE · CONFIDENCE
Attorney Notary
Lifetime Commission

AFFIDAVIT

My name is [redacted]. I am submitting this statement confidentially, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am providing this statement because I am concerned about the health of everyone who consumes Gulf seafood contaminated by the BP oil spill. I have lived in [redacted], Louisiana my whole life. Until recently, I helped run a seafood restaurant in Louisiana. [redacted] and I decided to close the restaurant after we realized that the seafood we served was contaminated by oil. I could not bear to serve other people's children and grandchildren a product that I did not want my own children to eat. Gulf seafood is being shipped all over the world. Who is going to take care of those made ill by contaminated seafood?

My family has worked in the seafood business for generations. [redacted]. [redacted] owns a seafood processing plant, and I worked for it from age 15 to 20. At the time it was called a platform. At the plant we would buy, boil, clean, package and sell shrimp. I later became a truck driver and for approximately three years I transported seafood for [redacted], located in Louisiana. The plant would buy crabs, peel them and sell the crab meat. I then began my own seafood transportation company called [redacted] and distributed different processed food to wholesalers in Louisiana. I closed it after I received a better job opportunity to become a [redacted]. However, that work slowed down in the years before the oil spill and when the offshore drilling moratorium took effect.

After the Deepwater Horizon explosion, [redacted]. Later, in October 2011 [redacted] offered me a position in his seafood restaurant. I was going to become a co-owner, but before we could do the paperwork we decided to shut down due to food safety concerns.

[redacted] We specialized in boiled seafood, and offered boiled crabs, shrimp and seafood platters. [redacted] One night in June 2012 when we were serving boiled crabs, a patron was eating the crabs and said that she couldn't get a black substance off of her hands, even when she scrubbed it with a napkin. She showed me that when she opened the back side of the crab and squeezed it, a black oil-like substance came out of it. I asked if she would mind if I documented it, in the event that she got sick. She agreed and we took photos of the crab and her hand. I proceeded to give her a wet paper towel with Dawn dish washing liquid and the black substance on her hand came off right away. She then proceeded to keep eating the crabs, at which point I panicked and said, "Let me get you some fresh crabs." I had never seen anything like that before the oil spill; I was shocked.

We were also having problems with soft shell crabs. [redacted] had frozen soft shell crabs from before the spill. We initially sold those, and they were very popular. However, we ran out and began serving soft shell crabs from catch that was collected after the Deepwater Horizon explosion. Customers repeatedly complained that they tasted bad, as if there were old. However, they were fresh catch. [redacted] owns a seafood plant, and he would buy the seafood for the restaurant directly from the fishermen and we would take them to the restaurant. They were as fresh as they could be. After the patrons complained about the soft shell crab we decided to stop selling them; we were scared of someone getting poisoned. Folks weren't complaining about hard shelled crabs at that time, but we started findings problems with them as well. After the first oiled crab incident we started paying closer attention and noticed more crabs that looked like they were contaminated with oil. We also started looking more closely at the shrimp; to our surprise, they frequently had no eyes and their heads contained a thick black substance. I didn't know what it was but [redacted] explained that it must be oil.

After these events, [redacted] and I had a long discussion and decided that we should close the restaurant before someone sick, or before we got sued for serving a contaminated product. After we closed the restaurant, on [redacted] I sent the photos to BP and asked about filing a business loss claim. The following week, a BP representative called me three times in one night, asking me questions and providing instructions on how to file my claim. He said, "I'm really glad you sent it to us. We can work together and it will be beneficial." I had not shared the photos publically yet and he said, "We appreciate you contacting us and not going public." He said that BP would help us out as much as it could. He told me to file as an individual for a claim for a business economical loss and to send the photos with my claim. He assured me not to worry, and said that BP would help. He didn't tell me how to contact him but instructed me to call the number 1-800-333-3991 and submit information by email. We decided to see what would happen with our claim before going public. One month ago – nine months after I had filed the claim - BP said I should have filed as an individual economical loss and denied my claim.

[redacted] wanted to figure out what was wrong with the crabs. He put them in a tank and placed 10 gallons on cooking oil into the tank. Within days, the cooking oil had disappeared. I believe that the crabs were exposed to Corexit and the Corexit is responsible for this. If the Corexit is going to eat the oil that fast, what is it going to do to a person? [redacted] processing plant was peeling crabs and he wanted to make sure they weren't contaminated. He contacted the Louisiana Department of Health and Hospitals, and it told him to get a black light to identify any contamination. [redacted] has photos of the crab under a black light that identifies chemicals, and the crab meat and shrimp are a neon blue color under the black light. Those photos as included in this affidavit as Exhibit 1.

I don't have a future anymore, because I don't have a restaurant; my dream was to oversee the restaurant and now I can't. [redacted] shared that dream. After we decided to close the restaurant, he had a stroke. He had invested all of his savings - $200,000 - into opening the restaurant. He was worried sick about closing it. Since the restaurant closed, I have been on

higher and higher doses of antidepressant pills. We are really struggling financially. My husband works as a [redacted], and we are trying to survive on his income. However, he makes in a month what he used to make in a week as a [redacted]. I am aggravated, because I was very active and always working, yet I have had no work since we closed the restaurant. After we decided to open the restaurant, I got rid of my truck. I cannot afford to start over or risk reinvesting in my previous company under the current conditions.

There is not a demand for distributing Gulf seafood. Since the spill seafood catch has declined dramatically and there is almost no seafood for commerce. Fishermen are having problems trying to find seafood, and its cost has skyrocketed since catch is scarce. This is usually the time of the year when crabs come out and the catch is so plentiful. However, this year there are virtually no crabs. A friend of mine went skimming – a method of collecting shrimp & crabs from the seafloor - all night and only caught three crabs. Normally he would come back with several bushels. Usually he would have a crab boil but this year he has to have a shrimp boil instead, and even then the shrimp were smaller than normal. Shrimpers going trolling are also noticing a significant decline in their catch. Each year since the spill the crab catch has declined and 2013 is the worst year yet.

My hope is that no one gets sick from contaminated seafood, and if they do then BP should take responsibility. BP should develop a fund for any health problems connected with this oil spill. I have lost almost half a dozen friends from cancer since the spill. What will happen to us? Prior to the spill, my friend had cancer of the stomach but the doctors had removed it all. After the spill he developed it again and passed away. Another friend found out that he had cancer six months ago and they will bury him today. There are so many people on our bayou dying from cancer. A 40 year-old mother who is a neighbor of mine developed rare cancer of the appendix after the spill. The doctors told her that the cancer is ongoing and there is no cure. She goes into remission and then the cancer comes right back. In addition to rising cancer rates, we have so any allergy problems. Every neighbor I speak with is living on antihistamines. Most people in our community are also living with awful sinus problems and migraines now. These problems were not common during previous oil spills or prior to the Deepwater Horizon disaster; they became widespread in the aftermath of the BP oil spill.

As part of the long-term GULF STUDY, the National Institute of Environmental Health and Sciences came into my house and took samples from my urine, fingernails, toe nails and hair, and swabbed the inside of my mouth. They said I would receive the results in two to three weeks, but it has been several months and I have not received anything.

I have read the foregoing three page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on May 30, 2013.

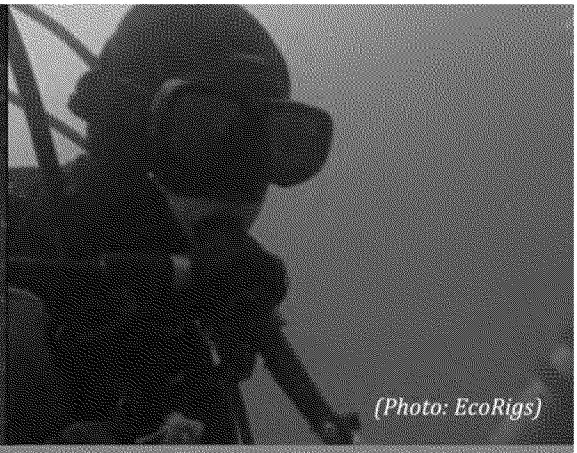
_____

Subscribed and sworn to before me
this _____ day of _____, 2013

_____

Notary Public
My Commission expires on: _____

(Photo: National Oil Spill Commission)



(Photo: EcoRigs)

Deadly Dispersants in the Gulf:

Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups?

(Photo: Scott Porter)

(Photo: Shanna Devine)

A GAP Whistleblower Investigation

By:
GAP Investigator
Shanna Devine
&
GAP Legal Director
Tom Devine

G·A·P
Government Accountability Project

Acknowledgements

Thanks to all the whistleblowers, community activists, public interest lawye
citizens who are the soul of this report. Special thanks to the Lo
Network, the foundation for all of our work, the Dr. Marion Michael Robinhau
whistleblowers abandoned by the conventional medical community; and lastly
investigative journalists and activists, Rocky Kistner and Riki Ott for the
tutoring us in this Special thanks to Climate to Science Watch, which contributed
this report, all and of our colleagues at the Government Accountability Project fo
terms of resources, time and solidarity.

Table of Contents

Executive Summary **1**

1. **Introduction** **7**

2. **Dispersant** **11**
   a. Oil "Disappeared" 14
   b. Contact with Toxicant 15
   c. Government and BP Positions 16
   d. Is Corexit Safe? 17

3. **Safety Ignored** **19**
   a. Insufficient Training and Personal Protective Equipment 22
   b. Public Exposure 26

4. **Health Impact** **29**
   a. Health Symptoms 33
   b. Is the Gulf Toxic? 38
   c. Chemicals in the Blood 39

5. **Seeking Medical Help** **43**
   a. Medical Response by BP, Government and Hospitals 46
   b. Gulf Coast Citizen Program 49

6. **Ecological Impact** **51**
   a. Ecological Impact 56
   b. Seafood Safety 58

7. **Retaliation** **64**
   a. Workplace Chilling Effect 67
   b. Strange Encounters 69

8. **Ongoing Threat vs. Marathon Public Relations Blitz** **71**
   a. Oil Not Gone 75
   b. Media Blackout 76

9. **Inadequate Compensation** **78**
   a. Gulf Coast Claims Fund 81
   b. Deepwater Horizon Class Action Settlement 82

10. **Recommendations** **84**

□ð

Table □ð of □ð Contents □ð Cont. □ð

Glossary …… □ð

□ð

"British □ð Petroleum" □ð by □ð Mark □ð Strickland …… □ð

□ð

Appendix: □ð Whistleblower □ð Witness □ð Affidavits …… □ð

□□□□

Executive Summary

Deadly Dispersants in the Public Health and Environmental Tragedies the New Norm for Oil Spill Cl

The 2010 Deepwater Horizon disaster was the largest U.S. oil spill, an history. Even worse, evidence suggests that cleanup efforts were more de and the environment than the spill government and other federal joint response to be the precedent for a new cleanup standard operating pr the widespread use of the chemical dispersant Corexit. When this product deadly synergy occurs greater poses than oil alone. The advantage of Corexit is the false impression that the oil disappears toxic chemical spreads throughout the environment, or settles on the seafloor.

An investigation by the Accountability Project (GAP) on whistleblower protection and advocacy – details the nightmarish conclusions. GAP' data and evidence comes from those citizens who experienced the cleanu Taken together, these testimonies belie repeated corporate and government no more dangerous than Dawn dishwashing soap.

Report Genesis, Resources & Methodology

Louisiana physician Dr. Michael Robichaux approached requesting in assistance to document ravaging health effects appearing to be caused by the spi application of Corexit and the spill. In response, from August 2011 to interviewed 25 whistleblowers with firsthand accounts of Corexit's devastating four whistleblowers chose not to go and are not reflected in GAP's stati findings. Of the 21 whistleblowers whose accounts are documented in thi workers, both are professionals (two doctors, one industry leader) who acted multiple cleanup workers, two are divers contracted by the federal gov Gulf communities exposed to the cleanup. Of these 21 women, were 14 ages ranging from 30s to late 60s. Their statements recount episodes Louisiana and Mississippi. Sixteen whistleblowers reinforced their interviews wit made public in this report. While figures scientific, these are conservative. Of those who acted as safe conduits for whistleblowers, each statement is reflected purposes of the data.

Together, these accounts produce a frighteningly consistent picture of healt devastation that is starkly at odds with official BP and government sta report, GAP worked closely with the nonprofit Louisiana Environmental Actio which was instrumental in supporting this investigation. GAP also conducted

ED_001324_00007754-00005

Information Act (FOIA) requests and interviews with government officials who to remain anonymous about their whistleblowing disclosures. In addition, GA contacted BP to draw significant findings, but GAP's questions were large unanswered. Since March 2012, GAP and LEAN have been involved in America Ombudsman Program on public and occupational health and safety cleanup, and handling of Corexit. So far there have been no tangible r discussions.

Each section in GAP's report summarizes, in order, the official position government, and independent critics, concluding with whistleblower excerpts from affidavits (which can be found in appendices in full). Whistleblowers have immediate impacts of the BP spill, but damage. Through their living histo and emerging science, the truth response's toxic legacy is beginning to surfa reach the third anniversary of the Deepwater Horizon explosion.

Key Findings

Key findings detailed in this report include:

I. Corexit's Devastating Effect on Human Health

Witnesses in GAP's investigation reported, as a result of coming into contact or being in areas near spray zones, severe negative health effects. These health effects abdominal pain; blood in urine; heart; allergic reactions; hyperesthesia; food and common household cleaning or petroleum based products; hypertension; withstand exposure to sun; kidney damage; liver damage; migraines; mult sensitivity; neurological damage resulting in some cases; rapid weight loss; respiratory system and nervous system irritation; seizures; and lesions; sudden inability to move or speak for sustained periods; vomiting episodes.

Interviewees are also extremely concerned about long health effects from this type of chemical exposure, which may not have manifested yet, including r as genetic mutations), endocrine disruption, and cancer.

II. BP's and the Federal Government's Inadequate Protection of Spill Worker

Contrary to warnings in BP's own internal manual, BP and the government misrepresented known risks by asserting that Corexit was low in toxicity (rou comparing it to Dawn dishwasher soap). 47% of reported that their employers told them Corexit did not pose a health risk.

BP □ð and □ð the □ð federal □ð government □ð each □ð identified □ð heat □ð stress □ð as □ð the □ð g
hazard □ð for □ð cleanup □ð workers, □ð leaving □ð them □ð almost □ð defenseless □ð against □ð chem
workers interviewed reported that they were provided minimal or no personal protective equipment on the job

□ð

Federally required worker resource manuals detailing the hazards were not delivered or were removed (according to an anonymous whistleblower) from BP worksites early in the cleanup, as health problems began. □ð and □ð LEAN □ð confron
BP, □ð the □ð company □ð stated □ð that □ð manuals □ð were □ð removed □ð as □ð the □ð shut
cleanup □ð operation □ð was □ð no □ð longer □ð using □ð dispersants □ð in □ð the □ð Gulf. □ð But □ð
cleanup □ð workers □ð reported □ð that □ð they □ð were □ð unable □ð to □ð find □ð any □ð safety □ð
literature □ð at □ð the □ð job □ð site.

□ð

Undermining □ð the □ð Occupational Safety □ð and □ð Health □ð Administration's □ð safety □ð training □ð
program □ð for □ð cleanup □ð workers, □ð interviewed **reported that they either did not receive any training, or did not receive the federally required training**

□ð

Demonstrated through GAP FOIA responses and whistleblower accounts, BP and the federal government acknowledged that allowing workers to wear respirators would create a good public image, and that retaliation by BP on this issue was
Buttressing □ð this, □ð more □ð than □ð 46% □ð reported □ð that □ð they □ð were □ð threatened □ð with □ð term
they □ð tried □ð to □ð wear □ð respirators □ð or □ð additional □ð safety □ð equipment □ð the □ð
reported that they received early termination after raising safety concerns on

□ð

A □ð FOIA □ð request □ð found □ð that □ð government □ð officials □ð knew □ð the □ð spill □ð
due □ð to □ð health **Yet, interviewed divers contracted by National Oceanic and Atmospheric Administration dove after assurances that it was safe, and additional protective equipment was unnecessary.**

□ð

III. BP's and the Federal Government's Insufficient Medical Monitoring Systems

□ð

BP □ð and □ð the □ð federal □ð government, □ð through □ð their □ð own □ð medical □ð monitoring □ð
denied □ð that □ð any □ð significant □ð chemical □ð exposure □ð occurred. □ð
interviewed, 87% reported contact with Corexit while on the job, and of all 57% reported that they and/or someone in their family was exposed to Cor of the cleanup zone

□ð

Further, **blood test results from our interviewees showed alarmingly high levels chemical exposure that correlated with the health effects** □ð GAP's □ð witnesses, □ð
more □ð than □ð 70% □ð took □ð a □ð blood □ð test □ð to □ð identify □ð chemicals □ð from □ð Corex
tested □ð positive □ð for □ð high □ð levels □ð of □ð such □ð chemicals, □ð which □ð included □ð know

□ð

ED_001324_00007754-00007

BP □ð and □ð government □ð medical □ð monitoring □ð program □ð worker □ð complaints □ð that □ð Corexi
exposure □ð resulted □ð in □ð hospitalization, □ð and □ð each □ð repeatedly □ð issued □ð official □ð st
communities □ð (including □ð vulnerable □ð populations) □ð that □ð the □ð environment □ð was □ð s
"normal." **Eventually □ð named □ "BP □ Syndrome" □ or □ "Gulf □ Coast □ Syndrome," □ all □ GAP □ witne**
experienced □ spill □ related □ health □ problems. □ð Furthermore, □ð 95% □ð report □ð that □ð they □ð cont
experience □ð spill□ related □ð health □ð problems □ð as □ð of □ð April □ð 2013, □ð and □ð more □ð
areas □ð reported □ð that □ð their □ð children □ð and/or □ð grandchildren's □ð health □ð has □ð deter
□ð
BP, □ð the □ð government □ð and □ð Gulf □ð hospitals □ð regularly □ð diagnosed □ð health □ð problem
residents □ð as □ð mere □ð heat □ð stress □ð or □ð anecdotal □ð individual □ð symptoms. □ð Further,
mobile □ð medical □ð unit □ð was □ð housed □ð in □ð a □ð private □ð BP □ð compound □ð guarded
impossible □ð for □ð workers □ð to □ð anonymously □ð seek □ð medical □ð assistance □ð (many □ð
retaliated □ð against □ð for □ð reporting □ð health □ð problems). **Of □ GAP's □ witnesses, □ early □ 86% □ were □ told □**
by □ a □ medical □ professional □ that □ there □ was □ no □ relationship □ between □ their □ health
and □ spill □ related □ chemicals, □ or □ that □ the □ professional □ recognized □ the □ relationship
refused □ to □ document □ it. □ Over □ 42% □ of □ witnesses □ were □ scared □ to □ ask □
their □ physician □ about □ a □ relationship □ between □ their □ health □ and □ the □ spill.
□ð
To □ð address □ð the □ð void □ð in □ð adequate □ð medical □ð care, □ð LEAN □ð and □ð Dr. □ð Rol
treatment □ð program □ð tailored □ð toward □ð chemical □ð exposure □ð that □ð voided □ð and □ð fill
provide □ð a □ð model □ð for □ð treatment □ð programs □ð throughout □ð the □ð Gulf □ð **Every □ of □ the □ interviewees □**
who □ underwent □ the □ Gulf □ Coast □ Detoxification □ Program □ reported □ that □ their □ healt
symptoms □ subsided □ or □ cleared □ after □ undergoing □ treatment.
□□□

IV. Existing □ Threats □ to □ the □ Public □ Ignored □□□□

□ð
The □ð federal □ð government's □ð failure □ð to □ð report □ð on □ð continuing □ð Gulf □ð public □ð
tourists □ð directly □ð in □ð more □ð than □ð 60% □ of □ GAP □ witnesses □ reported □ that □ they □ f
evidence □ of □ oil □ or □ oil □ debris □ after □ BP □ and □ announced □ that □ cleanup □
operations □ were □ complete. □ð
□ð
BP □ and □ the □ federal □ government □ reported □ that □ Corexit □ was □ last □ used □ in □ July □
one □ percent □ of □ GAP □ witnesses □ cited □ indications □ that □ Corexit □ was □ used □ after □ t
□□□
The □ð government □ð and □ð misleading □ð public □ð relations □ð campaign □ð to □ð lure □ð tourists □ð
was □ð joined □ð by □ð media □ð radio □ð silence □ð by □ð the □ð health □ð crisis. **Nearly □ 70% □ of □ GAP □ witnesses □**
that □ they □ primarily □ depend □ on □ social □ media □ to □ obtain □
related □ information.
□ð

V. Corexit's □ Impact □ on □ the □ Gulf □ Environment □ & □ Food □ Supply □□□

□□□ □
BP □ð and □ð the □ð federal □ð government □ð repeatedly □ð claimed □ð to □ð dispersant □ð employ
and □ mechanical □ cleanup □ (capturing) □ containment □ of □ GAP's □ cleanup □ worker

whistleblowers, nearly 77% were regularly given instructions to report the loca oil but not recover it. When to each of these workers returned to the same hours, the oil typically was completely gone from the surface.

BP and the government contended that dispersants would mitigate the impacts of the spill, **more toxic oil Corexit mixture coated the Gulf seafl permeated the Gulf's rich ecological web.** GAP witnesses revealed underwater footage oiled seafloor equivalent to a marine Death Valley where aquatic life documented widespread damage to coral communities.

Ignoring some industry requests to delay openings, the Gulf governments re within weeks of the capped. **The FDA grossly misrepresented its analysis for Gu seafood safety, relying primarily on a literal smell test to detect contamina** declined to test for Corexit chemicals, which could result in long undetected by government testing. **Of GAP's witnesses, 76% expressed concern over the quality of government seafood testing, and almost 60% reported seei seafood deformities firsthand. Nearly 80% of fishermen reported that their catc decreased significantly since the spill.**

VI. **Inadequate Compensation**

BP's Gulf Coast Claims Fund (GCCF) denied during its 18 months Although a significant precedent, the subsequent medical class action suit sick individuals; bypassed the worst health impacts resulting from dispe (such as rare birth defects); offered grossly inadequate maximum awards medical costs, and did not include **More than 60% of GAP interviewees reported that the GCCF and/or Deepwater Horizon class settlement made them an offer (most declined). Of those witnesses, 100% reported that compensation wa nominal compared to their medical and economic damages incurred from the**

Conclusions & Recommendations

The BP spill was the worst environmental disaster in American history, consent of BP's Corexit use has caused and long ecological tragedies that may worse. As deepwater drilling expands off U.S. coasts, incidents will occur. Renewed reliance on Corexit is planned as the SOP for future oil s continue to use the deadly dispersant as long as the government pe becomes reality, long-term destruction to our health and environment will expand

GAP's report illustrates that both BP and the government must take c ongoing suffering and to prevent the future use of this shoulder substance include:

A ð federal ð ban ð on ð the ð use ð of ð Corexit, ð which ð is ð already ð banned ð in
country) ð and ð Sweden. ð

ð

Congressional ð hearings ð on ð the ð link ð between ð the ð current ð public ð health ð
Corexit ð exposure.

ð

The ð immediate ð reform ð of ð EPA ð dispersant ð policy, ð specifically ð requiring ð the ð ag
whether ð such ð products ð are ð safe ð for ð human ð health ð and ð granting ð approval ð
under ð the ð National ð Contingency ð Plan ð (NCP).

ð

Establish ð effective ð medical ð treatment ð programs ð by ð medical ð experts ð specializing ð in ð chemic
exposure – ð for ð Gulf ð residents ð and ð workers. ð ð

ð

The ð federal ð government's ð funding ð of ð independent ð assessments ð of ð both ð the ð s
health ð impact ð on ð Gulf ð residents ð and ð workers ð and ð such ð assessments

1. Introduction

The 2010 Deepwater Horizon oil spill released a reported 210 million Gulf of Mexico and used nearly two million gallons of the dispersant By contrast, 1989 Exxon Valdez oil spill released approximately 11 million and used less than 4,000 gallons of Corexit. The devastating impacts cleanup workers and the ecological system have been [illegible] two decades. Surviving Exxon Valdez cleanup workers suffered from severe long problems associated with chemical exposure, and dispersed oil continues to environment, which has prompted Alaskan [illegible] of chemical dispersants.[3] The United Kingdom banned Corexit over a decade ago, and the use of any chemical dispersants in the event of an oil spill.

Notwithstanding grave warnings from the Exxon Valdez disaster and indepen has remained an Environmental Protection Agency (EPA) on the product schedule for the National Contingency Plan (NCP) blueprint for responding to oil spills and hazardous substance government and BP relied on Corexit to make the oil disappear from public view, deliberately pu false public perception rather than focus on public health protection. The Command, comprised of 13 agencies, BP and Transocean (owner of the D Horizon rig), was responsible for authorizing and coordinating all incident spill responses.[5] Working under the direction of the Coast Guard as the Fed Coordinator (FOSC), this union of entities coordinated the unprecedented use

In the summer of 2011, Louisiana physician Dr. Michael Robichaux appro of 2011 and requested assistance on documentation of the [illegible] caused by the extensive application of Corexit. Between August 2011 and investigators interviewed twenty five whistleblowers with first and accounts o devastating cost throughout the Gulf Coast (GOLF) Sixteen whistleblowers reinforced their GAP interviews with sworn affidavits made public in this report. Each sectio summarizes the official position of BP, the government, and the indepen with relevant excerpts from the whistleblowers.[7] The affidavits establish a reviewable record of the's disaster health and safety impacts, from and perspective residents' eyewitness accounts. They experienced a reality opposite from the official record provided by BP and the government. Whistleblowers not o immediate impacts of the BP spill, terms of human health and long environmental damage that society witnesses today are included in the report as appendic

GAP's Gulf partner, the Louisiana Environmental Action Network (LEAN) of more than 100 member groups and 1700 individual members – implementation of our investigation. GAP received affidavits from cleanup workers, fishe divers, coastal residents, parents of sick children, seafood industry leaders, chemist, and a physician. Some of the statements were provided anonymously at whistleblower to protect his or her identity. In addition to these accou

ED_001324_00007754-00011

Freedom □ð of □ð Information □ð Act □ð (FOIA □ð) □ð and □ð Gulf □ð interviews □ð with □ð government □ð officials □ð to □ð conduct □ð its □ð investigation. □ð

GAP □ð also □ð repeatedly □ð contacted □ð BP, □ð largely □ð in □ð vain, □ð to □ð get □ð the □ð company □ð to □ð side □ð of □ð the □ð story. □ð Since March □ð 2012, □ð GAP □ð and □ð LEAN □ð have □ð been □ð involved □ð in □ð a □ð Ombudsman □ð with □ð Program □ð (BP □ð Ombudsman) □ð public □ð and □ð occupational □ð health □ð and □ð safety □ð concerns □ð cleanup, □ð and □ð BP □ð handling □ð of □ð Corexit. □ð In □ð July □ð 2012, □ð GAP, □ð LEAN □ð founder □ð an LEAN □ð chemist □ð and □ð MacArthur □ð Genius □ð award □ð recipient □ð Dr. □ð Wilma □ð Subra, □ð Lo Michael □ð Robichaux □ð (known □ð as □ð "Dr. □ð Mike" □ð principle □ð United □ð Houma □ð Nation □ð Brenda □ð Dardar □ð Robichaux □ð attended □ð a □ð meeting □ð at □ð the □ð BP □ð headquarters □ð in findings. □ð It □ð was □ð coordinated □ð by □ð the □ð BP □ð Ombudsman, □ð and □ð chaired □ð by □ð BP senior □ð BP □ð industrial □ð hygienist □ð who □ð specializes □ð in □ð dispersants □ð was □ð supposed □ð to □ð be □ð presen not □ð attend □ð the □ð meeting, □ð however, □ð and □ð an □ð additional □ð attorney □ð for □ð BP □ð w purposes □ð of □ð the □ð meeting □ð were □ð to: □ð

> receive □ð information □ð from □ð BP □ð regarding □ð use □ð of □ð Corexit □ð potential □ð the □ð B future □ð use; □ð
> discuss □ð the □ð alleged □ð removal □ð of □ð the □ð Horizon □ð MC252, □ð Vessels □ð Captains □ð Ha Communication, □ð Resource □ð Manual □ð (resource □ð manual) □ð worksites; □ð
> discuss □ð the □ð Material □ð Safety □ð Data □ð Sheets □ð (MSDS) □ð for □ð Corexit □ð
> receive □ð a □ð high □ð overview □ð of □ð the □ð medical □ð claims □ð process □ð agreed □ð to □ð in Horizon □ð class □ð settlement; □ð
> provide □ð our □ð observations □ð regarding □ð health □ð problems □ð associated □ð with □ð Corexit □ð use;
> provide □ð our □ð concerns □ð over □ð the □ð claims □ð compensation □ð process.

Ignoring the □ð agreed □ð agenda, □ð BP □ð failed □ð to □ð address □ð the □ð public □ð health □ð conce refused □ð to □ð discuss □ð the □ð resource □ð manual □ð on □ð grounds □ð of □ð open □ð litigation, □ clear □ð that □ð it □ð had □ð no □ð intention □ð of □ð changing □ð its □ð practices □ð with □ð Corexit approves □ð its □ð use. □ð Alarmingly, □ð in □ð the □ð aftermath □ð of □ð the □ð BP □ð spill □ð the □ð government Corexit □ð through □ð the □ð National □ð Contingency □ð Plan □ð product □ð schedule □ð for □ð dispers to □ð exploit □ð the □ð tragedy □ð in □ð the □ð Gulf □ð as □ð an □ð Apportunity □ð BP □ð 2013 □ð promote □ð Annual General □ð Meeting □ð in □ð Chief □ð Executive □ð Officer □ð Bob □ð Dudley □ð made □ð comments □ð on □ð Corexit □ð use □ð (captured □ð by □ð the □ð Gulf □ð coast □ð based □ð media □ð project □ð "28 □

> I □ð continue □ð to □ð be □ð puzzled □ð by □ð something □ð called □ð Corexit, □ð which □ð was on □ð the □ð oil □ð … □ð Everything □ð to □ð a □ð degree □ð has □ð toxicity □ð about □ð the □ð to the □ð same □ð soap, □ð which □ð is □ð effectively □ð what □ð it □ð is □ð and □ð how □ð it □ð w U.S. □ð government □ð recommended □ð product □ð and □ð it □ð absolutely □ð believe. □ð And □ð … □ð the □ð best □ð thing □ð that □ð was □ð to □ð happen □ð was □ð to □ð have □ð dispersant □ having □ð huge □ð black □ð oil □ð waves □ð wash □ð on □ð to □ð the □ð beaches □ð … □ð I □ð ha of □ð people □ð who □ð have □ð studied □ð it □ð scientifically, □ð deeply, □ð that □ð would □ð loo dispersants □ð should □ð not □ð of □ð been □ð used.

On □ð the □ð third □ð anniversary □ð of □ð the □ð great □ð disaster □ð in □ð U.S. □ð history, □ð as □ð deepw drilling □ð expands, □ð the □ð public □ð remains □ð more □ð susceptible □ð to □ð chemical □ð dispersants

the □ð wake □ð of □ð the □ð Exxon □ð Valdez □ð disaster, □ð Congress □ð passed □ð the □ð Oil □ð Polluti
government's □ð ability □ð to □ð respond □ð to □ð oil □ð spills □ð through □ð a □ð trust □ð fund □ð an
contingency □ð planning □ð by □ð government [13] What □ð will □ð be □ð the □ð legacy □ð of □ð the □ð BP
have □ð yet □ð to □ð enact □ð a □ð single □ð measure □ð regulations □ð during □ð congressional □ð oversight □ð
hearing □ð on □ð Corexit □ð use, □ð Senator Ari Mikulski asked □ð the "□ð DDT □ð or □ð Agent □ð Orange
spill?" [14] Throughout □ð recent □ð history, □ð medical □ð and □ð scientific □ð experts □ð have □ð docume
devastating □ð impacts □ð of □ð chemical □ð exposure □ð on □ð human □ð health □ð and □ð the □ð environment. □ð Those
consequences □ð are □ð illustrated □ð by □ð Agent □ð Orange □ð Syndrome, □ð Valdez □ð Cough □ð and □ð Gulf □ð War □ð Syndrom
term □ð coined □ð for □ð widespread □ð health □ð problems □ð by □ð Exxon □ð Valdez □ð cleanup □ð wo
respiratory □ð problems □ð and □ð rates □ð by □ð 9/11 □ð First □ð Responders. □ð The □ð government's □ð response □ð to □ð
the □ð BP □ð spill □ð is □ð unique □ð in □ð that □ð it □ð partnered □ð with □ð a □ð profit □ð driven □ð
the □ð company □ð mess, □ð giving □ð birth □ð to □ð a □ð new □ð health □ð epidemic □ð within □ð mont
and □ð residents □ð would □ð coin □ð the □ð health □ð impacts □ð seen □ð throughout □ð the □ð coast □

Whistleblower □ Record □

"History □ð is □ð repeating □ð itself. □ð We □ð witnessed □ð the □ð same □ð government □ð response □ð
the □ð Vietnam □ð war, □ð and □ð problems □ð of □ð Exxon □ð Valdez □ð cleanup □ð workers □ð and □ð 9/1
responders: □ð After □ð the □ð damage □ð is □ð done, □ð the □ð federal □ð government □ð comes □ð back
examine □ð what □ð went □ð wrong. □ð They □ð were □ð warned □ð before □ð the □ð cleanup □ð began:
agency □ð and □ð I □ð am □ð telling □ð you □ð that □ð if □ð you □ð approach □ð to □ð the □ð cleanup, □ð peo
to □ð get □ð hurt. □ð However, □ð the □ð government □ð continued □ð to □ð use □ð Corexit □ð and □ð no
safety □ð equipment □ð." □ð (Dr. □ð Guidry, □ð 3) □ð

"Gulf □ð War □ð Syndrome, □ð and □ð the □ð government's □ð response □ð to □ð this □ð disorder, □ð has □ð proven □ð to
similar □ð to □ð the □ð BP □ð debacle. □ð □ð In □ð both □ð instances, □ð evidence □ð suggests □ð that
the □ð ingestion, □ð inhalation □ð or □ð contact □ð with □ð various □ð chemicals □ð to □ð which □ð the □
exposed. □ð □ð The □ð pattern □ð of □ð denial □ð and □ð suppression □ð of □ð information □ð Gulf □ð War □ð Syndrome □ð
'BP □ð Syndrome' □ð also □ð have □ð been □ð very □ð similar." □ð (Dr. □ð Michael □ð Robichaux, □ð 6) □ð

"Research □ð shows □ð dermal □ð exposure □ð symptoms □ð correlate □ð with □ð the □ð VOCs □ð I
got □ð into □ð our □ð liver, □ð kidney □ð and □ð fat □ð cells. □ð Further □ð analysis □ð shows □ð that □ð t
and □ð potentially □ð lead □ð to □ð cancer □ð ten □ð to □ð fifteen □ð years □ð from □ð now, □ð as □ð the
spill □ð confirms." □ð (Steve □ð Kolian, □ð 6) □ð

"[M]y □ð mom □ð is □ð the □ð North □ð American □ð coordinator □ð of □ð the □ð World □ð Forum □ð of □
Workers…She □ð would □ð educate □ð me □ð on □ð the □ð health □ð effects □ð that □ð cleanup □ð worke
experienced □ð and □ð everything □ð that □ð she □ð shared □ð I □ð was □ð actually □ð experiencing □ð a
rashes □ð and □ð respiratory □ð problems." □ð (Jenny □ð Danos, □ð 4) □ð

"Riki □ð Ott, □ð a □ð toxicologist □ð who □ð researched □ð the □ð health □ð and □ð environmental □ð imp
oil □ð spill, □ð predicted □ð that □ð the □ð impact □ð to □ð seafood □ð would □ð be □ð seen □ð within □
and □ð a □ð half □ð we □ð are □ð already □ð seeing □ð huge □ð declines □ð in □ð catch □ð across □ð the
Williams, □ð 2) □ð

"Consider □ð the □ð immense □ð impact □ð of □ð the □ð spill □ð on □ð the □ð ecosystem □ð by □ð lookin
1989 □ð Exxon □ð Valdez □ð spill □ð used □ð a □ð small □ð fraction □ð of □ð the □ð Corexit □ð that □ð w
catch □ð significant □ð harvests □ð of □ð herring □ð in □ð Prince □ð William □ð Sound. □ð Scientists □ð believe □ð that □ð
Corexit □ð affected □ð the □ð reproductive □ð cycle □ð (they □ð think □ð it □ð affects □ð the □ð cell □ð w

ED_001324_00007754-00013

mutate □ð the □ð RNA □ð or □ð DNA. □ð The □ð effects □ð are □ð still □ð unknown □ð to □ð the □ð pu
community." □ð (Scott □ð Porter, □ð 16┐ □괆Ġ17) □ð

□ð "□ð think □ð management □ð endorsed □ð a □ð policy □ð to □ð deny □ð the □ð toxicity □ð of □ð Corexit
anything □ð to □ð anybody □ð about □ð the □ð associated □ð risks. □ð In □ð fact, □ð they □ð purposely □
FDA □ð and □ð NRDA □ð knew □ð that □ð Corexit □ð very □ð toxic □ð combination. □ð There □ð are □ð num
publications □ð on □ð the □ð subject □ð and □ð there □ð is □ð historical □ð data □ð from □ð the □ð Alask
chose □ð to □ð adopt □ð this □ð policy □ð is □ð really □ð confusing. □ð

□□□□ □□□□

2. Dispersant

"Like any good magician, the oil industry has learned that if you can't see something must have disappeared." Oil companies have also learned that, out of sight, mind, equals out of mind. Therefore, they have chosen crude oil dispersants as the primary tool large, marine oil spills." Porter, Marine Biologist

Over the months and years following the disaster, official position on government Corexit would be corroded by living history and BP sound science. When common government/corporate official position was that Corexit was the b prevent offshore oil from polluting Gulf shorelines. They proceeded to million gallons of Corexit through vessel application, as well as novel ap wellhead in effort to disperse the spewing oil at surface. Both below and the government spokespeople told the public to rest assured about Corex said, posed no threat to public health and safety; it was low in Dawn dishwasher soap) and contact with humans and Neither life would be the government authorities mentioned, however, dispersant under regulations, the EPA depends solely on testing provided by the manufacturer and does not environmental impacts of the product before effectiveness Corexit unproven, subsurface application had never been studied, and the independent warned that the dispersant was dangerous. The conflicting perspectives saw one thing: Corexit use made the oil virtually invisible from the surface

Of GAP witness, 77% of cleanup workers reported that they were regularly report the location of oil but not mechanically clean it. When they the following day, the oil typically was surface. More than 85% of cleanup workers that they had contact with Corexit while and 57% reported that they and/or someone family was exposed to chemicals from Corexit outside of the cleanup zone. Nearly 47% reported that they were told by their employer C pose a health risk. More than 70% cited that Corexit continued to be used after (when the Unified Command reported it sto using Corexit)

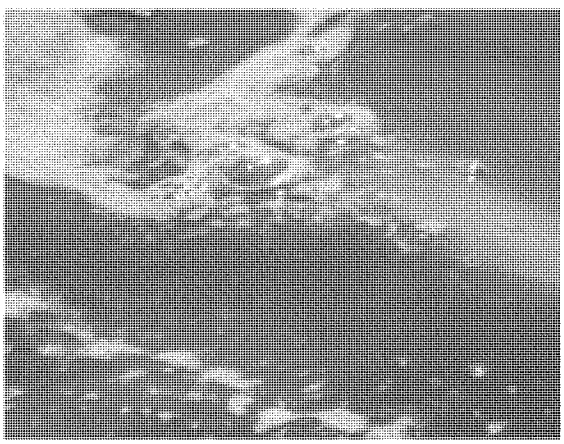


Photo by Shirley Wilkinson. Workers often reported seeing white foam after dispersant was used

BP Official Position

Throughout the spill response, BP provided reassurances surrounding Corexit's use. Press releases described it help a breakdown the oil droplets that could be mo easily dispersed through the seawater and then degraded by natural proc Director Bob Dudley while at the Chief Executives Club in Boston, to

representatives □ð repeatedly □ð compared □ð Corexit □ð to □ð Dawn □ð dishwasher □ð soap, □ð invoking common □ð household □ð product □ð that □ð breaks □ð up □ð the □ð oil □ð and □ð allows □ð for □ð m government □ð framed □ð dispersant "trade off □ð as □ð a □ð oil □ð effects □ð in □ð versus □ð at □ð the □ð shoreline."[19] The □ð company □ð insisted □ð that □ð dispersing □ð the □ð oil □ð offshore □ð would □ð pr wetlands □ð and □ð beaches, □ð where □ð the □ð public □ð would □ð be □ð exposed □ð to □ð chemicals □

To □ð ensure □ð worker □ð and □ð public □ð safety, □ð BP □ð application □ð of □ð Corexit □ð was □ð daylight □ð hours, □ð with □ð the □ð goal □ð of □ð keeping □ð any □ð surface □ð spray □ð two □ð or □ð any □ð boats □ð in □ð the □ð vessels □ð of □ð opportunity □ð program. □ð that □ð all □ð dispersants □ð "applied □ð more □ð three □ð miles □ð from □ð the □ð shoreline

□ð

According □ð to □ð BP, □ð an □ð unprecedented □ð 1.84 □ð million □ð gallons □ð of □ð Corexit □ð were □ its □ð last □ð application □ð on □ð July □ð 19, □ð 2010 □ð well □ð was □ð capped. □ð July □ð 2012 □ð meeting the □ð BP □ð headquarters □ð in □ð Houston, □ð BP □ð Vice □ð President □ð Luke □ð Keller □ð informed will □ð continue □ð to □ð consider □ð Corexit □ð as □ð a □ð viable □ð option □ð for □ð oil □ð spill □ð res approved □ð dispersant □ð on □ð the □ð National □ð Contingency □ð Plan. □ð whether □ð BP □ð will □ð do anything □ð different □ð with □ð how □ð it □ð uses □ð Corexit □ð for □ð the "No." □ð Next □ð the □ð spill, □ð th government □ð intervenes, □ð this □ð dispersant □ð will □ð be □ð the □ð unrestrained □ð chemical □ð of □ð oil □ð spills □ð apparently □ð vanish. □ð will □ð just □ð have □ð to □ð learn □ð to □ð live □ð with □ð Cor price □ð for □ð invisibility. □ð

□ð

Government □ð Official □ð Position

□ð

According □ð to 's □ð EPA □ð data, □ð Corexit □ð is □ð less □ð effective □ð on □ð Louisiana □ð Sweet □ð Cr the □ð type □ð of □ð oil □ð released □ð during □ð the □ð BP □ð spill □ð approved □ð dispersants. □ð by □ð the □ð environmental □ð and □ð public □ð health □ð community □ð around □ð the □ð toxic □ð natu issued □ð a □ð directive □ð in □ð May □ð 2010 □ð that □ð required □ð BP □ð to □ð use □ð a □ð less □ð had □ð already □ð been □ð required □ð to □ð switch □ð from □ð Corexit □ð 9527 □ð to □ð the □ð slightly When □ð BP □ð claimed □ð it □ð was □ð unable □ð to □ð identify □ð an □ð alternative □ð dispersant □ð i required □ð BP □ð to □ð dramatically □ð scale □ð back □ð the □ð use □ð of □ð Corexit □ð subsurface □ð ap at □ð the □ð wellhead. □ð However, □ð BP □ð was □ð able □ð to □ð request □ð exemptions □ð from □ð th and □ð aerial □ð and □ð vessel □ð spraying □ð continued □ð throughout □ð the □ð BP □ð spill, □ð often □ C┐ □관Ġ130 □ð planes.

□ð

Shortly □ð before □ð the □ð well □ð was □ð capped, □ð EPA □ð reported □ð that □ð Corexit □ð was □ð co dispersants, □ð sending □ð mixed □ð signals □ð to □ð the □ð public □ð about □ð workers □ð safety. sought □ð clarification. □ð In □ð an □ð internal □ð memo □ð Disease □ð Control □ð employee □ð inquired, "In □ð regards □ð to □ð the □ð issue □ð of □ð using □ð the □ð Corexit □ð dispersants, □ð is □ð it countries □ð have □ð banned □ð their □ð use □ð because □ð of □ð their □ð toxicity □ð and □ð because shown □ð to □ð be □ð more □ð effective □ð Hugh □ð Kauffman □ð Ġ□ð one □ð public □ð EPA □ð whistleblower on □ð Corexit – □ð more □ð bluntly □ð asked, □ð "I □ð would □ð be □ð grateful □ð … □ð if □ð someone □ð c of □ð lbs. □ð of □ð useless □ð toxic □ð dispersant □ð is □ð being □ð dumped □ð loading □ð the □ð Gulf, □ð to Publicly, □ð the □ð EPA □ð Administrator □ð Lisa □ð Jackson □ð can □ð honestly □ð say □ð I □ð had □ð a □ð tougher □ð decision □ð than □ð the □ð one □ð regarding □ð use □ð of □ð Andrea □ð 2011 □ð Coast □ð Gua

report □ð found: "[T]he □ð lack □ð of □ð current □ð scientific □ð data □ð and □ð effect □ð of □ð dispersed □ð c
toxicity □ð hindered □ð the □ð ability □ð of □ð responders □ð and □ð agency □ð officials □ð to □ð adequat
concerns."[33] Despite □ð these □ð uncertainties, □ð two □ð years □ð after □ð the □ð BP □ð spill, □ð in □ð Ap
reaffirmed □ð its □ð earlier □ð assessment □ð that □ð Corexit □ð had □ð roughly □ð the □ð same □ð toxici
and □ð reported "dispersant □ð oil □ð mixtures □ð were □ð generally □ð no □ð more □ð toxic □ð species □ð the □ð
than □ð oil □ð alone."[34] Six □ð months □ð later, □ð an □ð independent □ð study □ð would □ð find □ð that □ð Core
from □ð the □ð BP □ð spill □ð is □ð more □ð toxic □ð the □ð oil □ð alone, □ð casting □ð doubt □ð on □ð the □ð
position.[35] □ð □ð
□ð

Independent □ Position □

□ð

In □ð 2005 □ð the □ð National □ð Academy □ð of □ð Sciences □ð (NAS) □ð issued □ð the □ð last □ð comprehensiv
the □ð use □ð of □ð dispersants □ð in □ð oil □ð spill □ð responses. □ð The □ð report, □ð Understanding □
Efficacy □ð and □ð Effects, □ð warned □ð that □ð "the □ð current □ð understanding □ð of □ð key □ð processes □ð and □ð mechanisms □ð is □ð
inadequate □ð to □ð confidently □ð support □ð a □ð decision"[36] □ð to □ð apply □ð dispersants. □ð A □ð 2012 □ð study □ð published □ð in
international □ð journal □ð Environmental □ð Pollution □ð removed □ð room □ð for □ð doubt □ð around
that □ð synergistic □ð interaction □ð between □ð oil □ð and □ð Corexit □ð makes □ð the □ð combined □ð effect □ð
than □ð oil □ð alone. □ð The □ð study warned, "This □ð is □ð a □ð cautionary □ð tale □ð that □ð we □ð need □ð
science □ð before □ð the □ð emergency □ð happens □ð so □ð we □ð can □ð make □ð decisions □ð that □
case, □ð the □ð Corexit □ð is □ð simply □ð there □ð to □ð make □ð the □ð oil □ð disperse □ð and □ð go
mean □ð it □ð safe □ð in □ð regard □ð to □ð the □ð food □ð web."
□ð

While □ð BP □ð was □ð receiving □ð exemptions □ð to □ð use □ð more □ð Corexit, □ð much □ð of □ð the
pleading with □ð the □ð government □ð to □ð stop □ð its □ð use □ð altogether. □ð During □ð the □ð respo
statement □ð by □ð range □ð of □ð scientists □ð asserted: □ð
□ð

> Corexit dispersants, □ð in □ð combination □ð with □ð crude □ð oil, □ð pose □ð grave □ð health □ð ris
> life □ð and □ð human □ð health, □ð and □ð threaten □ð to □ð deplete □ð critical □ð niches □ð in □
> that □ð may □ð never □ð recover □ð. □ð The □ð use □ð of □ð dispersants □ð does □ð not □ð represent □ð a □ð sci
> based, □ð quantifiable □ð "trade off" □ð but □ð rather □ð amounts □ð to □ð large □ð experiment □ð on □ð the □ð
> Gulf □ð of □ð Mexico □ð ecosystem □ð that □ð runs □ð contrary □ð to □ð a □ð precautionary □ð ap
> experiment □ð where □ð the □ð costs □ð may □ð ultimately □ð outweigh □ð the □ð benefits.
> □ð

Concerns □ð were □ð widespread □ð that □ð the □ð political □ð will □ð to □ð make □ð the □ð oil □ð disappear
dispersion □ð would □ð take □ð precedent □ð over □ð impacts □ð long □ð Corexit □ð use. □ð The □ð consensus
statement □ð warned, "[O]nce □ð oil □ð is □ð dispersed □ð in □ð deep □ð water, □ð it □ð cannot □ð be □ð re
combined □ð with □ð dispersants □ð in □ð the □ð water □ð column □ð is □ð more □ð toxic □ð to □ð ma
dispersant □ð alone."[39] The □ð Natural □ð Resources □ð Defense □ð Council □ð (NRDC) □ð reported □ð that □ð only □ð eight □ð
percent □ð of □ð BP □ð was □ð removed □ð or □ð burned. □ð The □ð remainder □ð of □ð the □ð oil □ð
environment □ð as □ð it □ð or □ð dissolved □ð into □ð the □ð water □ð column, □ð floated □ð to □ð the
deposited □ð on □ð the □ð coast, □ð or □ð sank □ð to □ð seafloor □ð bottom
□ð

ED_001324_00007754-00017

On □ð the □ð day □ð was □ð volunteered, □ð officials □ð announced □ð that □ð 71 □ð percent □ð was □ð gone.[41] The □ð government □ð was □ð quickly □ð required □ð to □ð withdraw □ð the □ð assertion □ð tha degrading, □ð however, □ð after □ð scientists □ð discovered □ð extensive □ð underwater □ð plumes □ð thro that □ð resulted □ð from □ð dispersant □ð application □ð the □ð unprecedented □ð use □ð of □ð Corexit, □ð oil managed □ð to □ð plague □ð Gulf □ð wetlands □ð and □ð beaches. □ð According □ð to □ð the □ð Nationa following □ð the □ð BP □ð spill □ð more □ð than □ð 650 □ð miles □ð oil □ð coastal □ð ha

□ð

Human □ð health □ð concerns □ð were □ð founded □ð well. □ð NAS □ð reported □ð that □ð exposure □ð to □ð Cor caused □ð adverse □ð health □ð effects □ð to □ð some □ð responders □ð dating □ð as □ð far □ð back □ð a creation □ð of □ð the □ð slightly □ð less □ð 9500. □ð Despite □ð Corexit □ð known □ð threats, □ð Corexit □ð 9527 □ð w throughout □ð the □ð Gulf □ð early □ð in □ð the □ð cleanup. □ð □ð The □ð composition □ð of □ð both □ months □ð into □ð the □ð BP □ð spill □ð and □ð after □ð an □ð unprecedented □ð amount □ð of □ð Cor its □ð chemical □ð composition □ð was □ð increased □ð fears □ð that □ð it □ð was □ð much □ð more □ð than □ð the □ð public □ð was □ð led □ð to □ð believe, □ð and □ð sounding □ð alarms □ð throughout □ð the □ð Gulf □ð (s the □ð response, □ð workers □ð and □ð residents □ð frequently □ð reported □ð with □ð Corexit □ð into □ð through □ð aerial □ð and □ð vessel □ð spraying, □ð diving □ð or □ð even □ð near □ð shore □ð and □ð inshore □ð use Guard □ð released □ð a □ð report □ð finding □ð organization □ð was □ð able □ð to □ð refute □ð reports boats, □ð and □ð homes □ð being □ð with □ð dispersant. □ð However, □ð the □ð public □ð reported □ð by □ð internal □ð Coast □ð Guard □ð incident □ð tells □ð a □ð very □ð different □ð story. □ð

□ð

□ð **Whistleblower □ð Record** □ð

□ð

a. Oil □ð Disappeared □ð

"When □ð they □ð started □ð spraying □ð the □ð Corexit □ð we □ð did □ð they □ð were □ð doing, □ð dispersant □ð planes □ð would □ð fly □ð by □ð at □ð odd □ð hours □ð during □ð the □ð night □ð or □ð d information □ð about □ð the □ð spraying. □ð However, □ð we □ð quickly □ð learned □ð the □ð days □ð t spray. □ð The □ð Incident □ð Command □ð Center □ð provided □ð our □ð vessel □ð to □ð go □ð to □ð … □ð W miles □ð of □ð thick □ð tar □ð ball □ð oil □ð one □ð day, □ð and □ð the □ð next □ð day □ð they □ð wou went □ð to □ð our □ð new □ð location, □ð we □ð would □ð pass □ð the □ð location □ð from □ð the □ð pr dispersed □ð oil □ð happened □ð this □ð routinely." □ð (Jorey □ð Danos, □ð 3) □ð

□ð "From □ð May □ð 2010 □ð through □ð fall □ð 2011, □ð community □ð members □ð reported □ð to □ð and □ð see □ð a □ð slick, □ð that □ð night □ð hear □ð the □ð planes, □ð and □ð then □ð the □ð next □ð d and □ð estuary □ð Dr. □ð Wilma □ð Subra, □ð 14) □ð

"[T]here □ð was □ð an □ð oil □ð slick □ð three □ð miles □ð long □ð and □ð a □ð half □ð mile □ð wide □ð W we □ð reported, □ð however □ð … □ð BP □ð had □ð the □ð equipment □ð they □ð were □ð not □ð putting on □ð the □ð boats □ð … □ð I □ð raised □ð noise, □ð got □ð and □ð threatened □ð to □ð contact □ð r would □ð not □ð provide □ð us □ð the □ð tools □ð to □ð properly □ð contain □ð morning □ð clean □ð receive permission □ð to □ð lay □ð boom, □ð but □ð the □ð oil □ð was □ð all □ð gone □ð … □ð All □ð that □ð cou foam □ð … □ð The □ð evening □ð before, □ð they □ð had □ð contacted □ð me □ð and □ð wanted □ð a □ð slick." □ð (Sydney □ð Schwartz, □ð 2) □ð

□ð

"I □ð was □ð sprayed □ð off □ð of □ð Port □ð Fourchon. □ð That □ð was □ð the □ð same □ð day □ð that Tartellon □ð Bay □ð … □ð and □ð they □ð were □ð trying □ð to □ð contain □ð working □ð but □ð the □ð next □ð day, □ð after □ð they □ð had □ð sprayed, □ð there □ð was □ð no □ð more □ð oil □ð in □ð Tartellon □ð Ba

ED_001324_00007754-00018

"We ð waited ð two ð days ð in ð between, ð and ð when ð we ð went ð back ð to ð our
were cleaning ð was ð gone. ð Boats ð had ð come ð in ð and ð sprayed ð the ð dispersant
where ð after ð they ð came ð and ð sprayed ð the ð oil ð it ð just ð sank, ð but ð you
South ð Pass ð and ð when ð you ð spun ð the ð mud ð up ð you ð (Anonymous ð #1, ð 3)

"On ð more ð than ð one ð occasion ð my ð husband ð just ð begged ð to ð drop ð boom ð
could ð smell ð oil ð fields ð long ð of ð oil ð sheen ð with ð clumps ð of ð the ð oil ð i
would ð be ð sent ð to ð location ð different ð day ð in ð late ð July ð when ð we ð went ð out
everywhere ð … ð the ð Coast ð Guard ð directed ð us ð not ð to ð drop ð boom ð and ð
direction ð of ð the ð oil. ð The ð following ð day ð Coast ð Guard ð Admiral ð Thad ð Aller
more ð recoverable ð oil ð (Shirley ð Tillman, ð 5)

"Using ð Corexit ð in ð the ð Gulf ð made ð it ð more ð difficult ð to ð identify ð BP ð MC
breaks ð down ð very ð fast ð in ð the ð environment, ð and ð it ð is ð supposed ð to ð e
down ð 'fingerprint' of ð the ð oil. ð The ð fingerprint ð contains ð organic ð hydrocarbons ð th
and ð we ð have ð tools ð to ð help ð determine ð if ð the ð oil ð came ð from ð the ð
(Scott ð Porter, ð 6) ð

b. Contact with Corexit

"Airplanes ð sprayed ð dispersant ð on ð our ð members ð on ð multiple ð occasions. ð After ð th
happened ð I ð reported ð it ð to ð OSHA ð … ð and ð sprayed ð when ð that ð they ð did ð were
there. ð The ð Coast ð Guard ð had ð to ð approve ð the ð sprays ð each ð time. ð BP ð s
inshore; ð however, ð they ð would ð have ð the ð VoO ð workers ð report ð the ð location
them ð to ð a ð different ð location, ð and ð then ð spray ð the ð locations ð that ð they
spray ð from ð a ð distance ð but ð the ð wind ð and ð hit ð came ð (Anonymous ð directly.
Cooper, ð 4) ð

"[O]n ð the ð VoO ð program, ð I ð was ð sprayed ð with ð Corexit ð four ð times ð … ð T
dispersed ð oil ð corresponded ð with ð our ð health ð symptoms, ð Gender ð was ð an ð old
take ð our ð breath ð The ð dispersant ð was ð sprayed ð when ð you ð spray ð a ð water ð h
the ð wind, ð it ð will ð mist ð and ð spray ð back ð on ð you ð … ð [T]wice ð over ð saw
then ð we ð entered ð a ð cloudy ð haze, ð even ð though ð it ð was ð instances ð the ð sunny
dispersant ð directly ð hit ð me, ð including ð Dayos, ð 4) ð

"I ð been ð taking ð pictures ð of ð the ð wildlife ð and ð the ð water ð … ð [T]hese ð b
were ð going ð west ð the ð stuff ð they ð were ð spraying ð would ð have ð stood ð us ð
to ð take ð pictures ð had ð I ð known ð what ð I ð do ð now ð about ð the ð effects ð
public ð health ð threat, ð because ð it ð has ð been ð approved ð for ð use. ð I ð went ð
tried ð to ð wash ð my ð face ð and ð hands ð but ð it ð was ð already ð in ð my ð eye
(Shirley ð Tillman, ð 6) ð

"On ð August ð 21, ð 2010 ð I ð was ð sprayed ð by ð the ð BP ð decontamination ð boat
wind ð came ð off ð the ð Gulf ð and ð the ð mist ð from ð the ð decontamination ð arm
the ð time ð I ð was ð concerned ð and ð did ð not ð think ð it ð was ð dispersant, ð becau
Corexit ð was ð being ð used ð as ð of ð July ð 2010. ð However, ð by ð that ð afternoon ð
been ð sunburned ð (Lori ð Bosarge, ð 1) ð

ð "My ð boat ð got ð sprayed ð on ð May ð 26, ð 2010, ð the ð same ð day ð as ð the
got ð sprayed ð with ð dispersants ð and ð got ð sick. ð Then ð two ð days ð after ð that ð
got ð misted. ð (Anonymous ð #1, ð 3) ð

“I ð got ð sprayed ð with ð Corexit ð was ð having ð a ð casual ð conversation, ð and ð all ð o
plane. ð The ð Corexit ð is ð nasty ð stuff. ð It ð’s ð disintegrates ð it, ð comes ð right ð off ð skin. ð and When
is ð sprayed ð from ð an ð airplane ð and ð it ð hits ð you ð (Anonymous ð #2, ð 4)…ð

“They ð were ð spraying ð Corexit ð around ð the ð time ð we ð started ð diving ð … ð NOAA
2010 ð Corexit ð would ð not ð be ð sprayed ð in ð the ð areas ð where ð we ð were ð c
the ð well ð was…ð ð However, ð we ð have ð Corexit ð in ð the ð freshwater ð from ð August ð
2010 ð and ð August ð 18, ð 2011” ð (Steve ð Kolian, ð 4) ð

ð “[O]n ð October ð 13, ð 2010 ð I ð was ð sitting ð in ð front ð of ð my ð house ð and
realized ð it ð was ð C130s ð flying ð over ð us. ð I ð ran ð into ð the ð house ð and ð I ð
windshield… ð An ð investigative ð journalist ð came ð to ð our ð home ð a ð few ð days ð
from ð our ð pond…[and] ð from ð the ð beach ð at ð Pass ð Christian, ð Mississippi. ð The
came ð back ð positive ð for ð the ð chemical ð Corexit” ð (Lorie ð Williams, ð 5) ð

“My ð son ð was ð three ð in ð June ð 2010 ð when ð my ð relatives ð took ð him ð to
[large ð military] ð planes ð flew ð over ð the ð water ð they ð dispersed ð what ð my ð re
since ð it ð was ð still ð flying ð in ð the ð Gulf ð during ð that ð time. ð As ð it ð was ð
may ð have ð carried ð it ð into ð the ð pool ð that ð my ð son ð used. ð I ð found ð
agent ð for ð the ð compounds ð found ð in ð Corexit” ð (Anonymous #3, ð 1) ð

“I ð [attended] ð a ð meeting ð at ð the ð BP ð Unified ð Command ð Center ð on ð July
safety ð protection ð issues ð for ð VoO ð workers ð … ð When ð I ð walked ð into ð the
representative ð dropped ð an ð Incident ð Report ð right ð in ð front ð of ð me ð that ð
to ð VoO ð vessels ð in ð May ð 2010 ð … ð On ð May ð 5, ð 2010 ð there ð were ð fou
planes ð sprayed ð inside ð of ð procedural ð distances. ð They ð were ð supposed ð to ð ma
one ð mile ð from ð any ð vessels ð or ð platforms ð and ð the ð source ð (well ð location), ð
according ð to ð the ð Incident ð Report, ð on ð two ð occasions ð a ð plane ð reported ð a
passed ð directly ð over ð a ð platform ð while ” (Spraying ð Guidelines, ð 2)

c. Government and BP Positions

“On ð May ð 26, ð 2010, ð Administrator ð Jackson ð responded ð that ð BP ð must ð reduce
used ð by ð 75%. ð Subsurface ð application ð of ð the ð dispersant ð continued ð and ð BP
use ð under ð the ð terms ð of ð the ð directive. ð Surface ð application ð was ð supposed
could ð justify ð its ð use ð due ð to ð weather ð or ð if ð it ð identified ð an ð oil ð s
exemptions ð to ð apply ð the ð dispersant” (Dr. ð Wilma ð Subra, ð 14) ð

“During ð the ð time ð that ð BP ð was ð spraying ð from ð the ð August ð 2010, ð I ð kept ð g
lot ð of ð calls ð from ð workers ð offshore ð reporting ð that ð they ð were ð being ð spra
respiratory ð problems ð and ð nausea. ð On ð an ð ongoing ð basis ð I ð would ð speak ð
received ð information ð that ð these ð workers ð offshore ð rigs ð were ð being ð sprayed. ð
into ð it ð and ð come ð back ð and ð say ð to ð Wilma. ð We ð are ð not ð spraying ð wh
workers ” ð (Dr. ð Wilma ð Subra, ð 14) ð

“Their ð [government] ð cards ð read ð special ð agents, ð and ð they ð investigating ð the ð use
of ð Corexit ð in ð inland ð water ð ... ð I ð asked ð them, ð for ð you ð all ð to ð get ð
Corexit ð manufacturer ð Nalco ð for ð how ð many ð gallons ð BP ð has ð bought ð from ð
here…since ð they ð admitted ð spraying ð 1.8 ð million ð gallons? ð No, ð two ð can
that, ð it ð way ð too ð early ð in ” ð (Shirley ð Gibson, ð 12, ð 13) ð

By "□ law, □ dispersants □ cannot □ be □ applied □ closer □ than □ three □ miles □ to □ sho
into □ the □ spill □ BP □ started □ spraying □ inshore □ … □ EPA □ stated □ that □ Corexit □ was □
but □ went □ on □ to □ explain □ that □ through □ state □ exemptions □ it □ could □ be □ s
state □ waters, □ the □ company □ applying □ the □ dispersant □ that □ they □ have □ sprayed
dispersants… □ You't □ can □ find □ out □ who □ sprayed □ what, □ when, □ where, □ and □ yet □
reporting □ that □ they □ have □ been □ sprayed. □ Dr. □ Wilma □ Subra, □ 14 □ ┐ □ 괆Ġ □ 15) □

I □ asked □ Captain □ Stanton □ with 'Don't □ you □ to □ the □ squalls □ forming □ over □ the □
Northern □ Gulf □ are □ going □ to □ pick □ up □ some □ of □ these □ chemicals, □ bring □
people?" He □ replied, □ no, □ we □ not □ spraying □ anywhere □ within □ 30 □ miles □ they □ land
sprayed □ closer □ than □ that □ but □ it □ anyway □ … □ because □ the □ rain □ clouds □
northern □ Gulf □ outside □ of □ the □ Peninsula □ during □ the □ mid □ summer □ and □ in
within □ 70 □ miles □ of □ the □ coast □ could □ be □ swept □ inland. □ We □ warned □ th
representatives □ that □ we □ would □ be □ exposed □ to □ the □ pollutants □ from □ the □
unconcerned. □ At □ that □ meeting □ I □ was □ in □ tears, □ I □ feared □ for □ my □ kids.

□ "By □ the □ time □ we □ left □ the □ [July □ 2012] □ meeting, □ BP □ asserted □ that □
they □ would □ not □ consider □ discontinuing □ the □ use □ of □ Corexit □ as □ a □ dispersa
They □ also □ refused □ to □ commit □ immediately □ to □ when □ they □ use □ the □ dispersa
in □ the □ future, □ but □ said □ they □ would □ consider □ action □ to □ stop □ blindsidin
that □ as □ long □ as □ Corexit □ was □ approved □ by □ U.S. □ regulations, □ they □ had □
responding □ to □ oil □ spill. □ Dr. □ Michael □ Robichaux, □ 15) □

"We □ worked □ with □ the □ Parish □ to □ the □ point □ where □ they □ now □ notify □ a
before □ they □ spray □ [for □ mosquitoes], □ so □ that □ they □ can □ chose □ to □ leave □
the □ newspaper, □ so □ the □ broader □ population □ can □ know □ when □ they □ are □ go
It's □ not □ dispersant □ very □ toxic □ … □ The □ problem □ is □ worse □ with □ dispersan
no □ requirement □ that □ BP □ has □ to □ record □ where □ it □ sprayed, □ and □ that □
they □ were □ spraying" □ Dr. □ Wilma □ Subra, □ 15) □

In "□ Gonzales, □ LA □ there □ is □ a □ major □ holding □ facility □ where □ several □ kinds
there □ is □ August □ 2011 □ and □ saw □ believe □ stored. □ After □ Corexit □ damage □
caused, □ it □ is □ still □ being □ sold □ … □ BP □ whole □ the □ federal □ government □
sight, □ out □ of □ that □ what □ the □ Corexit □ (Anonymous □ #2, □ 6) □

d. Is □ Corexit □ Safe? □

"The □ government □ and □ BP □ also □ have □ taken □ the □ not □ need □ to □ be □ concern
exposure □ to □ Corexit, □ because □ it □ has □ a □ 90 □ minute □ half □ life, □ which □ me
the □ components □ evaporate □ and □ the □ other □ half □ of □ the □ concentration □ remain
dangerous. □ That □ is □ accurate □ in □ this □ case, □ because □ the □ compounds □ from □
in □ contact □ with □ the □ crude □ and □ get □ interconnected □ … □ This □ is □ really □
amount □ of □ dispersant □ has □ not □ been □ used □ before □ in □ such □ quantities □ with
oil. When □ the □ remaining □ oil □ and □ dispersants □ are □ disrupted, □ the □ compounds □
divers □ went □ into □ plumes, □ they □ were □ exposed. □ Dr. □ Wilma □ Subra, □ 10) □

"I □ have □ lived □ on □ the □ Louisiana □ coast □ for □ 67 □ years □ and □ spent □ Grand
Isle □ and □ in □ the □ waterway □ now □ named □ Port □ Fourchon. □ The □ earliest □ offsh
off □ the □ coast □ of □ Louisiana. □ At □ that □ time, □ have □ called □ companies □ could □ spilling
into □ the □ environment. □ Those □ frequented □ the □ beach □ at □ Grand □ Isle □ came □
feet □ and □ stained □ swim □ suits □ due □ to □ the □ oil □ present □ on □ the □ beaches

not □ð recall □ð a □ð single □ð incidence □ð in □ð which □ð anyone □ð became □ð ill □ð as □ð the □ð res
to □ð the □ð tar □ð balls □ð and □ð tar □ð present □ð on □ð the □ð beaches. □ð It □ð is □ð obvious □ð th
different □ð about □ð this □ð recent □ð spill. □ð BP □ð insisted, □ð even □ð after □ð the □ð EPA □ð reques
dispersant □ð than □ð Corexit □ð they □ð could □ð and □ð should □ð use □ð this □ð chemical □ð to □ð hi
pouring □ð into □ð the □ð Gulf. □ð It □ð is □ð beyond □ð credible □ð doubt □ð that □ð this □ð decision □
Corexit □ð is □ð the □ð prime □ð suspect □ð for □ð the □ð illnesses □ð ruining □ð the □ð lives □ð of □ð s
today. □ð It □ð is □ð probably □ð also □ð responsible □ð for □ð the □ð death □ð of □ð our □ð dolphins, □
the □ð crabs □ð and □ð shrimp □ð that □ð are □ð harvested □ð from □ð the □ð waters's □ð where □ð these
defiance □ð in □ð this □ð situation □ð is □ð similar □ð to □ð ignoring □ð safety □ð guidelines □ð that □ð resulte
original □ð explosion □ð of □ð the □ð Deepwater □ð Horizon. □ð Michael □ð Robichaux, □ð 14) □ð

"In □ð the □ð fall □ð of □ð 2010 □ð we □ð had □ð just □ð come □ð in □ð from □ð a □ð day □ð research
Bobby □ð Jindal □ð getting □ð on □ð the □ð helicopter □ð We... □ð will □ð get □ð this, □ð area □ð reopened □ð for □
responded, If □ð so, □ð they □ð be □ð can spraying... □ð Corexit □ð a □ð supporter □ð of □ð the □ð governor, □
even □ð get □ð a □ð response □ð from □ð his □ð office □ð on □ð whether □ð spray □ð not □ð Louisiana □ð was
It □ð was □ð important □ð because □ð throughout □ð this □ð time □ð NOAA □ð said □ð it □ð was □ð safe
dive. □ð However, □ð my □ð health □ð was □ð getting □ð worse. □ð (Scott □ð Porter, □ð 13┐ □관 Ġ14) □ð

"The □ð oil □ð sludge □ð that □ð they □ð and □ð other □ð workers □ð brought □ð in □ð problem □ð in □ð w
dangerous □ð ... □ð Early □ð on □ð I □ð asked □ð a □ð BP □ð staff □ð member □ð how □ð I □ð could □ð
what □ð was □ð in □ð it □ð ... □ð He □ð said □ð that □ð the □ð stuff □ð on □ð the □ð floor □ð that □ð I
sludge □ð ... □ð was □ð safe □ð as □ð washing □ð detergent □ð I □ð could □ð mop □ð it □ð like □ð I □ð moppe
floor; □ð no □ð special □ð treatment □ð was □ð needed." □ð (Jamie □ð Griffin, □ð 3) □ð
□ð
"They □ð started □ð spraying □ð the □ð dispersant □ð it □ð Corexit □ð hard □ð to □ð breathe □ð and □ð everyone
for □ð respirators. □ð Everyone □ð was □ð getting □ð worried □ð because □ð the □ð boats □ð got □ð spray
breathing □ð the □ð mist □ð in □ð all □ð day □ð long. □ð know □ð anything □ð about □ð the □ð deal □ð da
the □ð Corexit; □ð they □ð explained □ð that □ð Corexit □ð was □ð like □ð Anonymous □ð #1, □ð 2) □ð liquid

We □ð knew □ð that □ð the □ð BP □ð spill □ð was □ð Louisiana □ð Sweet □ð Crude. □ð We □ð knew □ð
toxicity □ð level □ð increased □ð when □ð mixed □ð with □ð Corexit. □ð BP □ð Corexit □ð 9527 □ð and □ð
shortly □ð into □ð the □ð spill □ð they □ð switched □ð to □ð a □ð slightly □ð less □ð toxic □ð 9500, □ð w
alternative □ð EPA □ð approved □ð dispersants. □ð EPA □ð and □ð BP □ð knew □ð of □ð the □ð health □ð
The □ð issue □ð was □ð responding □ð to □ð this □ð magnitude, □ð with □ð unprecedented □ð quantities
including □ð novel □ð subsurface □ð application. □ð Gulf □ð coastal □ð communities, □ð and □ð individua
seafood □ð or □ð recreate □ð in □ð the □ð gulf, □ð are □ð the □ð guinea □ð pigs □ð left □ð to □ð deal
feeling □ð the □ð full □ð effect □ð in □ð (Dears □ð Wilma □ð Sohra, □ð 16) □ð

□ð

□ð □ð

3. Safety Ignored

"They hired people from all over who didn't know about the conditions and real sa you did what you had to do; you had to take the cause you have to do with go home. There was a safety bush, happen." Anonymous Cleanup Worker

A total of 47,000 workers were involved in the response to the BP employed by BP Contractors. its Operation was under the Unified Command, the Occup Safety and Health Administration (OSHA) was responsible to ensure that all workers protected from hazards associated with the cleanup. Workers cleanup included offshore, near shore (within three nautical miles), and (beach shore cleanup). The Vessels of Opportunity (VoO) Program, created to employ local boat operators during to near shore and some offshore activities such with the temporary oil, floating barrier used to contain skimming (spill) and a machine to remove on the water).

Placing public perception above public safety, BP and the government gro associated with chemical exposure from the BP spill. BP's falsely asserted was the most serious cleanup hazard. Based on what prohibited from us respirators and initially offered minimal safety training that did not equip workplace. Corporate and government announcements repeatedly issued official s coastal communities (including vulnerable populations) that their environment was sa was "normal." Meanwhile, EPA reports used to validate the respirator policy ease about exposure to carcinogens were contradicted by mutual government independent data. Raising additional safety questions, when GAP and LEAN the alleged removal of federally required resource manuals (detailing Corexit from VoO worksites, the company provided contradictory information surroundin the manuals.

Photo by NOAA. Worker spraying dispersant with protective equipment.

Of GAP witnesses, 100% of workers interviewed reported that they ei not receive training, or did no the federally required training. 100% reported that they wer minimal or personal protective equipment. Nearly 85% reported were not aware of available literature on the job site.

BP Official Position

Following the BP spill, Bob Dudley, CEO of BP's Gulf Coast Restoration Organization, in association with the Unified C provided task specific training, supplied personal protective equipment and c

environmental □ð and □ð worker □ð monitoring □ð to □ð protect □ð the □ð health □ð of □ð response □ð w
cleanup."[50] Throughout □ð the □ð BP □ð spill, □ð worker □ð safety □ð trainings □ð and □ð personal □ð prot
(PPE) □ð were □ð tailored □ð to □ð address □ð what □ð BP □ð "risked from the □ð workers □ð in the □ð
summer □ð heat □ð of"[51] BP □ð created □ð a [52] that □ð OSHA □ð adopted □ð on □ð its □ð website □ð for □ð
on □ð cleanup □ð positions. Suggested □ð safety □ð gear □ð ranged □ð from □ð a □ð sunhat/sunscreen, □ð hardha
and □ð gloves □ð to □ð various □ð styles □ð of □ð suits □ð and □ð boots. □ð When □ð workers □ð asked
argued □ð that □ð it □ð was □ð not □ð necessary □ð to □ð EPA □ð air □ð quality □ð threatened □ð work
termination □ð if □ð they □ð wore □ð their □ð own □ð respiration □ð protection □ð (see data □ð would □ð
undermine □ð its □ð position, □ð when □ð in □ð June □ð 2010 □ð it □ð conducted □ð 32 □ð KEG □ð to □ð health
effects □ð in □ð Exxon Valdez □ð workers □ð and □ð a □ð key □ð ingredient □ð in □ð Corexit □ð 9527 □ð – □
offshore □ð workers □ð at □ð levels □ð two □ð times □ð greater □ð than □ð worker □ð safety □ð standards
Institute □ð for □ð Occupational □ð Safety □ð and □ð Health □ð (NIOSH) □ð seeming □ð
evidence □ð of □ð chemical □ð exposure, □ð the □ð government □ð maintained □ð a □ð loyal □ð partnershi
downplaying □ð the □ð threat □ð surrounding □ð crude □ð oil □ð and □ð Corexit □ð in □ð the □ð Gulf. □ð
□ð

Government □ð Official □ð Position □ð

□ð

According □ð to □ð OSHA's □ð Hazard □ð Communications □ð Standard, □ð "Employees □ð have □ð both □ð a □ð need □ð and □ð a
know □ð the □ð hazards □ð and □ð identities □ð of □ð the □ð chemicals □ð they □ð are □ð exposed □ð to
to □ð know □ð what □ð protective □ð measures □ð are □ð available □ð to □ð prevent □ð adverse □ð effect
Under government □ð requirements, □ð BP □ð was □ð required □ð to □ð provide □ð each □ð hazwoper □ð with
communication □ð programs; □ð labels □ð and □ð other □ð forms □ð of □ð warning; □ð Material □ð Safety
employee □ð information □ð and □ð training □ð initial □ð assignment □ð to □ð work □ð with □ð a □ð haz
chemical[.]"[58] OSHA □ð records □ð show □ð that □ð of □ð the □ð varying □ð levels □ð of □ð Hazardous □ð
Emergency □ð Response □ð (HAZWOPER) □ð trainings, □ð during □ð the □ð response □ð over □ð 30,000 □
went □ð through □ð a □ð KEG □ð post □ð abbreviated □ð HAZWOPER □ð training □ð VoO □ð workers □ð were □ð required □ð to □ð
take □ð eight □ð hours □ð of □ð training; □ð and □ð supervisors □ð were □ð required □ð to □ð take □ð OSHA □ð complete □
Director □ð David □ð Michaels, □ð in □ð an □ð effort □ð to □ð allay □ð concerns □ð from □ð worker □ð sa
assure □ð only □ð trained □ð workers □ð were □ð in □ð the □ð response, □ð OSHA □ð pressed □ð BP □ð to □ð implem
credentialing □ð system □ð to □ð allow □ð OSHA □ð inspectors □ð to □ð easily □ð verify □ð that □ð all □
required □ð training. □ð That □ð assertion □ð would □ð be □ð flatly □ð refuted □ð by □ð workers □ð participa
investigation. □ð

□ð

Throughout □ð the □ð response, □ð EPA □ð assured □ð workers □ð and □ð residents □ð that □ð air □ð q
and □ð pollutants □ð associated □ð with □ð petroleum □ð products □ð were □ð found □ð at □ð low, □ð
EPA □ð advised □ð sensitive □ð populations □ð to □ð stay □ð indoors □ð to □ð limit □ð exposure, □ð close □ð windows □ð and □ð
doors, □ð and □ð set □ð your □ð air □ð conditioner □ð to □ð recirculation □ð mode. □ð Amazingly, □ð the □ð OSHA □ð policy □ð intended
to □ð prevent □ð these □ð sensitive □ð populations □ð from □ð working □ð in □ð hazardous □ð workplaces
forgoing □ð respirator □ð use □ð during □ð the □ð cleanup, □ð OSHA □ð explained □ð as □ð to □ð why □ð respirators □ð we
during □ð the □ð cleanup, □ð OSHA □ð stated □ð that □ð workers □ð may □ð fail □ð to □ð pass □ð the □ð medical □ð e
required □ð for □ð respirator □ð use □ð "because □ð they □ð suffer □ð from □ð respiratory □ð or □ð cardiac □ð
Ruling □ð out □ð the □ð option □ð for □ð voluntary □ð respirator □ð use, □ð OSHA □ð argued □ð "[c]ertain □ð responses □ð could □ð
put □ð a □ð strain □ð on □ð the □ð heart □ð and □ð lungs □ð of □ð some □ð workers □ð and □ð therefore

ED_001324_00007754-00024

recommended □ð for □ð voluntary □ð use. □ð Furthermore □ð … using □ð respirators □ð risks □ð from □ð extreme □ð heat □ð exceeded □ð the □ð low □ð risk □ð of □ð OSHA's □ð website □ð recommended □ð that □ð the oil □ð away □ð from □ð the □ð well," and □ð was □ð the □ð dangerous □ð substances, □ð such □ð as □ð benzene, □ð evaporated, □ð decreasing □ð the □ð risk □ð posed □ð inhalation □ð fixed □ð heat □ð related □ð illness □ð as □ð most □ð serious □ð threat □ð to □ð cleanup □ð worker □ð health.

While □ð heat □ð stress □ð remained □ð at □ð the □ð forefront □ð of □ð government □ð warnings, □ð othe cautionary □ð perspective. □ð NIEHS □ð warned □ð that □ð synergistic □ð various □ð chemicals □ð in □ð w breathing □ð zones □ð could □ð much □ð greater □ð challenges □ð for □ð establishing □ð acceptable □ð expo criteria[.]"[68] And □ð early □ð worker □ð training □ð conducted □ð by □ð the □ð NIEHS □ð Worker □ð Educat Program □ð (WETP) □ð listed □ð different □ð that □ð workers □ð could □ð encounter □ð on □ð the □ð clear cautioning: "Even □ð if □ð air □ð sampling □ð shows □ð no □ð detectable □ð levels □ð or □ð very □ð low □ may □ð be □ð health □ð effects □ð stressing □ð those □ð warnings, □ð an □ð NIEHS □ð report □ð found □ð personal □ð protective □ð equipment □ð [and] □ð exposure □ð to □ð toxins □ð the □ð impact □ð of □ð the □ð B on □ð response □ð workers.□ð

Despite □ð uncertainties □ð haunt □ð the □ð Gulf □ð to □ð this □ð day, □ð FOSC □ð partnership □ð the □ð BP/ for □ð dodging □ð a □ð public □ð health □ð efforts □ð crisis □ð and □ð commitment □ð to □ð ensure □ð the □ð safety □ð worked □ð on □ð the □ð spill, □ð and □ð that □ð of □ð the □ð public, □ð is □ð one □ð of □ð the □ð single Deepwater □ð Horizon □ð response. □ð The □ð experiences □ð of □ð workers □ð and □ð residents □ð from □ð this repeatedly □ð demonstrate □ð the □ð exact □ð opposite □ð risk □ð record. □ð □ð

□ð

Independent □ð Position □ð

□ð

□ð In □ð May □ð 2010, □ð a □ð U.S. □ð District □ð Court □ð judge □ð granted □ð a □ð temporary □ð rest responsibility □ð for □ð hazardous □ð chemical □ð exposure □ð safety □ð all □ð commercial □ð fishermen □ð working □ð on □ð the □ð cleanup □ð in □ð Louisiana. □ð The □ð Legislature □ð required □ð safety □ð oversight □ð required □ð BP a □ð written □ð safety □ð and □ð health □ð program, □ð monitoring □ð for □ð airborne □ð hazardous □ð c the □ð hazardous □ð chemical □ð exposure □ð risks □ð specific □ð to □ð work □ð areas, □ð monitoring □ð chemicals □ð in □ð work □ð areas, □ð and □ð providing □ð necessary □ð personal □ð protective □ð equip actions.[73] Gulf □ð fishermen □ð largely □ð comprised □ð the □ð VoO □ð workforce, □ð which □ð was □ð pa to □ð chemical □ð exposure □ð through □ð aerial □ð dispersant □ð spraying □ð burns □ð toxic (surface □ð burning □ð of □ð crude □ð oil). □ð However, □ð BP □ð would □ð fail □ð to □ð uphold □ð the □ð court □ð order □ð workers □ð on □ð the □ð frontlines □ð of □ð the □ð cleanup.

Independent □ð air □ð monitoring □ð by □ð LEAN □ð found □ð that □ð chemical □ð concentrations □ð exce health □ð symptom □ð concentrations □ð by □ð 100┐ □괆Ġ120 □ð times, □ð and □ð may □ð have □ð excee average □ð standard □ð by □ð 50 □ð times, □ð undercutting □ð BP □ð and □ð government □ð assertions □ were □ð normal. □ð This □ð caused □ð great □ð alarm □ð among □ð public □ð rights □ð advocates, □ð since □ð EPA □ð air □ð monitoring □ð data □ð was □ð at □ð the □ð forefront □ð of □ð the □ð decision □ð not □ð t exacerbated □ð by □ð reports □ð that □ð workers □ð lacked □ð even □ð the □ð most □ð basic □ð PPE, □ð did □ð not □ð have □ð access □ð to □ð safety □ð information. □ð

Following □ð the □ð BP □ð spill □ð response, □ð confidential □ð whistleblowing □ð disclosures □ð alerted □ resource □ð manuals □ð either □ð were □ð not □ð delivered □ð or □ð were □ð removed □ð from □ð VoO □

cleanup, □ð around □ð the □ð same □ð time, □ð that □ð experience □ð health □ð symptoms □ð detailed □ð by manual.[76] The □ð resource □ð manual □ð provided □ð risks □ð for □ð VoO □ð workers □ð from □ð the □ included □ð the □ð MSDSs □ð for □ð Corexit □ð as □ð required □ð by □ð OSHA □ð regulations. □ð In □ð M sent □ð a □ð letter □ð the □ð BP □ð Ombudsman, □ð to □ð help □ð resolve □ð an □ð apparent □ð and □ð pa between □ð BP □ð safety □ð reassurances □ð to □ð and □ð restrictions □ð on □ð its □ð employees, □ð com warnings □ð and □ð mandatory □ð precautions □ð required □ð by □ð its □ð own □ð internal □ð manual.[77]

In □ð confidential □ð letter, □ð BP □ð confirmed □ð the □ð authenticity □ð of □ð the □ð resource □ð manua removed □ð as □ð the □ð VoO □ð program □ð came □ð to □ð operations □ð was □ð no □ð longer □ð using □ dispersants □ð in □ð the □ð Gulf. □ð GAP □ð subsequently a □ð survey □ð of □ð Vo□ ... □ð Captains, □ð some □ð of whom □ð supervised □ð multiple □ð other □ð captains, □ð and □ð none □ð were □ð aware □ð of □ð such VoO □ð captains □ð surveyed □ð stated □ð they □ð lit□ature □ð on □ð workplace □ð safety, □ð and □ð receiv minimal □ð or □ð no □ð PPE. □ð The □ð BP □ð Ombudsman □ð scheduled □ð the □ð July □ð 2010 □ð me part □ð for □ð BP □ð to □ð explain □ð what □ð happened. □ð At □ð the □ð meeting, □ð however, □ð BP □ resource □ð manual □ð disappearance □ð open □ð litigation □ð medical □ð claims. □ð[78]

BP's □ð contradictory □ð actions □ð raise □ð serious □ð questions □ð whether □ð the □ð company □ð tri hazards □ð of □ð Corexit, □ð as □ð confirmed □ð by □ð the □ð resource □ð manual, □ð from □ð its □ð own broadly, □ð it □ð casts □ð further □ð doubts □ð overall □ð government □ð workplace □ð safety □ð regulations. □ð

At □ð the □ð time □ð of □ð release, □ð the □ð BP □ð Ombudsman □ð is □ð conducting □ð formal □ð investigation □ð into □ð the □ð full □ð extent □ð of □ð BP □ð federal □ð law □ð requiring □ð workplace information □ð for □ð VoO □ð workers; □ð allegations □ð of □ð retaliation □ð against □ð workers □ð for □ð wearing □ protective □ð equipment; □ð and □ð unauthorized □ð use □ð of □ð Corexit □ð after □ð July □ð 2010. □ð GA the □ð investigation □ð BP □ð Ombudsman □ð beginning □ð to □ð schedule □ð interviews □ð with □ð witnesses □ð in □ð 13 □ð months □ð since □ð March □ð 2011, □ð when □ð GAP □ð first □ð disclosed □ð the □ð resourc investigation. □ð □ð

Whistleblower □ □ □ □ Record □

□ð

a. Insufficient □ □ Training □ □ Personal □ Protective □ □ Equipment □ □ □

□ð "Throughout □ð the □ð oil □ð spill □ð cleanup, □ð worker □ð safety □ð trainings □ð were □ð insufficient the □ð workers. □ð OSHA □ð and □ð BP □ð reduced □ð the □ð 40 □ð hour □ð HAZMAT □ð trainings □ð to of □ð the □ð workers. □ð Some □ð workers □ð did □ð not □ð receive □ð any □ð training □ð ... □ð They □ sick, □ð but □ð desperate □ð needing □ð the □ð work. □ð Then □ð they □ð would □ð go □ð back □ð out □ all □ð over □ð again □ð with □ð headaches, □ð nausea, □ð respiratory □ð problems □ð and □ð skin □ð rash the □ð symptoms □ð associated □ð with □ð exposure □ð to □ð the □ð crude □ð oil □ð and □ð dispersant. □ from □ð there." □ð (Dr. □ð Wilma □ð Subra, □ð 3) □ð

"On □ð May □ð 24, □ð 2010 □ð ... □ð DHS □ð invited □ð me □ð to □ð attend □ð a □ð meeting □ð in □ð Ga our □ð opinion □ð on □ð the □ð cleanup. □ð At □ð that □ð meeting □ð I □ð said □ð that □ð I □ð wanted □ that □ð the □ð cleanup □ð workers □ð were □ð being □ð put □ð and □ð I □ð warnings □ð from □ð the □ð briefin packet □ð I □ð created, □ð which □ð included □ð dangers □ð associated □ð with □ð Corexit □ð ... □ð I □ð statement □ð for □ð everyone □ð at □ð the □ð table, □ð including □ð Secretary □ð of □ð the □ð Interior Janet □ð Napolitano, □ð BP □ð Chief □ð Operating □ð Officer □ð Doug □ð Suttles, □ð Senator □ð Landrieu, □ð

Senator □ð Barbara □ð Murkowski, □ð Senator □ð Dick □ð Durbin, □ð then┐ □괆Ġ Coast □ð Guard □ð Rear
Governor □ð Jindal, □ð Mayor □ð Mitch □ð Landrieu, □ð Mayor □ð David □ð Carmadele,tal □ð Representative
Parish □ð Presidents □ð and □ð Councilmen. □ð After □ð the □ð meeting □ð Senator □ð Durbin □ð approac
'They □ð needed □ð to ' □ð I □ð was □ð that □ð trying □ð to □ð prevent □ð them □ð from □ð killing □ð people □ð ar
but □ð they □ð didn't □ð heed □ð my □ð warnings □ð … □ð Two □ð Days □ð workers □ð were □ð May □ð 26, □
the □ð hospital □ð (Clint □ð Guidry, □ð 4) □ð
□ð
□ð "LEAN □ð attorney □ð Stuart □ð Smith □ð took □ð BP □ð to □ð federal □ð court □ð in □ð early □ð Ma
BP □ð was □ð not □ð providing □ð the □ð cleanup □ð workers □ð with □ð adequate □ð protection □ð and
However, □ð even □ð after □ð the □ð court □ð ruling □ð to □ð enforce □ð worker □ð safety □ð … □ð BP □
regulations □ð and □ð allowed □ð the □ð workers □ð to □ð be □ð made □ð sick □ð … □ð There □ð are □ð
that □ð deal □ð with □ð oil □ð spills □ð all □ð the □ð time, □ð measures □ð they □ð know □ð the □ð taken □ð
yet □ð BP □ð was □ð allowed □ð to □ð hire □ð cleanup □ð workers □ð without □ð proper □ð training □ð
them □ð in ' □ð harm □ð way □ð through □ð direct □ð contact □ð with □ð the □ð crude □ð [oil] □ð and □ð the
dispersants. □ð No □ð matter □ð how □ð emergency' it □ð was, □ð they □ð knew □ð how □ð to □ð protect □ð those □ð
didn't." □ð (Dr. □ð Wilma □ð Subra, □ð 3, □ð 6) □ð

"In □ð mid □ð May □ð 2010 □ð I □ð asked □ð workers □ð from □ð the □ð in, □ð 2 □ð the □ð oil, □ð and
explained, 'We □ð look □ð around □ð and □ð when □ð your □ð eyes □ð stoughing □ð burning □ð your □ð lungs
hurt, □ð you □ð in □ð the □ð thickest □ð part □ð of □ð the □ð oil □ð greatly □ð concerned □ð burn □ð because
at □ð that □ð point □ð respirator □ð protection □ð sufficient □ð to □ð protect □ð them □ð from □ð the □ð tox
inhaling. □ð However, □ð I □ð knew □ð by □ð speaking □ð with □ð workers □ð and □ð government □ð officials
even □ð provided □ð respirators." □ð (Clint □ð Guidry, □ð 2) □ð

"I □ð knew □ð from □ð all □ð of □ð the □ð paperwork □ð I □ð had □ð read □ð that □ð BP □ð was □ð sup
respirators, □ð hazmat □ð suits □ð and □ð other □ð safety □ð gear, □ð since □ð they □ð were □ð working
concerned □ð that □ð they □ð were □ð out □ð there □ð touching □ð the □ð chemicals □ð with □ð their
husband □ð did □ð have □ð sufficient □ð safety □ð gear. □ð Before □ð he □ð began □ð working, □ð the □ð o
provided □ð was □ð boom □ð course. □ð He □ð learned □ð how □ð to □ð set □ð up □ð boom □ð and □ð con
advice □ð the □ð training □ð provided □ð was □ð that □ð workers □ð should □ð drink □ð a □ð bottle □ð o
Miller, □ð 1) □ð

"Before □ð we □ð began □ð work □ð Ġ □ð took □ð one □ð basic □ð course □ð administered □ð by □ð the □ð
company □ð Falk □ð Alford □ð in □ð Houma, □ð Louisiana. □ð However, □ð it □ð was □ð about □ð beach
through □ð the □ð VoO □ð program □ð was □ð to □ð clean □ð up □ð the □ð oil □ð offshore, □ð before □ð
offered □ð any □ð additional □ð (Jones □ð Danos, □ð 1) □ð

"The □ð situ □ð teams, □ð which □ð were □ð the □ð teams □ð that □ð burned □ð the □ð oil, □ð also □ð only
training □ð before □ð working □ð in □ð the □ð most □ð hazardous □ð conditions □ð of □ð all □ð of □ð the
Allen, □ð the □ð BP □ð technical □ð advisor □ð Ġ □ð 'My □ð training □ð has □ð taught □ð me □ð that □ð w
burn □ð dangerous □ð chemicals, □ð you □ð form □ð oxides □ð that □ð are □ð even □ð more □ð dangerous
you □ð started □ð out □ð with; □ð if □ð you □ð burn □ð H2S □ð gas, □ð which □ð is □ð hydrogen □ð sulfi
and □ð you □ð end □ð up □ð with □ð sulfur □ð dioxide, □ð which □ð can □ð kill □ð you. □ð That □ð applies
chemicals.' Then □ð I □ð asked □ð you, □ð have □ð any □ð data □ð on ' □ð what □ð is □ð in □ð the □ð smoke
not. □ð I □ð asked □ð you, □ð have □ð any □ð tests □ð or □ð is □ð way □ð the □ð determine □ð what
that □ð they □ð did □ð not, □ð but □ð that □ð it □ð was □ð not □ð hazardous □ð because □ð they □ð stay
through □ð photos □ð and □ð firsthand □ð accounts □ð that □ð were □ð often □ð exposed □ð to □ð the □ð
the □ð burns □ð (Clint □ð Guidry, □ð 2, □ð 5) □ð

Dur □ð ring □ð the □ð oil □ð spill □ð I □ð had □ð one □ð of □ð the □ð first □ð boats □ð out □ð there □ð invo
boat □ð around □ð and □ð looked □ð for □ð the □ð oil □ð … □ð Then □ð I □ð worked □ð at □ð a □ð [deco

dispersed □ð oil □ð off □ð of □ð the □ð boats □ð that □ð we □ð were □ð up □ð using □ð to □ð clean □ð up □ð the □ð oil □ð during □ð the □ð morning □ð until □ð three □ð weeks □ð before □ð my □ð work □ð was □ð over. □ð This □ð was □ð after □ð we □ð were □ð spraying □ð I □ð had □ð gotten □ð sick." □ð (Anonymous □ð #1, □ð 1) □ð □ð

BP □ð "□ð hired □ð safety □ð contractor □ð PEC □ð to □ð put □ð on □ð a □ð safety □ð class □ð for □ð us □ð in □ð the □ð job. □ð They □ð were □ð giving □ð everyone □ð the □ð class □ð in □ð four □ð hours □ð … □ð I □ð class, □ð but □ð we □ð finished □ð it □ð in □ð five □ð hours. □ð I □ð have □ð been □ð to □ð a □ð lot □ð none □ð of □ð them □ð were □ð as □ð in □ð this □ð class. □ð Some □ð people □ð got □ð up □ð and □ð left likely □ð because □ð they □ð felt □ð like □ð it □ð was □ð a □ð waste □ð of □ð time. □ð The □ð instructors for □ð five □ð hours, □ð and □ð then □ð told □ð us □ð the □ð test □ð answers □ð before □ð we □ð took □ð told □ð the □ð chemicals □ð would □ð be □ð weathered □ð by □ð the □ð time □ð we □ð went □ð out □ð dangerous. □ð They □ð didn't □ð discuss □ð PPE, □ð just □ð that □ð the □ð oil □ð we □ð would □ð be □ð dealing Later □ð we □ð realized □ð it □ð was □ð a □ð lie. □ð Every □ð day □ð I □ð wore □ð tennis □ð shoes □ð a shrimpers □ð had □ð shorts □ð and □ð tank □ð tops □ð on. □ð At □ð that □ð point □ð the □ð environment was." □ð (Anonymous □ð #2, □ð 1) □ð

"They □ð never □ð admitted □ð that □ð it □ð was □ð a □ð hazardous □ð environment, □ð but □ð they □ð eve and □ð air □ð packs □ð to □ð the □ð boats. □ð However, □ð by □ð the □ð time □ð they □ð responded □ respirators □ð and □ð escape □ð packs, □ð all □ð of □ð the □ð controlled □ð burns □ð already □ð had □ð b late. □ð The □ð damage □ð to □ð the □ð workers □ð had □ð been □ð done. □ð BP □ð sent □ð them □ð out □ð there □ð in These □ð are □ð fishermen □ð who □ð before □ð the □ð BP □ð oil □ð spill □ð had □ð never □ð worked life, □ð and □ð they □ð were □ð not □ð informed □ð about □ð the □ð dangers □ð of □ð the □ð chemicals until □ð after □ð they □ð were □ð exposed. □ð They □ð were □ð out □ð there □ð on □ð top □ð of □ð the □ð oil toed □ð boots □ð until □ð July." □ð (Clint □ð Guidry, □ð 6) □ð

"Shortly □ð after □ð James □ð stopped □ð working □ð on □ð the □ð VoO □ð program, □ð BP □ð gave □ð hi did □ð not □ð offer □ð it □ð while □ð he □ð was □ð still □ð working □ð there. □ð But □ð enough □ð people □ð were □ð asking □ð about □ð workplace finally □ð the □ð course □ð was □ð made □ð available □ð … □ð I □ð took □ð it □ð with □ð him □ð so □ð reason □ð I □ð go □ð to □ð all □ð of □ð these □ð different □ð meetings □ð with □ð him □ð so □ð what very □ð well □ð and □ð my □ð husband □ð is □ð one □ð of □ð those □ð people □ð who □ð understand □ð the □ð material □ð they out. □ð After □ð he □ð took □ð the □ð course, □ð he □ð explained □ð to □ð me □ð that □ð he □ð never VoO □ð program □ð had □ð he □ð known □ð about □ð the □ð health □ð and □ð safety □ð risks □ð associated □ð with □ð the □ð chemical □ð exposure □ð from □ð the beginning." □ð (Betsey □ð Miller, □ð 3) □ð

"I □ð went □ð head □ð to □ð head □ð with □ð several □ð people □ð on □ð the □ð issue □ð of □ð respirato Robert □ð Bourgeois □ð of □ð the □ð Bourgeois □ð Medical □ð Clinic. □ð He □ð was □ð hired □ð by □ð HH response, □ð and □ð he □ð was □ð board □ð certified □ð in □ð occupational □ð medicine. □ð I □ð spoke □ð with □ð him about □ð the □ð need □ð for □ð workers □ð to □ð have □ð respirators, □ð he □ð argued □ð against □ð it have □ð to □ð have □ð a □ð complete □ð physical □ð and □ð shave □ð in □ð order □ð to □ð wear □ð the that □ð some □ð workers □ð would □ð not □ð be □ð able □ð to □ð work □ð on □ð the □ð job □ð if □ð they □ð could □ð not responded, □ð "You're □ð going □ð to □ð risk □ð your □ð life □ð because □ð you □ð don't □ð want □ð him □ð to □ð have □ð a □ð physical his □ð beard □ð was □ð shaved." □ð (Clint □ð Guidry, □ð 5)

"I □ð worked □ð 60 □ð days □ð straight, □ð 12 □ð hours □ð a □ð day □ð for. □ð We □ð had □ð morning □ð briefings, □ð safety □ð guy □ð would □ð come. □ð But □ð all □ð he □ð talked □ð about □ð was □ð drinking □ð plenty When □ð we □ð went □ð out □ð in □ð the □ð boats, □ð we □ð had □ð little □ð to □ð no □ð safety □ð gear to □ð wear □ð at □ð hand □ð you □ð would □ð move □ð and □ð the □ð hardhat □ð would □ð fall □ð off □ð wouldn't □ð know □ð a □ð respirator □ð if □ð I □ð saw □ð it. □ð We □ð had □ð to □ð wear □ð our □ð life Tillman, □ð 3) □ð

□ð

“Each □ð team □ð has □ð a □ð designated □ð safety □ð representative, □ð who □ð supposedly □ð watched □ð wore □ð a □ð Tyvek □ð suit □ð to get □ð the □ð oil □ð on □ð our □ð clothes □ð or □ð skin, □ð and □ð latex □ð blue □ð gloves. □ð The □ð safety □ð representative □ð made □ð sure □ð that □ð you □ð wore □ð safety □ð all □ð day, □ð mistakenly □ð thinking □ð that □ð fisherman; □ð’t we □ð were □ð lifejackets □ð all □ð day □ð unless □ð we □ð area □ð where □ð we □ð need □ð them. □ð What □ð we □ð needed □ð were □ð respirator □ð … □ð On □ð while □ð they □ð were □ð spraying □ð dispersant, □ð our □ð fishermen □ð were □ð inhaling □ð the □ð toxic □ð Cooper, □ð 2, □ð 4) □ð

“The □ð [safety] □ð class □ð was □ð completed □ð within □ð four □ð hours. □ð I □ð used □ð to □ð work □ð on □ð boats, □ð and □ð the □ð class □ð covered □ð a □ð lot □ð of □ð the □ð same □ð basic □ð safety □ð principles □ð vests □ð when □ð you □ð go □ð to □ð get □ð the □ð close □ð water. □ð If □ð the □ð weather □ð is □ð bad, □ð they □ð don’t □ð went □ð into □ð small □ð about □ð handling □ð the □ð oil, □ð but □ð not □ð beyond □ð telling □ð us □ð to □ð wear □ð gloves □ð and □ð shirts □ð or □ð pants. □ð No □ð respirators □ð were □ð discussed. □ð If □ð they □ð could □ð smell □ð the □ð oil, □ð then □ð you □ð know □ð that □ð you □ð may □ð need □ð to □ð move □ð somewhere □ð fresh □ð air. □ð (Symeonidis, □ð 3) □ð

□ð

“Workers □ð had □ð air □ð monitors, □ð but □ð sometimes □ð BP □ð or □ð even □ð the □ð government □ð on □ð the □ð board □ð of □ð the □ð Louisiana □ð Shrimp □ð [Association], □ð Coast □ð Guard □ð told □ð me □ð to □ð turn □ð off □ð the □ð air □ð monitors □ð because □ð they □ð were □ð going □ð off □ð and □ð malfunction □ð times. □ð It □ð was □ð extremely □ð dangerous □ð for □ð the □ð workers □ð not □ð to □ð have □ð air □ð instructed □ð to □ð go □ð out □ð in □ð the □ð middle □ð of □ð the □ð bay □ð and □ð locate □ð the □ð fresh □ð oil □ð based □ð and □ð noses □ð would □ð burn, □ð and □ð if □ð they □ð could □ð smell □ð the □ð oil. □ð How □ð could □ð they □ð were □ð inhaling? □ð … □ð The □ð air □ð monitors □ð were □ð supposed □ð to □ð measure □ð the □ð air □ð to □ð ensure □ð that □ð they □ð did □ð not □ð exceed □ð permissible □ð exposure □ð limits. (Anonymous □ð #3) □ð

“In □ð May □ð 2010, □ð I □ð worked □ð with □ð the □ð VoO □ð program □ð as □ð a □ð deckhand □ð … □ð the □ð boom □ð and □ð setting □ð the □ð boom. □ð The □ð VoO □ð program □ð did □ð not □ð provide □ð even □ð have □ð masks □ð or □ð a □ð pair □ð of □ð gloves □ð when □ð we □ð were □ð out □ð on □ð the □ð day □ð at □ð Dauphin □ð Island □ð for □ð safety □ð equipment. □ð We □ð were □ð only □ð given □ð boom □ð work □ð with. □ð We □ð wanted □ð to □ð pick □ð up □ð the □ð oil □ð because □ð our □ð waters □ð getting □ð ruined. □ð make □ð a □ð living □ð out □ð there. □ð The □ð people □ð in □ð charge □ð of □ð the □ð safety □ð equipment □ð but □ð they □ð told □ð us □ð to □ð do □ð it □ð anyway □ð because □ð it □ð was □ð for □ð people □ð on □ð the □ð beach □ð who □ð w 1ㄱ □곧Ġ2) □ð

□ð

“The □ð beach □ð crew □ð did □ð have □ð to □ð wear □ð Tyvek □ð suits, □ð but □ð after □ð the □ð cleanup □ð and □ð safety □ð concerns □ð were □ð raised. □ð All □ð of □ð a □ð sudden □ð minimal □ð PPE □ð was □ð personnel, □ð such □ð as □ð Tyvek □ð suits □ð and □ð gloves □ð were □ð given □ð to □ð the □ð boat. (Anonymous □ð #2, □ð 4) □ð

“When □ð we □ð found □ð out □ð [our □ð members] □ð were □ð being □ð denied □ð safety □ð equipment, □ð the □ð beginning □ð to □ð try □ð and □ð get □ð them □ð what □ð they □ð needed □ð … □ð We □ð wanted □ð bills □ð and □ð belly □ð fillers, □ð but □ð yet □ð five □ð or □ð ten □ð years □ð down □ð the □ð road □ð kids □ð and □ð grandkids □ð with □ð no □ð fathers □ð and □ð grandfathers. □ð We □ð were □ð very □ð w equipment □ð issue, □ð but □ð it □ð never □ð got □ð resolved □ð … □ð As □ð a □ð result □ð of □ð providing □ð with □ð PPE, □ð BP □ð and □ð the □ð government □ð have □ð not □ð addressing □ð (Anonymous, □ð 1) □ð

“On □ð June □ð 22, □ð 2010 □ð … □ð I □ð had □ð lunch □ð with □ð Dr. □ð David □ð Michaels, □ð Director was □ð happening □ð with □ð the □ð workers, □ð and □ð what □ð the □ð response □ð was □ð from □ð BP ‘We □ð have □ð a □ð problem, □ð we □ð have □ð to □ð do □ð something □ð about □ð it, □ð have □ð a □ð p and □ð OSHA □ð is □ð supposed □ð to □ð be □ð in □ð charge □ð of □ð this □ð issue □ð he □ð pushed □ð back □ð on □ð invo respirators. □ð He □ð said, □ð ‘If □ð we □ð make □ð the □ð workers □ð wear □ð respirators, □ð then □ð you, □ð Wilm them □ð to □ð have □ð heart □ð attacks □ð it □ð as □ð if, □ð by □ð my □ð advocating □ð for □ð their □ð use □

causing □ð the □ð workers □ð harm. □ð I □ð responded □ð that □ð the □ð fishers □ð participating □ð in
much □ð harder □ð on □ð them □ð not □ð to □ð wear □ð the □ð respirator □ð and □ð [illegible] (Dr. Wanda, □ð [illegible] □ð

"From □ð the □ð very □ð beginning □ð we □ð asked □ð our □ð supervisors □ð for □ð respirators, □ð and □
us □ð to □ð wear □ð them □ð because □ð they □ð were □ð unsafe □ð and □ð [illegible] (Anonymous □ð #1, □ð 2) □ð he

"Some □ð of □ð our □ð members □ð were □ð working □ð for □ð [illegible] contractor □ð on □ð area, □ð which □
located □ð only □ð a □ð couple □ð miles □ð from □ð the □ð site □ð of □ð the □ð Deepwater □ð Horizon □
a □ð big □ð concern □ð for □ð us, □ð because □ð when □ð they □ð were □ð doing □ð the □ð burns □ð the
equipment, □ð including □ð respirators. □ð Toward □ð the □ð end □ð of □ð the □ð burns, □ð a □ð few □ð
respirators. □ð We □ð found □ð it □ð strange □ð that □ð [illegible] □ð from □ð the □ð start, □ð becau
OSHA's □ð policy □ð is □ð for □ð workers □ð to □ð be □ð protected □ð … □ð As □ð many □ð times □ð a
we're □ð on □ð record □ð asking □ð for □ð respirators □ð to □ð give □ð to □ð our □ð fishermen, □ð not □
Guard □ð or □ð the □ð federal □ð government □ð [illegible] (A.C.P. □ð [illegible] □ð 2, □ð 4) □ð

□ð I □ð realized □ð how □ð pungent □ð the □ð Corexit □ð was □ð [illegible] □ð equipment. □ð I □ð asked □ð a □ð BP □ð representative □ð [illegible] □ð told □ð me □ð that □
had □ð one, □ð all □ð of □ð the □ð workers □ð would □ð want □ð one, □ð and □ð it □ð would □ð look □
caught □ð footage □ð of □ð a □ð bunch □ð of □ð workers □ð [illegible] □ð on □ð its □ð own □
images □ð showed □ð up □ð in □ð the □ð media □ð of □ð cleanup □ð personnel □ð without □ð protective
were □ð so □ð cheap □ð that □ð they □ð would □ð rip, □ð and □ð we □ð would □ð be □ð touching □ð the
would □ð get □ð into □ð my □ð skin □ð and □ð burn □ð … □ð [illegible] □ð
When □ð we □ð did □ð ask □ð the □ð BP □ð representatives □ð or □ð contractors □ð for □ð better □ð equ
there □ð were □ð going □ð to □ð get □ð them, □ð but □ð they □ð would "□ð [illegible] □ð with □ð th

"Throughout □ð the □ð cleanup □ð my □ð supervisors □ð [illegible] □ð to □ð enforce □ð that
now, □ð we □ð have □ð to □ð get □ð [illegible] □ð from □ð all □ð over □ð about □ð
the □ð conditions □ð and □ð real □ð safety □ð [illegible] □ð you □ð had □ð to □ð
deal □ð with □ð it □ð because □ð [illegible] □ð to □ð go □ð home □ð … □ð [illegible] □ð safe
it □ð did □ð happen □ð At □ð Grand □ð Isle, □ð I □ð befriended □ð a □ð BP □ð safety □ð representative. □ð
world, □ð including □ð Iraq, □ð and □ð was □ð a □ð high □ð class □ð safety □ð guy. □ð He □ð would □ð c
'Man, □ð I □ð don't □ð understand. □ð They □ð have □ð protocol □ð [illegible] (Anonymous □ð #2, □ð 2) □ð

"At □ð one □ð point □ð for □ð a □ð month □ð I □ð was □ð the □ð captain □ð for □ð a □ð safety □ð boat
would □ð bring □ð the □ð medical □ð staff □ð from □ð the □ð BP □ð Command □ð Center □ð and □ð take
Worker □ð safety □ð incidents □ð occurred □ð multiple □ð times □ð [illegible] □ð the
BP □ð shut □ð down □ð the □ð command □ð post □ð and □ð facilities, □ð we □ð discovered □ð that □ð all
trailer □ð disappeared □ð in □ð Grand □ð Isle. □ð The □ð BP □ð [illegible] □ð the □ð
Safety □ð Analyses] □ð from □ð [illegible] (Anonymous □ð #2, □ð 3) □ð

□ð "The □ð MSDSs □ð for □ð Corexit □ð list □ð several □ð of □ð the □ð health □ð problems □ð I □ð am
throughout □ð the □ð Gulf □ð … □ð When □ð I □ð [illegible] □ð barge □ð was □ð exposed. □ð [illegible] □ð wo
outside □ð too, □ð breathing □ð in □ð what □ð burning, □ð without □ð a □ð respirator □ð or □ð a □ð Tyvek
apron, □ð a □ð hairnet, □ð a □ð spatula □ð and □ð some □ð rubber □ð gloves, □ð and □ð they □ð told □ð
dangerous □ð chemical □ð environment. □ð Yet □ð they □ð were □ð willing □ð to □ð tell □ð me □ð that □
the □ð oil □ð I □ð was □ð cleaning □ð was □ð as □ð safe □ð as □ð touching □ð Dawn □ð dishwashing □ð s
health □ð problems □ð that □ð I □ð have □ð never □ð had □ð before □ð (Jamie Griffin, □ð 10) □ð the □ð barge □

b. Public Exposure

"There □ð were □ð millions □ð of □ð gallons □ð of □ð oil □ð in □ð the □ð Gulf □ð of □ð Louisiana □ð Sweet □ð Crude □ð is □ð 4
volume □ð light □ð ends, □ð such □ð as □ð xylene, □ð toluene □ð and □ð benzene. □ð Along □ð Venice □ð

toxic □ð dispersant □ð Corexit □ð 9527A □ð where □ð VoO □ð cleanup □ð workers □ð were □ð working. □
time □ð before □ð others □ð and □ð then □ð public □ð became □ð sick. □ð As □ð part □ð of □ð an □ð impro
feedback □ð from □ð the □ð shrimping □ð industry □ð to □ð EPA □ð and □ð NOAA, □ð I □ð met □ð with □
in □ð Venice □ð on □ð June □ð 1, □ð 2010. □ð By □ð that □ð point, □ð already □ð 800,000 □ð to □ð 900,0
been □ð sprayed. □ð I □ð was □ð sitting □ð across □ð the □ð table □ð from □ð Ms. □ð Jackson □ð and □ð
you □ð have □ð all □ð of □ð this □ð going □ð on □ð and □ð three □ð air's □ð monitors □ð from □ð Venice,
showing □ð any □ð high □ð levels □ð of □ð chemicals? □ð Mr. □ð Jackson □ð responded, □ð the □ð levels □ð were □ð a □ð little □ð
we □ð did □ð want □ð to □ð create □ð a □ð republic □ð panic. □ð Vol. □ð scaring □ð the □ð hell □ð out □ð of □ð me
Guidry, □ð 6) □ð □ð

"In □ð late □ð April □ð 2010, □ð before □ð the □ð crude □ð made □ð it □ð into □ð days, □ð Louisiana □ð shor
aerosol □ð came □ð on □ð shore □ð all □ð the □ð way □ð across □ð from □ð Louisiana □ð to □ð Mississipp
panhandle. □ð The □ð aerosol □ð was □ð dispersed □ð crude □ð oil. □ð It □ð came □ð from □ð the □ð slick
into □ð the □ð air □ð from □ð the □ð heavy □ð seas. □ð It □ð caused □ð severe □ð nausea, □ð headaches □ð
respiratory □ð problems." □ð (Dr. □ð Wilma □ð Subra, □ð 3) □ð □ð

"When □ð the □ð oil □ð landed □ð on □ð the □ð Mississippi □ð shores □ð on □ð July □ð 1, □ð 2010 □ð BP
dumping □ð the □ð oil □ð waste □ð four □ð miles □ð north □ð of □ð the □ð ... □ð stop, □ð after □ð which □ð Grov
way □ð the □ð wind □ð was □ð blowing, □ð because □ð I □ð would □ð either □ð get □ð chemical □ð expos
beach." □ð (John □ð Gooding, □ð 2) □ð

"A □ð lot □ð of □ð the □ð chemicals □ð from □ð the □ð spill □ð became □ð airborne, □ð turned □ð into □
Consequently, □ð children □ð and □ð people □ð throughout □ð the □ð Gulf □ð Coast □ð are □ð affected, □ð
working □ð directly □ð on □ð the □ð Jorley □ð Danos, □ð 6) □ð

"From □ð May □ð 2010 □ð through □ð August □ð 2010 □ð when □ð I □ð walked □ð out □ð my □ð back □
my □ð head □ð in □ð oil □ð can; □ð the □ð oil □ð smell □ð was □ð that □ð pungent □ð ... □ð After □ð resid
and □ð the □ð media □ð questions □ð about □ð the □ð safety □ð of □ð the □ð spill, □ð because □ð everyon
petrochemicals, □ð the □ð local □ð news □ð station □ð you □ð have, □ð any □ð problems □ð or □ð
compromised □ð health, □ð you □ð need □ð to □ð stay □ð inside □ð Lorrie □ð Williams, □ð 6) □ð

"The □ð first □ð week □ð of □ð the □ð spill, □ð we □ð were □ð about □ð what □ð was □ð going □ð on □ð and □
kids □ð go □ð outside □ð to □ð play. □ð Then □ð by □ð the □ð end □ð of □ð the □ð second □ð and □ð started
to □ð get □ð concerned. □ð I □ð put □ð the □ð bikes □ð in □ð the □ð shed □ð and □ð drained □ð the □ð p
binding □ð agent □ð with □ð other □ð chemical □ð compounds, □ð I □ð decided □ð it □ð was □ð the □ð kids
basically □ð locked □ð them □ð up □ð in □ð our □ð mobile □ð home. □ð PlaqueminesParish.gov □ð would
emails □ð for □ð the □ð air □ð sampling. □ð Unusually □ð sensitive □ð people □ð should □ð refrain □ð from □
exertion.' At □ð the □ð local □ð town □ð hall □ð officials □ð told □ð us □ð to □ð stay □ð inside □ð and □ð turn
on □ð recirculation." □ð (Kindra □ð Arnesen, □ð 6) □ð

"There □ð are □ð compounds □ð in □ð the □ð makeup □ð of □ð Corexit □ð that □ð empty □ð resemble □ð glycol □ð
antifreeze □ð into □ð the □ð street. □ð Corexit □ð we □ð are □ð dusting □ð a □ð type □ð of □ð glycol, □ð in □
amounts □ð in □ð the □ð Gulf, □ð and □ð the □ð public □ð now □ð much □ð glycol □ð or □ð how □ð much □ð o
toxic □ð chemicals □ð comprise." □ð (Scott □ð Porter, □ð 10) □ð

"Sometimes □ð it □ð gets □ð really □ð frustrating □ð [BP] □ð had □ð total □ð control □ð to □ð stop □ð this. □
what □ð happened. □ð If □ð what □ð happened □ð after □ð the □ð spill □ð were □ð an □ð accident, □ð I □
happened, □ð and □ð it □ð will □ð Good □ð take □ð life □ð as □ð it □ð comes. □ð But □ð they □ð did □ð kn
unsafe □ð and □ð still □ð allowed □ð people □ð to □ð handle □ð them □ð use □ð Corexit □ð in □ð them. □ð W
country, □ð but □ð our □ð government □ð allowed □ð BP □ð to □ð come □ð into □ð our □ð country □ð a
Griffin, □ð 15) □ð

“There □ð is □ð no □ð debate □ð that □ð VOCs □ð go, □ð away □ð quickly. □ð Hill □ð very □ð prevalent □ð environment. □ð It’ð not □ð over. □ð The □ð main □ð VOCs □ð are □ð xylene, □ð ethyl □ð benzene □ð and to □ð be □ð in □ð the □ð crude, □ð to □ð movegassing □ð from □ð the □ð crude □ð as □ð it □ð floats □ð on □ of □ð the □ð Gulf □ð as □ð it □ð is □ð in □ð the □ð wetlands □ð and □ð the □ð beach. □ð These □ð are □ð kn agents □ð that □ð also □ð cause □ð acute □ð respiratory □ð problems □ð and □ð gastrointestinal □ð proble function □ð tissues.” □ð (Dr. □ð Wilma □ð Subra, □ð 10) □ð

“[W]hen □ð my □ð family □ð began □ð sick, □ð I □ð think □ð we □ð had □ð anything □ð to □ð fear □ð as □ð far contact □ð with □ð any □ð type □ð of □ð BP □ð chemical □ð to □ð We □ð hadn □ð and □ð any □ð hadn seafood, □ð so □ð why □ð would □ð we □ð have □ð to □ð worry □ð about □ð health □ð problems □ð thin got □ð worse, □ð and □ð test □ð results □ð came □ð back □ð that □ð showed □ð he □ð had’ □ð levels □ð of (Christina □ð Tillman, □ð 1) □ð

□ð □ð

4. Health Impact

"What brought all of these individuals into the same pool was the fact that their almost identical, and were different from anything that I had ever observed in my physician. However, until people are educated about the symptoms associated with waste from the spill, we cannot assume they will make the connection. I continue disconnect and these symptoms on a daily basis." Michael Robichaux, Physician

The clean-up health impact may have been a greater disaster than the epidemic of chemical illnesses across the Gulf. The full impact remains a Nearly two million gallons of dispersed Corexit later, the environmental la reported that five of its ingredients cancer. Material Safety Data Sheets for C warned that the dispersant posed high and immediate human testing haza found that workers were exposed to a possible human carcinogen from government medical monitoring programs, however, denied any significant chemical and dismissed worker complaint that Corexit exposure resulted in hospitalizatio deserved compensation for its effects. Independent monitoring by CLEAN valid educated the public on the real human impact of the disaster, as i symptoms that can result from chemical exposure. Eventually coined the times "Gulf Coast Syndrome," often took months, cases in years, before workers a residents connected their sudden health problems with the BP spill.

Of GAP witnesses, GAP witnesses, more than 70% took a blood test to Corexit and oil. Of those, 100% tested positive such chemicals, which incl known carcinogens. Ninety-five percent report that they continue to related health spill problems as of April 2013, and more than 50% living in affected a and/or grandchildren's health has deteriorated.

BP Official Position

From the beginning of the disaster is BP important to recognize that the health of people from the chemicals associated with both the crude oi dispersants used to the oil are very low. With the cooperation of the Unified Are Command, BP implemented a comprehensive industrial hygiene monitoring progr that.[81] In the vast majority of cases, BP "no significant exposure to were airborne concentrations of benzene, total hydrocarbons or dispersant chemicals lauded the high degree of correlation between its monitoring results and agencies.[82] Yet, two months into the disaster, BP testing results found that 2 detected in more than 20% of offshore workers and 15% of near greater than NIOSH worker safety standards. It may not have been a dispersant chem interest by BP's, but it certainly is by health experts. According to Department of Health, 2-Butoxyethanol is a possible human carcinogen. Alarmingly, it makes up 30 to 60 percent of Corexit 9527, according to the CDC website.

ED_001324_00007754-00033

The MSDSs incorrectly listed the source material subject of the BP Ombudsman investigation for alleged absence from list of the following symptoms of exposure Corexit 9527A and/or Corexit 9500A: red blood cells (hemolysis), liver, kidney or irritate the upper respiratory tract, nervous system effects; nausea, vomiting or narcotic effects; defat and dry the skin, leading to discomfort and dermati aspirated into lungs following ingestion. The potential human health "High" risk for Corexit 9527, and there is "Immediate (Acute) Health" Hazard Corexit 9500.

In the public sphere BP dismissed concerns, disregarding internal data a health warnings. In an interview Tony Hayward attributed the illnesses of nine workers airlifted from their vessels in food poisoning, avoiding possible workers claims that it was a result of the chemical dispersants being sprayed conclusion of BPs Gulf Coast Claims Process, it denied all claims for exposure by workers and the public (see: Inadequate Compensation).

Government Official Position

Akin to BP's worker monitoring program, OSHA and other government agencies have developed a sampling plan and conducted extensive monitoring of w found no levels of toxic chemicals.[89] Consistent with OSHA's conservative of dispersant health threats, NIOSH did not include Human Health Evaluation prompted by the VoO workers. Although all seven fishermen were hospitalized on the same d their symptoms could not be linked to the chemical dispersant that so originally suspected. The report instead associated their symptoms with such as heat and fatigue, the same symptoms as fatigue, headaches, dizziness and like symptoms and also signs of chemical exposure. Despite government findings, workers and residents remained skeptical that their emerging health problem with chemicals from the BP spill.

In an attempt to assuage public skepticism, the CDC released on July chemicals reported in data. It could cause temporary eye problems, such as irritation, but they were not considered long effects should go away when levels go down.[93] CDC stated that while dispersant exposure is *"Unlikely to impact [health] [emphasis added]* not accounting for warnings listed on the federally mandated MSDS for Corex damage.[95] In response to reports that residents and workers were getting Volatile Organic Compounds (VOCs) found in the air CDC released fact sheet reassuring residents that VOCs are "very common and the public can come in contac them through pumping gas, cigarettes, pesticides,[96] and recommended against blood tests, stating: chemicals only stay in the blood a short time reflect very recent exposure (within or days). The of government attempt to put the Gulf at ease seemed to backfire. Workers and residents found that subsided when they left the Gulf region and their blood tests contin levels of chemicals long after the BP spill was over, raising questions ab questions shared internally by government employees.

ED_001324_00007754-00034

In □ð an □ð internal □ð memo, □ð a □ð CDC □ð employee □ð concerned □ð about □ð the □ð somewhat □ð approach □ð to □ð concerns □ð about □ð dispersants, □ð especially □ð considering □ð the □ð numerous □ð (mostly reports □ð of □ð possible □ð human □ð health □ð effects □ð from □ð the □ð use □ð of □ð Corexit □ð dispe environmental □ð health □ð specialist □ð inquired □ð with □ð any □ð agency □ð whether □ð OSHA/NIOSH □ð is □ð looking □ð at □ð the □ð MSDSs □ð for □ð these □ð chemicals □ð as □ð well □ð with concerns?"[98] □ð Concerned □ð about □ð divers □ð exposure □ð to □ð the □ð toxins, □ð an □ð EPA □ð Unit □ð "As □ð everyone □ð knows, □ð diving □ð in □ð polluted □ð water □ð is □ð not □ð … □ð Even □ð diver □ð does □ð not □ð get □ð sick □ð immediately, □ð in □ð fact □ð it □ð may □ð take □ð years □ð for □ð possible □ð exposure □ð to □ð crude and □ð dispersants □ð components □ð of □ð which □ð could □ð increase □ð your □ð lifetime □ð cancer □ð ris while □ð not □ð of □ð the □ð government □ð official □ð position, □ð echoed □ð concerns □ð within □ð the □ scientific □ð community.

Independent □ Position □

The □ð human □ð health □ð impacts □ð of □ð Corexit □ð were □ð virtually □ð absent □ð from □ð BP □ð discourse, □ð but □ð they □ð were □ð at □ð the □ð forefront □ð of □ð discussions □ð within □ð Gulf □ð co along □ð the □ð Gulf □ð had □ð been □ð exposed □ð to □ð oil □ð spills □ð for □ð generations; □ð however this □ð time. □ð A □ð strange □ð cough □ð was □ð prevalent □ð from □ð Louisiana, □ð Mississippi, □ð Ala and □ð Florida □ð were □ð experiencing □ð the □ð same □ð health □ð symptoms, □ð and □ð workers □ð w within □ð the □ð first □ð few □ð days □ð on □ð the □ð job. □ð Especially □ð included □ð children, □ð elders, pregnant □ð women □ð with □ð preexisting □ð conditions, □ð and □ð individuals □ð working □ð or □ð liv conditions □ð that □ð imposed □ð health □ð stresses □ð on □ð them. □ð Eventually □ð coined □ð "BP □ð Syndrome □ð Gulf □ð Coast □ð Syndrome," □ð three □ð years □ð after □ð the □ð disaster □ð individuals □ð made □ð sick □ð from □ð their □ experience □ð severe □ð health □ð problems.[101] □ð

LEAN □ð filled □ð the □ð government □ð void □ð and □ð quickly □ð became □ð an □ð information □ð hub residents.[102] □ð The □ð group □ð created □ð a □ð fact □ð sheet □ð involving □ð the □ð human □ð health □ð BP □ð spill, □ð provided □ð workshops □ð throughout □ð the □ð Gulf □ð to □ð educate □ð communities □ð about □ð BP health □ð risks, □ð conducted □ð health □ð surveys, □ð and □ð raised □ð money □ð to □ð conduct □ð 100 assistance □ð of □ð Louisiana □ð physician □ð Dr. □ð Michael □ð Robichaux. □ð LEAN □ð educated □ð resid didn't □ð work □ð on □ð the □ð cleanup, □ð routes □ð of □ð chemical □ð exposure □ð include: □ð inhalatio (skin) □ð contact, □ð and □ð eye □ð contact. □ð Individuals □ð tested □ð and □ð surveyed □ð ranged □ð fr divers, □ð to □ð wives □ð who □ð washed □ð off □ð their □ð clothes □ð and □ð children, □ð to □ð citizens □ð who nothing □ð more □ð than □ð live □ð in □ð communities □ð subjected □ð to □ð aerial □ð spraying. □ð The alarmingly □ð high □ð chemical □ð levels □ð that □ð correlated □ð with □ð the □ð health □ð effects □ð rep residents.[103] □ð Based □ð on □ð results □ð from □ð its □ð 2011 □ð to □ð 2012 □ð health □ð survey, □ð LEAN previous □ð as □ð well □ð as □ð ongoing □ð exposure □ð to □ð the □ð crude □ð oil, □ð community □ð me health □ð impacts □ð experienced □ð by □ð the □ð coastal □ð community □ð members □ð respond □ð to associated □ð with □ð the □ð chemical □ð components □ð of □ð the □ð BP □ð crude □ð and □ð the □ð dis

According □ð to □ð Nalco, □ð the □ð manufacturer □ð of □ð Corexit, □ð all □ð of □ð the □ð safe □ð ingredients □ð and □ð found □ð in □ð common □ð household □ð products. □ð However, □ð a □ð report □ð by □ð the □ð found □ð that, □ð of □ð the 57 □ð ingredients □ð in □ð Corexit, □ð five □ð of □ð the □ð chemicals □ð are □ð associated □ð with □ð ca

skin □ð irritation □ð from □ð rashes □ð to □ð burns; □ð 33 □ð are □ð linked □ð to □ð eye □ð irritation; □ð potential □ð respiratory □ð toxins □ð or □ð irritants; □ð and □ð 10 □ð are[106] □ð suspected □ð to □ð cause □ð kidney □ð toxins. butoxyethanol, □ð found □ð in □ð the □ð blood □ð samples □ð taken □ð from □ð BP □ð offshore □ð and □ð linked □ð to □ð severe □ð health □ð problems □ð with □ð cleanup □ð workers □ð on □ð the □ð Exxon □ð Valdez □ð oil □ð spill □ð includ respiratory, □ð nervous □ð system, □ð liver, □ð kidney, □ð and □ð blood □ð disorders.[107] □ð Many □ð of □ð those □ð suffered □ð lasting □ð neurological □ð problems[108] □ð

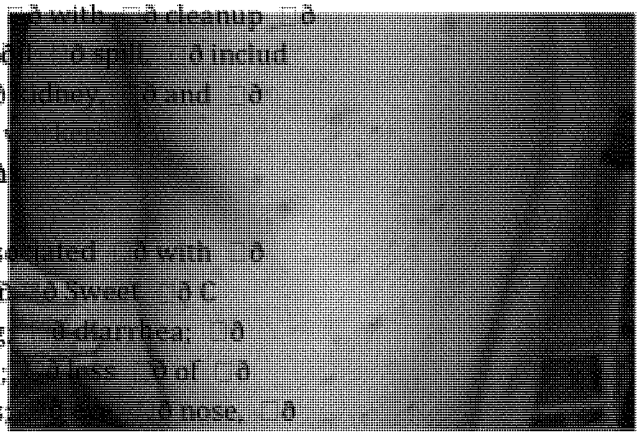


Photo by EcoRiver with skin after diving into dispersed oil plumes

According □ð to □ð LEAN, □ð symptoms □ð associated □ð with □ð exposure □ð to □ð Corexit □ð and □ð Louisiana □ð Sweet □ð C include: □ð headaches; □ð nausea; □ð vomiting; □ð diarrhea; □ð abdominal □ð pains; □ð dizziness; □ð confusion; □ð loss □ð of □ð balance; □ð chest □ð pains □ð and □ð tightness; □ð nose, □ð throat □ð and □ð lung □ð irritation; □ð decreased □ð function; □ð difficulty □ð breathing; □ð rapid □ð breathing; □ð asthma □ð attacks; □ð chemical □ð pneumonia; □ð allergic □ð reactions; □ð skin □ð irritation, □ð damage, □ð and □ð sensitization; □ð hypertension; □ð damage □ð to □ð respiratory □ð system; □ð central □ð nervous □ð system □ð depression; □ð neurological □ð deficits; □ð damage □ð to □ð red □ð blood □ð cells; □ð blood □ð disorders; □ð genetic □ð damage □ð and □ð mutations; □ð infertility; □ð reproductive □ð and □ð developmental □ð damage; □ð immune □ð system □ð arrhythmia; □ð cardiovascular □ð damage; □ð gastrointestinal □ð disturbance; □ð endocrine □ð disruption; □ð hormone □ð level □ð disruption; □ð immune □ð system □ð damage; □ð nervous □ð system □ð damage; □ð and □ð increa chronic □ð obstructive □ð pulmonary[109] □ð disease.

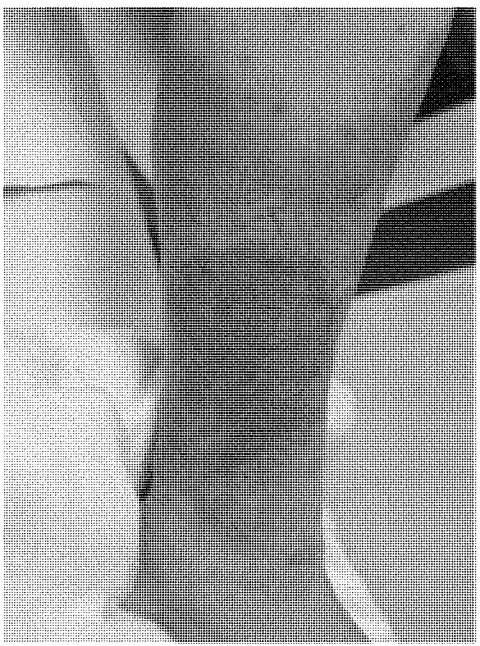


Photo by GAP witness. Leg □ð after being exposed to Corex

In □ð addition □ð to □ð those □ð symptoms, □ð witnesses □ð in investigation □ð reported: □ð blood □ð in □ð urine, □ð vomit □ð and □ð rectal □ð bleeding; □ð seizures; allergy □ð to □ð processed □ð foods; □ð violent □ð vomiting □ð episodes □ð that □ð last □ð for and □ð result □ð in □ð rapid □ð weight □ð loss; □ð weakness □ð at □ð times □ð leading □ð to □ð depression; □ð migraines; □ð ab pain □ð attacks; □ð skin, □ð irritation, □ð burning □ð and □ð lesions; □ð inability □ð to □ð withstand □ð exposure □ð to □ð sun; □ð Multi Chemical □ð Sensitivity, □ð resulting □ð in □ð new □ð sensitivitie everyday □ð household □ð cleaning □ð products □ð (i.e. □ð Wind air □ð fresheners) □ð or □ð petroleum □ð based □ð products □ð water □ð bottles); □ð neurological □ð damage □ð resulting □ð in □ð memory □ð loss □ð and □ð severe □ð IQ □ð drop; □ð difficulty concentrating; □ð sexual □ð dysfunction □ð and □ð impotence; □ð heart □ð palpitations; □ð and □ð hypertension. □ð

Whistleblower Record

a. Health Symptoms

I "ð … ð developed ð two ð worksheets ð early ð in ð the ð oil ð spill ð cleanup ð process; associated ð with ð Louisiana ð Sweet ð Crude ð … ð and ð a ð list ð of ð health ð impacts dispersants. ð The ð combined ð short ð term ð health ð symptoms ð include ð syncute ð respiratory ð problems, ð sk rashes, ð cardiovascular ð impacts, ð gastrointestinal ð impacts, ð and ð short ð term ð loss ð c impacts ð include ð cancer, ð decreased ð lung ð function, ð liver ð damage, ð Wilmand ð kidney Subra, ð 7) ð

[F]"rom ð Florida, ð Alabama, ð Mississippi ð and ð Louisiana ð … ð [w]hat ð brought ð all ð the ð same ð pool ð was ð the ð fact ð that ð their ð symptoms ð were ð almost ð identical anything ð that ð I ð had ð ever ð observed ð in ð my ð 40 ð plus ð years ð common ð a ð ph symptoms ð experienced ð by ð my ð patients ð include ð impotence ð both ð in ð young ð loss, ð headaches, ð extreme ð fatigue, ð irritability, ð abdominal ð cramps, ð seizures, ð and ð that ð many ð patients ð and ð their ð family ð members ð have ð observed. ð These ð symptoms ð are ð quite ð co among ð workers ð and ð even ð some ð residents ð who ð live ð along ð the ð Gulf. ð ð educated ð about ð the ð symptoms ð associated ð with ð exposure ð to ð toxic ð waste ð fro assume ð they ð will ð make ð the ð connection. ð ð I ð continue ð to ð witness ð this ð on ð a ð daily ð (Dr. ð Michael ð Robichaux, ð 4, ð 6) ð ð

"I ð had ð it ð bad, ð but ð so ð did ð my ð supervisors. ð The ð stuff ð they ð had ð to do ð again. ð Yeah, ð they ð made ð good ð said ð worth ð it. ð Recently ð I ð spoke ð people ð who ð worked ð for ð ES&H, ð which ð was ð one ð of ð BPs ð primary ð contract efforts. ð The ð four ð guys ð are ð now ð sick." ð (Anonymous ð #2, ð 5) ð

South ð Bay ð Community, ð All ð community ð group ð that ð I ð am ð a ð part ð of, ð general ð care ð and ð to ð bring ð awareness ð to ð people ð the ð symptoms ð of ð chemica dispersants ð and ð crude ð oil ð … ð I ð went ð to ð the ð fair, ð because ð I ð wanted ð exposure ð from ð the ð spill ð and ð health ð problems, ð and ð were ð not ð aware ð abo spoke ð with ð about ð 40 ð people. ð As ð soon ð as ð I ð would ð share ð a ð list ð of them ð would ð say ð they ð had ð similar ð problems ð the ð cleanup ð someone ð had ð them. (Lori ð Bosarge, ð 5) ð

"Within ð one ð month ð after ð my ð son ð returned ð from ð Orange ð Beach, ð he ð had approximately ð one ð third ð of ð his ð body ð weight, ð which ð took ð him ð over ð a ð 2010 ð my ð son ð had ð his ð first ð pheard ð him ð scream ð from ð the ð bathroom ð ran ð to ð the ð bathroom ð and ð he ð was ð passed ð out ð on ð the ð floor ð in ð a saw ð a ð kidney ð stone ð that ð he ð had ð passed ð … ð Later, ð his ð brain ð attacks times ð a ð week. ð He ð said ð it ð felt ð like ð someone ð was ð stabbing" ð him ð on ð (Anonymous ð #3, ð 1┐ ð괆Ġ2) ð

"Noah, ð Bubba, ð my ð older ð son ð Dustin ð and ð I ð were ð noticeably ð sick ð by ð 2010 ð we ð didn't ð realize ð that ð our ð health ð effects ð could ð be ð attributed ð to ð expos Corexit. ð I ð wanted ð to ð know ð why ð we ð were ð suddenly ð developing ð the ð simi researching ð the ð health ð symptoms ð associated ð with ð the ð dispersant ð from ð the ð they ð mirrored ð what ð we ð have ð experienced ð … ð I ð have ð learned ð that ð one ð exposure ð is ð brain ð fog, ð when ð the ð short ð term ð memory ð is ð affected ð … ð

had □ð difficulty □ð remembering □ð things □ð I □ð BP □ð would □ð get □ð disoriented □ð and □ð our □
would □ð go □ð into □ð a □ð fog □ð like □ð state. □ð Sometimes □ð I □ð still □ð experience □ð this. □ð Bu
and □ð a □ð bad □ð cough, □ð big □ð white □ð scabs □ð all □ð over □ð his □ð arms □ð as □ð well □ð as
have □ð health □ð insurance. □ð The □ð boils □ð start □ð out □ð as □ð bumps, □ð and □ð when □ð you □
Noah □ð and □ð I □ð both □ð have □ð asthma □ð but □ð it □ð got □ð worse □ð after □ð the □ð Deepwate
week □ð of □ð May □ð 2010 □ð we □ð had □ð to □ð support □ð and □ð additional □ð breathing □ð so doubled □
asthma □ð medication □ð … □ð During □ð the □ð spill □ð we □ð were □ð both □ð doing □ð breathing □ð t
Since □ð this □ð began, □ð we □ð have □ð been □ð on □ð antibiotics □ð and □ð steroids □ð back □ð and □
compromised □ð our □ð immune □ð system." (Tonya □ð Williams, □ð 7) □ð

"[A □ð good □ð friend □ð of □ð mine] □ð has □ð Crones □ð disease □ð but □ð it □ð was □ð dormant □ð fo
after □ð the □ð spill □ð took □ð place □ð it □ð became □ð real □ð bad; □ð he □ð had □ð chronic □ð blood
would □ð get □ð skin □ð rashes, □ð and □ð he □ð use □ð a □ð nebulizer □ð to □ð breathe □ð properly." □ð (Joh

"For □ð the □ð first □ð time □ð in □ð my □ð diving □ð career □ð I □ð had □ð a □ð burning □ð sensation
in □ð my □ð chest. □ð After □ð each □ð dive □ð I □ð began □ð having □ð chest □ð colds, □ð and □ð burnin
itchy □ð skin □ð rashes. □ð A □ð lot □ð of □ð it □ð has □ð continued □ð to □ð this □ð day □ð … □ð Afte
At □ð that □ð point □ð it □ð took □ð five □ð to □ð six □ð days □ð to □ð get □ð rid □ð of □ð the □ð burni
lethargic □ð and □ð also □ð had □ð a □ð cough." (Scott □ð Porter, □ð 12) □ð

"I □ð just □ð found □ð out □ð my □ð liver □ð is □ð partially □ð damaged □ð due □ð to □ð exposure □ð to
dermatitis □ð on □ð my □ð face. □ð My □ð face □ð is □ð the □ð only □ð part □ð of □ð my □ð body □ð tha
(Steve □ð Kolian, □ð 6) □ð □ð

"Prior □ð to □ð the □ð oil □ð spill □ð we □ð have □ð any □ð eye □ð problems; □ð my □ð husband □ð and □ð I □ð bo
healthy □ð people. □ð Now □ð his □ð whole □ð eye □ð is □ð messed □ð up, □ð completely □ð irritated □ð
migraines. □ð These □ð were □ð like □ð migraines; □ð they □ð were □ð just □ð horrible □ð headaches □ð where
get □ð nauseated □ð … □ð I □ð have □ð thrown □ð up □ð more □ð in □ð the □ð last □ð year □ð than □ð
[Y]ou're □ð just □ð completely □ð drained □ð for □ð no □ð reason □ð at □ð all. □ð You □ð wake □ð up □ð
to □ð sleep." □ð (Shirley □ð Tillman, □ð 9) □ð

"Some □ð of □ð our □ð guys □ð with □ð the □ð association □ð got □ð very □ð sick □ð and □ð still □ð have □ð big □ð
especially □ð our □ð men □ð who □ð were □ð sprayed □ð with □ð the □ð dispersants. □ð Health □ð proble
boils □ð on □ð their □ð skin, □ð severe □ð headaches, □ð dizziness, □ð and □ð nausea."
(Antonio □ð Cooper, □ð 4) □ð

"Several □ð patients □ð also □ð had □ð a □ð unique □ð neurological □ð disorder □ð that □ð one □ð victim
'condition' consisted □ð of □ð the □ð patient □ð being □ð cognizant □ð of □ð his □ð or □ð her □ð surroun
or □ð to □ð speak. □ð □ð My □ð first □ð encounter □ð with □ð this □ð phenomenon □ð was □ð in □ð the
described □ð sitting □ð on □ð his □ð porch □ð while □ð facing □ð his □ð truck. □ð □ð The □ð truck □ð d
running. □ð □ð He □ð could □ð not □ð walk, □ð talk □ð or □ð otherwise □ð move. □ð □ð He □ð describe
two □ð hours. □ð □ð His □ð memory □ð of □ð the □ð entire □ð event □ð was □ð quite □ð vivid. □ð □ð He □
in □ð different □ð settings." (Dr. □ð Michael □ð Robichaux, □ð 4) □ð □ð

"When □ð I □ð was □ð working □ð on □ð the □ð VoO □ð program □ð my □ð family □ð was □ð to □ð
the □ð kids. □ð Prior □ð to □ð the □ð health □ð effects □ð when □ð I □ð was □ð sick □ð I □ð had □ð a □ð
that □ð ultimately □ð inhibited □ð me □ð from □ð taking □ð care □ð of □ð my □ð family □ð … □ð After □ð
within □ð 24 □ð hours □ð I □ð had □ð boils □ð on □ð my □ð neck, □ð they □ð looked □ð like □ð squeeze □ð ch
blood □ð and □ð black □ð puss □ð would □ð come □ð to □ð the □ð surface □ð … □ð I □ð lost □ð over □ð
September, □ð 2011 □ð I □ð weighed □ð 185 □ð pounds □ð and □ð it □ð steadily □ð declined □ð to □ð 13
months. □ð I □ð could □ð gain □ð back □ð weight □ð for □ð 10 □ð months □ð … □ð Around □ð September, □ð 2
was □ð neurologically □ð off □ð track, □ð realize □ð I □ð didn't □ð it □ð was. □ð I □ð was □ð cognizant □ð of □ð

ED_001324_00007754-00038

and □ð could □ð feel, □ð hear □ð and □ð [illegible] with □ð abdominal □ð pai
for □ð months, □ð and ’t □ð figure □ð out □ð why. □ð It □ð felt □ð like □ð someone □ð had □ð stabbed □ð m
poured □ð alcohol □ð over □ð it, □ð and □ð the □ð pains □ð were □ð sporadic. □ð bus □ð stop □ð with □ð 15 p
feet □ð from □ð the □ð front □ð door, □ð and □ð them □ð go □ð to □ð the □ð bus □ð stop □ð until □ð I □ð
difficulty □ð sleeping □ð and □ð often □ð only □ð slept □ð two □ð hours □ð a □ð night. □ð When □ð I □ð
sweat, □ð my □ð skin □ð would □ð flare □ð up □ð and □ð would □ð get □ð redmed □ð bumps □ð small □ð or
even □ð mow □ð the □ð lawn □ð for □ð more □ð than □ð a □ð few □ð minutes □ð without □ð dropping □
still □ð experiencing □ð the □ð skin □ð problems □ð and □ð I □ð feel □ð easily □ð fatigued □ð from □ð m
4) □ð

□ð “On □ð April □ð 26, □ð 2010 □ð I □ð was □ð working □ð on □ð my □ð shop □ð about □ð six □ð miles
I □ð was □ð working □ð 26 □ð feet □ð off □ð the □ð ground □ð on □ð a □ð ladder, □ð and □ð I □ð got □
… □ð My □ð whole □ð body □ð started □ð shaking □ð from □ð the □ð smell, □ð and □ð my □ð eyes □ð be
and □ð I □ð could □ð barely □ð breathe. □ð I □ð did □ð a □ð few □ð jobs □ð since □ð then □ð in □ð an □
health □ð problems □ð escalated □ð until □ð it □ð got □ð to □ð the □ð point □ð where □ð I □ð would □ð
around □ð chemicals □ð … □ð I □ð know □ð when □ð [the □ð seizures] □ð occur. □ð Sometimes □ð when □ð I □ð
seizures □ð I □ð turn □ð blue □ð because □ð I □ð am □ð not □ð getting □ð oxygen. □ð It □ð concerns □
works □ð during □ð the □ð day □ð and □ð I □ð am □ð often □ð alone □ð … □ð I □ð have □ð probably □ð
February □ð 2011 □ð … □ð I □ð had □ð a □ð seizure □ð in □ð my □ð life □ð until □ð the □ð oil □ð spill □ð
energy □ð I □ð exert □ð the □ð better □ð I □ð feel. □ð This □ð has □ð completely □ð affected □ð my □ð lif
used □ð to □ð work □ð 10 □ð to □ð 15 □ð hours □ð a □ð day □ð on □ð historicst □ð restoration □ð projects
sitting.” □ð (John □ð Gooding, □ð 1, □ð 7) □ð

“In □ð addition □ð to □ð this □ð seizure □ð disorder, □ð he □ð also □ð has □ð developed □ð multiple □ð
sensitivities □ð (MCS), □ð a □ð condition □ð in □ð which □ð a □ð large □ð number □ð of □ð chemicals □
severe □ð symptoms □ð in □ð response □ð their □ð exposure. □ð □ð This □ð disorder □ð is □ð well □ð recogni
who □ð have □ð experienced □ð contact □ð with □ð toxic □ð chemicals. □ð □ð People □ð with □ð MCS □ð
household □ð cleaning □ð products □ð and □ð many □ð other □ð materials □ð that □ð contain □ð even □ð
aromatic □ð chemicals. □ð □ð Additionally, □ð these □ð patients □ð often □ð have □ð adverse □ð reactions
commonly □ð used □ð prior □ð to □ð their □ð toxic □ð exposure, □ð such □ð as □ð scented □ð soaps □ð
products □ð like □ð Windex. □ð Michael □ð Robichaux, □ð 5) □ð

“[My □ð husband] □ð sensitive □ð to □ð common □ð scents, □ð such □ð as □ð hair □ð spray □ð or certain □ð perfumes. □
deodorants □ð now, □ð and □ð toothpaste □ð irritates □ð his □ð mouth. □ð He □ð cannot □ð use □ð dishes
because □ð the □ð smell □ð of □ð Cascade □ð upsets □ð his □ð system. □ð He □ð when □ð he □ð touches □
oil □ð his □ð hands □ð break □ð out □ð in □ð Betsey □ð Miller, □ð 4) □ð

“Before □ð the □ð spill □ð my □ð health □ð was □ð generally □ð fine □ð … □ð Since □ð I □ð was □ð spray
developed □ð sensitivity □ð to □ð regular □ð smells, □ð like □ð our □ð lysol □ð Did □ð soap □ð since □ð I □ð
was □ð a □ð baby, □ð and □ð I □ð can □ð now. □ð It □ð causes □ð my □ð throat □ð to □ð close □ð up □ð like
Bosarge, □ð 2) □ð

□ð “Right □ð around □ð the □ð time □ð I □ð got □ð sick □ð on □ð the □ð barge □ð in □ð June □ð 2010 □
loss □ð … □ð □ð □ð It □ð gradually □ð severe □ð problems □ð … □ð In □ð December □ð 2010 □ð I □ð le
pants □ð on; □ð I □ð was □ð going □ð to □ð work □ð with □ð a □ð shirt, □ð drawers, □ð and □ð no □ð pa
in □ð my □ð car □ð and □ð realized. □ð I □ð laugh □ð because □ð funny. □ð I □ð honey, □ð but □ð for □ð six □
years. □ð In □ð the □ð summer □ð of □ð 2011 □ð I □ð went □ð to □ð Houma □ð and □ð got □ð lost, □ð fo
remember □ð why □ð I □ð went □ð to □ð Houma, □ð or □ð where □ð I □ð was □ð time. □ð I □ð went □ð to
taught □ð singing □ð and □ð piano □ð until □ð the □ð from □ð spill □ð 22 □ð to □ð remember □ð now □ð can’
to □ð play □ð the □ð piano. □ð I □ð sit □ð at □ð the □ð piano □ð and □ð I □ð cry, □ð because □ð I □ð kn
can’t □ð remember. □ð (Jamie □ð Griffin, □ð 9) □ð

ED_001324_00007754-00039

"I can't remember everything; literally my memory is gone now. I sometimes leave home without a wallet. I have a notebook that I record everything in and ... as if I'm studying for school. That is the only way that I am able ... changed so much." (Anonymous #2, 6)

"Our friend stated that she had been quite ill, and doctors at a ... had leukemia. Her husband is a fisherman who worked the VoO p... apparent that she had been washing his working clothes and husband was exposed to toxic ... chemicals through this route…Interestingly, while he had worked for 95 ... location had little oil present … However, he explained that he saw ... throughout the time that he worked on the VoO program." (Dr. Michael Robichaux, 5)

"In the beginning it was hot, but I thought it would be a regul... there was a mist that we were breathing in and I started feeling ... immediately … I had a shortness of breath. I could not ... tell me; I had ... never take breaks." (Anonymous #1, 3)

"The BP medics told me it had to be heat related … My wife ... lost 15 pounds in three weeks … My breathing has been messed u... cleanup … I play with my dogs for 15 to 20 minutes and I can't breathe. Now I cannot take a whole cigarette; I smoke half and start to feel it ... I feel like I am choking ... never ... this coming, because prior to working on the cleanup I was in good ... football field all day long. I had been working ... I was 12 ..." (Anonymous #4, 4)

"Before I saw Dr. Mike for treatment, I had consumed almost nothing for two weeks. I ... 320 to 280 lbs, and eventually I lost 70 pounds. It ... I coughed up vile ... 2011 at Walmart I saw the foreman who first showed me the deco... weight and I was pale. I told him about my situation, and he said he ... thought that there could be a connection to his work conditions." (Jamie Griffin, 2)

"When I washed his clothes or we were intimate, I would break ... would start itching real bad … This happened even after he would ... scrub the vinegar all over him to break the smell because he sm... about six months, even after he stopped working." (Betsey Miller, 2)

"I woke up one morning in November 2010 and my eye was swol... blind from one eye for almost a year … I went to the retinal ... there was good news and bad news. The good is that there was no damage to ... is that because I couldn't see out of it, it's neurological" (Jamie Griffin, 7-8)

"He couldn't stop vomiting for 12 hours straight. The first time he got all the way out on the water to find the oil and told his crew that he f... called his team leader and said, 'This is not safe, I'm going back in for my sake as w... sake' … He explained to the HAZMAT instructor that he was experiencing most of the symptoms on the list provided for chemical exposure symptoms, including ... nose, skin tingling, ears that would leak liquid, violent vomiting and r... instructor told him that he needed to see a detox specialist because he bel... chemically poisoned." (Betsey Miller, 3-4)

"Since the oil spill, we also get calls from scores of sick residents ... reported by workers. Based on my experience with cancer alley, this was not sur...

concerned □ð about □ð future □ð cancer □ð rates □ð among □ð gulf □ð residents □ð who □ð have □ð bee
more □ð vulnerable □ð populations □ð in □ð any □ð toxic □ð environment □ð are (Dr. □ð the Wilma □ð ly □ð a
Subra, □ð 8) □ð

"My □ð daughter □ð had □ð a □ð baby, □ð Avereigh, □ð on □ð June □ð 7, □ð 2010. □ð Before □ð I □ð real
and □ð that □ð young □ð people □ð with □ð compromised □ð immune □ð systems, □ð should □ð would □ð tak
on □ð the □ð porch □ð with □ð us □ð every □ð morning. □ð Since □ð Avereigh □ð has □ð been □ð to □ð the □ð p
least □ð two □ð to □ð three □ð times □ð a □ð month □ð for □ð a □ð disease, □ð and □ð respiratory □ð condition □
known □ð as □ð croup, □ð upper □ð respiratory □ð infections □ð and □ð sinus □ð infections, □ð ear □ð and
infections □ð in □ð her □ð mouth □ð and □ð nose □ð (Dr. □ð Wilma □ð Subra, □ð 6) □ð

"When □ð I □ð was □ð working, □ð my □ð wife □ð and □ð kids □ð were □ð in □ð Grand □ð Isle □ð for □
beaches □ð were □ð fine □ð and □ð clean. □ð However, □ð I □ð am □ð afraid □ð that □ð my □ð kids □ð w
swam □ð in □ð the □ð ocean □ð and □ð pools □ð … □ð My □ð health □ð problems □ð are □ð not □ð the □ð only □ð one □ð that □ð
been □ð affected. □ð We □ð all □ð had □ð urinary □ð track □ð problems. □ð My □ð wife □ð and □ð I □ð h
overheated, □ð I □ð will □ð suffer □ð … □ð I □ð am □ð blessed □ð to □ð have □ð two □ð very □ð intelligen
little □ð girl □ð Dad's, □ð my □ð belly □ð hurts, □ð daddy □ð my □ð heart □ð … □ð My □ð
… □ð has □ð stomach □ð problems □ð and □ð doesn't □ð eat. □ð She □ð runs □ð a □ð high □ð fever □ð at □ð
do □ð we □ð do? □ð Now □ð one □ð knows □ð when □ð we □ð dealt □ð with □ð this □ð #2, □ð 5) □ð

"I □ð put □ð the □ð website □ð [www.truthoutonbpillnesses.com] □ð together □ð because □ð if □ð there □ð
had □ð gone □ð to □ð the □ð website □ð and □ð had □ð a □ð sick □ð child, □ð they □ð could □ð catch □ð
was □ð not □ð experiencing □ð life □ð threatening □ð illnesses □ð … □ð The □ð symptoms □ð were □ð mo
sinus □ð symptoms, □ð low □ð energy □ð and □ð loss □ð of □ð appetite □ð that □ð progressed □ð into □
… □ð It □ð was □ð one □ð month □ð before □ð he □ð was □ð diagnosed □ð with □ð asthma
They □ð did □ð a □ð CT □ð scan □ð of □ð his □ð sinuses, □ð and □ð the □ð doctors □ð said □ð that □ð
adult □ð male □ð with □ð severe □ð chronic □ð sinus □ð problems; □ð that □ð he □ð had □ð never □ð see
year □ð old □ð in □ð life. □ð (Christina □ð Tillman, □ð 2, □ð 5) □ð

"When □ð [the □ð national □ð director □ð of □ð Health □ð Fund] □ð went □ð to □ð Boothville □ð Elementa
Plaquemines □ð Parish □ð and □ð they □ð opened □ð the □ð medical □ð closet, □ð it □ð was □ð full □ð of
flag? □ð What □ð is □ð causing □ð that □ð many □ð breathing □ð problems □ð with □ð that □ð number □ð
Boothville □ð Elementary □ð we □ð have □ð sick □ð kids □ð all □ð over □ð the □ð place □ð who □ð are □
infections, □ð severe □ð asthma, □ð skin □ð infections, □ð blisters □ð in □ð between □ð their □ð fingers
legs □ð and □ð their □ð feet. □ð Some □ð kids □ð have □ð blisters □ð all □ð around □ð their □ð mouths □
were □ð perfectly □ð fine □ð before □ð the □ð spill □ð and □ð the □ð (Kindra □ð Arnesen, □ð 7) □ð began.

"A □ð lot □ð of □ð workers □ð did □ð not □ð even □ð have □ð a □ð day □ð to □ð vent □ð or □ð off □ð g
should □ð have □ð been □ð educated □ð that □ð ethylbenzene □ð and □ð other □ð organic □ð compounds
that □ð get □ð into □ð bloodstreams □ð and □ð mimic □ð hormones. □ð When □ð they □ð get □ð in □ð the
Estrogen □ð receptors □ð from □ð getting □ð into □ð a □ð receptor □ð site. □ð In □ð effect, □ð the □ð bo
(Scott □ð Porter, □ð 15) □ð

"Before □ð all □ð of □ð this, □ð he □ð was □ð as □ð healthy □ð as □ð a □ð horse, □ð as □ð strong □ð as
doctor □ð s. □ð It's □ð hard, □ð because □ð deteriorating □ð front □ð of □ð me. □ð He □ð looks □ð like □ð he □ð has
I □ð have □ð been □ð married □ð to □ð this □ð (Betsy □ð Miller, □ð 7) □ð six □ð years.

"In □ð November □ð 2010, □ð I □ð began □ð writing □ð a □ð paper □ð on □ð our □ð health □ð problems
Marylee □ð Orr □ð … □ð if □ð I □ð could □ð to □ð assist □ð LIVers □ð that □ð may □ð be □ð suffering □ð fro
symptoms. □ð After □ð she □ð read □ð the □ð paper, □ð she □ð asked □ð if □ð she □ð could □ð put □ð

ED_001324_00007754-00041

symptoms □ð and □ð exposure. □ð I □ð provided □ð a □ð link □ð to □ð the □ð videos □ð of □ð what □ð
'If □ð you □ð think □ð you □ð were □ð in □ð this, □ð you'" □ð (Steve □ð Kolian, □ð 6) □ð blood □ð tested.

"In □ð response □ð to □ð a □ð letter □ð I □ð wrote □ð the □ð CDC □ð about □ð health □ð problems □ð as
wrote □ð back □ð on □ð June □ð 15, □ð 2011 □ð that □ð there □ð are □ð no □ð multiple □ð illness □
surveillance □ð systems □ð used, □ð and □ð that □ð there □ð have □ð been □ð no □ð approved □ð dispe
summer □ð of □ð 2010. □ð □ð These □ð assertions □ð need □ð to □ð be □ð supported □ð with □ð facts."

b. Is the Gulf toxic?

"Based □ð on □ð our □ð findings □ð approximately □ð 100 □ð surveys, □ð in □ð addition □ð to □ð approximately □
individuals □ð reported □ð being □ð ill □ð often, □ð on □ð an □ð ongoing □ð basis, □ð everyday □ð and
exposure □ð identified □ð by □ð all □ð of □ð the □ð individuals □ð surveyed □ð consisted □ð of □ð contam
water, □ð contaminated □ð wetlands □ð and □ð beaches □ð and □ð contaminated □ð tissue." □ð (Dr. □ð Wi

□ð "We □ð went □ð up □ð North □ð Mississippi □ð in □ð the □ð summer □ð of □ð 2011, □ð and □ð this
and □ð the □ð health □ð problems □ð immediately □ð returned. □ð There □ð we □ð went □ð for □ð a □
and □ð all □ð the □ð congestion □ð and □ð stuff □ð went □ð away. □ð We □ð come □ð home, □ð and □ð t
pattern □ð continues." □ð (Donald □ð Tillman, □ð 10) □ð

"[My □ð sick □ð granddaughter, □ð Avereigh, □ð and □ð her □ð parents] □ð moved □ð to □ð St. □ð Augusti
months □ð and □ð her □ð infections □ð cleared. □ð They □ð returned □ð in □ð March □ð 2012 □ð and □ð
returned. □ð When □ð they □ð were □ð in □ð Florida, □ð [we] □ð visited □ð them □ð for □ð six □ð days, □
better. □ð We □ð had □ð our □ð life □ð force □ð back □ð to □ð the □ð Gulf □ð when □ð we □ð returned □ð symptoms □
to □ð repeat □ð themselves." □ð (Lorrie □ð Williams, □ð 6) □ð

□ð "On □ð February □ð 15, □ð 2011 □ð I □ð went □ð to □ð Atlanta, □ð Georgia □ð to □ð see □ð my □ð g
and □ð during □ð that □ð time □ð I □ð did □ð not □ð experience □ð any □ð problems. □ð When □ð
woke □ð up □ð the □ð following □ð morning □ð I □ð had □ð a □ð severe □ð cough □ð with □ð bloody □ð
a □ð quarter. □ð I □ð was □ð wheezing □ð and □ð could □ð barely □ð talk." □ð (Lori □ð Stoeger, □ð 30) □ð

□ð "Within □ð a □ð week □ð of □ð leaving □ð Venice □ð was □ð fine. □ð Every □ð time □ð I □ð took □ð [my □
her □ð skin □ð would □ð clear □ð up. □ð Then □ð when □ð I □ð brought □ð her □ð back, □ð she □ð would
(Kindra □ð Arnesen, □ð 36) □ð

"I □ð won't □ð let □ð my □ð son □ð go □ð back □ð to □ð the □ð Gulf □ð because □ð of □ð the □ð change
Beach, □ð and □ð he □ð still □ð has □ð chronic □ð coughing □ð and □ð a □ð constant □ð runny □ð nose. □
the □ð symptoms □ð subside, □ð but □ð then □ð when □ð he □ð completes □ð the □ð antibiotic □ð his □ð
clockwork. □ð He'd □ð stay □ð on □ð antibiotics □ð for □ð the □ð rest □ð of □ð his □ð life. □ð We □ð made □ð several □ð attempts □ð to □
get □ð away □ð from □ð the □ð general □ð toxicity □ð of □ð Louisiana; □ð we □ð just □ð could □ð not □ð leave. □ð My
in □ð the □ð summer □ð of □ð 2011 □ð for □ð Phoenix, □ð San □ð Diego □ð and □ð Houston □ð for □ð al
He seemed □ð to □ð be □ð doing □ð better." □ð (Anonymous □ð #3, □ð 5) □ð

"Everyone □ð who □ð goes □ð to □ð my □ð house □ð on □ð the □ð beach □ð in □ð the □ð bay □ð then □ð
sinus. □ð I □ð took □ð Al □ð Jazeera □ð reporters □ð to □ð the □ð bay, □ð and □ð they □ð got □ð sick.
their □ð eyes □ð and □ð had □ð sinus □ð symptoms. □ð It □ð is □ð toxic." □ð (John □ð Gehring, □ð 3) □ð □ð

□ð "Noah □ð stopped □ð going □ð to □ð the □ð beach □ð in □ð July □ð 2010, □ð after □ð he □ð woke □ð
gushing □ð with □ð blood. □ð He □ð doesn't □ð go □ð outside □ð anymore; □ð he □ð says □ð it □ð makes □ð him □ð sick. □ð It □ð
horrible □ð way □ð for □ð a □ð kid □ð to □ð live, □ð but □ð we □ð live □ð on □ð a □ð corner □ð so □ð t
There □ð is □ð nothing □ð to □ð obstruct □ð the □ð wind." □ð (Lorrie □ð Williams, □ð 6) □ð

"I ð have ð been ð to ð the ð beach ð in ð awhile, ð because ð every ð time ð you ð go ð
three ð days ð like ð you ð pay ð for ð it ð with ð bad ð headaches, ð nausea ð or ð resp
in ð early ð August ð 2011 ð that ð I ð was ð going ð to ð go ð down ð there ð to ð Pas
pictures. ð And ð the ð very ð next ð morning ð I ð woke ð up ð and ð a ð vessel ð in ð
time." ð (Shirley ð Tillman, ð 10) ð

"We ð have ð stopped ð even ð walking ð on ð the ð beach ð because ð it ð tends ð to ð
However, ð in ð March ð 2012 ð we ð took ð a ð journey ð to ð the ð beach ð out ð there,
Bubba ð was ð sick ð for ð three ð days, ð I ð got ð sores ð in ð my ð mouth ð and ð m
you ð had ð a ð head ð cold ð and ð went ð to ð the ð beach, ð the ð salt ð water ð wo
doesn't ð do ð that, ð the ð opposite ð is ð effect." ð (Lorrie ð Williams, ð 7) ð

"How ð does ð a ð three ð year ð old ð get ð that ð much ð toxicity ð in ð his ð blood ð when ð he
coast, ð except ð for ð one ð time ð when ð he ð was ð on ð the ð coast ð for ð five ð
present ð prior ð to ð this ð trip ð to ð Orange ð Beach ð ... ð Just ð before ð Thanksgiving ð of ð 2010
Mike ð Robichaux ð who ð was ð drawing ð blood. ð We ð drove ð about ð 150 ð miles ð s
because ð he ð was ð the ð only ð doctor ð willing ð to ð draw ð blood ð for ð us ð back ð in ð January ð of ð 2011 ð ... ð
2011 ð and ð at ð the ð time ð my ð son ð had ð the ð second ð highest ð level ð of ð t
been ð tested ð by ð LEAN ð except ð for ð one ð diver ð at ð the ð Anonymous ð #3, ð the ð
3) ð

a. Chemicals in the Blood

LEAN ð and ð working ð with ð Dr. ð Michael ð Robichaux, ð have ð taken ð excess ð of ð 100
on ð workers ð and ð residents ð who ð have ð reported ð health ð problems ð in ð the ð
blood ð samples ð have ð analyzed ð for ð VOCs, ð the ð compounds ð found ð in ð the ð c
results ð demonstrate ð an ð increase ð in ð the ð blood ð concentrations ð of ð those ð chem
exposed ð to ð the ð crude ð and ð dispersants ð ... ð When ð levels ð exceed ð the ð 95th ð percentile, ð it ð is ð clearly ð shows ð that ð exposure ð did ð occur." ð (Dr. ð Wilma ð Subra, ð
8) ð

"As ð I ð observed ð these ð patterns ð in ð my ð patients ð I ð was ð also ð able ð to
their ð symptoms ð and ð blood ð test ð results ð that ð I ð had ð been ð able ð to ð attain ð throu
this ð point ð my ð feelings ð went ð from ð being ð skeptical ð to ð being ð extremely ð al
these ð patients ð in ð a ð somewhat ð different ð light. ð I ð learned ð what ð questions ð
information ð that ð they ð wouldn't ð necessarily ð associate ð with ð their ð illness." ð (Dr. ð Michael ð Robichaux, ð
4) ð

"When ð you ð look ð at ð the ð overall ð data ð from ð the ð blood ð testing, ð the ð highe
current ð workers, ð and ð former ð workers ð who ð could ð not ð have ð had ð current
of ð the ð 95th ð percentile. ð The ð divers ð are ð just ð below ð that; ð they ð actually ð went ð ou
slick ð when ð it ð was ð in ð the ð gulf, ð and ð in ð the ð marshy ð areas. ð The ð p
the ð coast ð are ð still ð in ð the ð 95th ð percentile, ð because ð there ð is ð ongoing ð exposure ð through ð
their ð environment." ð (Dr. ð Wilma ð Subra, ð 8) ð

"Even ð though ð it ð is ð expensive, ð the ð easiest ð approach ð was ð to ð test ð for ð
as ð the ð CDC, ð argue ð that ð the ð volatiles ð disappear ð quickly. ð If ð that ð is ð th
alarm. ð The ð crude ð supposedly ð stopped ð flowing ð in ð the ð middle ð of ð July ð 20
to ð this ð *Either ð they ð don't ð disappear, ð or ð the ð oil ð is ð still ð contaminating ð the ð region ð* ð Because ð the ð region ð
testing ð for ð VOCs, ð the ð agency ð or ð government ð is ð going ð to ð be ð constantly ð pushing ð back ð
bad ð things ð about ð our ð data ð based ð on ð the ð aforementioned ð reasons. ð Yet ð

ED_001324_00007754-00043

taking ð over. ð Traditionally ð I ð help ð get ð testing ð off ð the ð ground ð in ð affected
CDC ð and ð state ð department ð of ð health ð services ð get ð involved ð to ð help ð impl
larger ð scale. ð That ð was ð not ð the ð cases ð in ð the (Dr. Wilma Subra, ð 9)

"[Certain ð VOCs] ð are ð known ð suspected ð cancer ð causing ð agents ð ... ð living ð a ð n
life ð but ð not ð cleanup ð workers, ð the ð two ð ways ð that ð you ð can ð be ð most
your ð car ð with ð gas ð and ð smoking. ð However, ð that ð exposure ð is ð much ð smal
in ð the ð blood ð tests. ð have ð fact, ð and ð six ð year ð old ð children ð who ð had ð h
blood, ð and ð they ð don't ð go ð out ð and ð fill' ð their ð car ð with ð gas, ð or ð smo (Dr. Wilma Subra, ð 10)

ð "In ð January ð 2011 ð I ð had ð a ð VOC ð identify ð chemicals ð performed ð the ð oil ð and
The ð test ð results ð found ð concentrations ð in ð my ð blood ð one ð to ð three ð times
percentile ð for ð ethyl ð benzene. ð My ð dive ð partners, ð who ð never ð wore ð dry ð suits, ð
test ð in ð January ð 2011. ð Their ð blood ð levels ð turned ð out ð to ð be ð higher ð than ð the ð chemicals ð i
water ð and ð now ð we ð are ð finding ð the ð same ð chemicals ð in ð our ð bloodstream (Scott Porter, ð 14) ð

"We ð tried ð to ð get ð the ð medical ð labs ð interested ð in ð doing ð analysis ð of ð th
major ð component ð of ð the ð crude ð oil. ð To ð this ð day ð we ð have ð been ð unable ð
the ð analysis, ð although ð PAHs ð are ð known ð and ð suspected ð cancer ð causing ð age
components ð that ð last ð a ð long ð time ð in ð the ð environment ð and ð are ð PAHs ð
crude ð oil ð will ð be ð present ð for ð decades. (Dr. Wilma Subra, ð 11) ð ð

"My ð blood ð was ð tested ð January ð 21, ð 2011 ð and ð levels ð were ð extremely ð hig
through ð our ð skin ð when ð we ð dove ð ... ð The ð test ð screens ð for ð as ð lighter
benzene, ð toluene, ð ethylbenzene ð and ð a ð few ð others. ð Research ð shows ð dermal ð
correlate ð with ð the ð symptoms ð I ð documented: ð the ð VOCs ð got ð into ð our ð li (Steve Kolian, ð 6) ð

"In ð January ð 2011 ð my ð husband ð got ð sick. ð By ð then ð it ð was ð sever
we ð had ð been ð working ð on ð the ð cleanup, ð however, ð the ð test ð still ð found ð
Were ð we ð continuing ð to ð be ð exposed ð to ð something? ð We ð didn't ð know ð how ð the ð spil
been ð handled ð and ð our ð health ð problems, ð until ð our ð blood ð tests ð came ð back ð
positive ð for ð four ð chemicals ð found ð in ð the ð crude ð oil ð spill: ð methylpentane, ð methylpentane, ð 2
and ð isooctane. ð His ð exposure ð surprised ð us, ð because ð since ð the ð spill ð he ð d
any ð seafood. ð However, ð when ð he ð began ð getting ð sick ð in ð September ð 2010 ð
felt ð like ð you ð could ð see ð we ð knew ð by ð then ð that ð BP ð had ð done ð this ð to
mentality ð shifted ð to, ð whatever ð is ð needed ð to ð raise ð awareness ð around ð the ð p
impact ð from ð the" (Shirley ð Tillman, ð 10) ð

The ð week ð after ð I ð returned ð from ð the ð hospital, ð in ð mid-ð August ð 2011
Blue ð Shield ð representative ð ... ð "[S]he ð asked ð always ð had ð allergies ð and ð rashes?
no, ð and ð gave ð her ð the ð history ð of ð my ð exposure, ð and ð told ð her ð that ð
positive ð for ð compounds ð present ð in ð the ð oil ð spill. ð She ð said ð that ð she ð s
she read ð Benzene, ð it ð is ð consistent ð with ð what ð would ð cause ð the ð problem. ð repeat ð what ð she ð said ð please?
said, 'I ð read ð Benzene ð is ð consistent ð with ð the ð give ð problem, ð more ð information. ð Tha
all ð it ð says ð was ð so ð shocked ð that ð there ð was ð actually ð something ð in ð my ð c
(Lori ð Bosarge, ð 8) ð ð

ð "ð Mike ð had ð not ð made ð that ð connection ð when ð I ð was ð first ð seeing ð h
high ð levels ð of ð chemicals ð from ð the ð oil's ð blood, ð and ð they ð people ð having

same health problems. I went back to Dr. Mike, and he reminded me
oil and dispersant chemicals when working on the barge. At first I
their clothes and mopped the floors. I kept just getting out, until a
my blood test results ... Out of the 10 chemicals they tested me
I looked up how they affect health it looked like reading my medi
health symptoms cited also with exposure to the chemicals in my blood test
Most prominent, with toluene, it listed blindness, seizures, nausea, vomiting,
neurological problems." (Jamie Griffin, 관Ġ10)

"I did research on the at four chemicals in body and also found in t
oil and dispersant, Corexit ... Dr. Soto said that it is possible when
he would have had much higher levels. Dr. Soto added that the sh
was already having were consistent with the results, such as the flu
problems ... [and] expressed that there could be long term effects and
distraught and trying to digest that myself son of did these have chemicals in his
Dr. Soto's main concern now his immune system, seeing been what depleted ... I feel
basically now're we just sitting." (Christina Tillman, 2, 5, 8)

"We love Dr. Mike's because only he one willing who to help ... Dr. Mike drew
for a volatile solvent profile test ... [H]e tested high positive for si
the oil and dispersant ... Dr. Mike explained that we needed to fin
results, because it was not his field of expertise. We sent his test
in chemical exposure. She explained that James is so poisoned that
before some of the symptoms even subside. She its explained day that because wh
he sweats he releases the chemicals from the fatty tissues, and it i
at one." (Betsey Miller, 5)

We asked Biloxi Regional Hospital to run the volatile solvent profile
blood and had to send it to the Metametrix Lab; however, the hos
called and told us that out of his 35 years in practice, this was
been lost." (Betsey Miller, 6)

"I added LEAN on February 1, 2011 and I had my blood tested two
LEAN paid for the test and [Dr. Mike] drew the blood. Dr. Mike
knowledge who was willing to draw blood for an, the test. He is the
hour early so my friend and I could meet him. He took us to
I was shocked by how easy it was. Prior to that experience, I
off for three months I could see them. That is what the power of
Mississippi. Now LEAN and Dr. Mike are providing a detoxification progra
from the spill. I have done any faith in the doctors around here, but I
(John Gooding, 6)

"During an informal lunch I met with a representative from a governm
responsibilities pertaining to the oil spill health responsible. I work, and her
her eyes welled up; she said that he will likely have cancer in
can't see the harm being done by these chemicals because they get
DNA on a molecular level on the of pogovernment officials at a meeting
day, I't think she was supposed to share that with me; but it
seeing my's son test results ... Everyone in our group had health concern
we went around the room sharing them ... We left with more conf

we □ð are □ð facing □ð than □ð when □ð we □ð entered, □ð because □ð the □ð government □ð representa
that □ð our □ð health □ð problems □ð could □ð be □ð" (Anonymous with #3, □ð the 4) □ð spill.

□ð □ð

5. Seeking Medical Help

"It's been really hard to get an accurate diagnosis or treatment, because none of *even admit there is a problem. There's one friend of mine who happens to be* *well aware of what's going on but is afraid to take Shirley Stillman, Mississippi."* Resident, Cleanup Worker

The health impact from combined exposure to Corexit and oil was u the medical industry response has well proved inadequate to meet the needs of t sickened by the disaster. BP, the government and hospitals across the of relevant medical expertise, by diagnosing the health problems as mere individual symptoms. While heat stress was certainly a contributing factor problems, it did not explain chronic unrelated symptoms, or the identical residents living in communities along the Gulf. Unable to get straight a communities were left feeling helpless, confused and scared about their their loved ones. LEAN and a brave Louisiana physician have tried to official disaster response and through a treatment program tailored toward exposure, in t offer providing a model for treatment programs throughout the

Of GAP witnesses nearly 86% were told by a medical professional that t between their health problems and chemicals, or that the professional recogn relationship but refused to document it. Over 42% of witnesses reported ask their physician about a relationship between more than 70% and reported that they did not have medical insurance, cover to treated BP exposures. Everyone who underwent the Gulf Coast Detoxification Program reported tha or cleared after undergoing treatment.

BP Official Position

BP continued to highlight its government partnership i health and safety. According to a company "We worked closely with contract providers, local counties, and Department of Health and Human Services to develop the to medical and health responses." This was done through a network that purportedly provided emergency medical services, exposure risk control programs with an emphasis on heat stress management. BP management took credit for extending medical "individuals in the affected communities who sought help with 's complaints impacts."[111]

BP set up a private medical service *requested* to cleanup workers they fell the job, before they could go to a public hospital. Combined BP see their Emergency Medical Services (EMS), clinics were only equipped to provide bas Medical staff working so underwent BP reported being extremely frustrated by their provide workers adequate care. One nurse, after being told by BP that aspirin and band aids to a sick individual, reported "service" frustration tha actually was blocking victims from getting "BP needed to medical its own Emerge

Medical □ð Service □ð and…the □ð sickest □ð people □ð are □ð being □ð taken □ð there □ð and □ð avoidin center."[114] This □ð would □ð prove □ð to □ð be □ð a □ð problem as □ð the government □ð medical □ð BP □ð spill, units □ð were □ð housed □ð within □ð BP □ð

Government □ð Official □ð Position

One □ð month □ð into □ð the □ð BP □ð spill □ð response, □ð HHS □ð Secretary □ð Kathleen □ð Sebelius □ "We □ð are □ð all □ð aware □ð of □ð the □ð potentially □ð serious □ð health □ð consequences □ð of □ð the □ð Deepwater □ð oil □ð spill," □ called □ð for □ð appropriate □ð clinical □ð services □ð for □ð those □ð sickened □ð by □ð exposure □ð t dispersant, □ð heat, □ð or □ð other □ð work[115] Her □ð letter □ð addressed, □ð committed □ð to □ð ensuring □ effort □ð conducted □ð responsibly, □ð compassionately, □ð and □ð with □ð absolute □ð scientific □ð integr BP □ð to □ð pay."[116] Shortly □ð thereafter, □ð HHS □ð government □ð mobile □ð medical □ð unit □ð in □ð Venice, □ Louisiana, □ð one □ð of □ð the □ð coastal □ð parishes □ð closest □ð to □ð the □ð disaster. □ð The □ð unit, □ð according □ð to □ð HHS, □ð was □ð additional □ð basic □ð medical □ð care □ð for □ð responders □ð and □ coastal □ð communities □ð affected □ð by "working □ð in □ð partnership □ð with □ð the □ð local □ð medic community.[117] The □ð government □ð mobile □ð unit □ð was □ð housed □ð in □ð a □ð private □ð BP □ð compound security, □ð making □ð it □ð impossible □ð for □ð workers □ð to □ð anonymously □ð seek □ð medical □ workers □ð sought □ð due □ð to □ð fears □ð that □ð they □ð would □ð be □ð retaliated □ð against □ð for This □ð fear □ð was □ð exacerbated □ð by □ð BP □ð health □ð waivers □ð that □ð workers □ð were □ð required □ð t response.[118] □ð □ð

Worker □ð medical □ð logs □ð kept □ð throughout □ð the □ð response □ð recorded □ð individual □ð sympt nose, □ð throat □ð and □ð respiratory □ð complaints. □ð The □ð NIOSH □ð Health □ð Hazard □ð Evaluati "nonspecific □ð signs" □ð such □ð as □ð dizziness □ð and □ð headaches, □ð rashes □ð and □ð disorders, □ð declining □ð to □ð acknowledge □ð that □ð those □ð symptoms □ð were □ð also □ð early □ð signs □ð of □ the □ð other □ð specific □ð symptoms □ð recorded □ð including □ð HHE □ð symptoms.[119] According □ð to □ð the □ð HHE, □ð about □ð 70% □ð of □ð the □ð infirmary □ð visits □ð it □ð examined □ð by □ð evaluation □ð workers □ by □ð emergency □ð medical □ð technicians □ð and □ð treatment □ð with □ð medications.[120] □ð added □ð that "[m]edical support □ð staff □ð was □ð available □ð at □ð many □ð sites □ð where □ð workers □ð wer This □ð staff □ð played □ð an □ð important □ð role □ð in □ð monitoring □ð possible □ð health □ð effects medical □ð assessments □ð with □ð referral □ð for □ð higher □ð levels □ð of □ð care □ð as □ð needed. witnesses, □ð however, □ð referrals □ð were □ð rare, □ð and □ð workers □ð had □ð to □ð break □ð ranks outside □ð of □ð BP □ð EMS □ð before □ð receiving □ð additional □ð medical □ð care. □ð □ð

The □ð government □ð assertion □ð that □ð no □ð trends □ð in □ð illnesses □ð were □ð identified □ð was hospital □ð records.[121] The □ð Louisiana □ð Department □ð of □ð Health □ð and □ð Hospitals □ð reported □ð September □ð 25, □ð 2010, □ð Louisiana □ð received □ð 415 □ð reports □ð believed □ð to □ð health □ð complaints □ð exposure □ð to □ð pollutants □ð from □ð 329 □ð oil □ð spill, □ð involved □ð workers, □ð 86 □ð which □ð involv general □ð public, □ð and □ð 18 □ð which □ð resulted □ð in □ð hospitalizations.[123] Also □ð Louisiana □ð hospital □ treated □ð several □ð of □ð the □ð patients □ð for □ð what □ð the □ð referral □ð symptoms □ð as □ð respiratory □ð problems, □ð headaches □ð and □ð nausea □ð that □ð this □ð mass □ð sickness □ð may □ð hav caused □ð by □ð the □ð noxious □ð fumes □ð from □ð the □ð dispersant □ð and □ð oil □ð during □ð the perspective □ð was □ð the □ð exception □ð within □ð the □ð medical □ð community, □ð however, □ð which the □ð number □ð of □ð misdiagnosed □ð or □ð unreported □ð chemical □ð exposure □ð cases. □ð With □ unwillingness □ð to □ð identify □ð chemical □ð exposure □ð as □ð a □ð possible □ð relative □ð contributing □ð factor

health □ð symptoms, □ð sick □ð individuals □ð failed □ð to □ð receive □ð the □ð appropriate □ð immediate
less □ð be □ð prepared □ð for □ð health □ð problems □ð that □ð could □ð manifest □ð years □ð later, □ð s

Instead □ð of □ð educating □ð Gulf □ð clinicians □ð on □ð the □ð most □ð severe □ð health □ð hazards □ð
the government □ð launched □ð a □ð campaign □ð to □ð neutralize □ð community □ð efforts □ð to □ð sound
When □ð CDC □ð got □ð word □ð about □ð the □ð growing □ð use □ð of □ð blood □ð tests □ð to □ð ident
Corexit, □ð the □ð agency □ð created □ð a □ð fact □ð sheet □ð for □ð clinicians □ð stating □ð that □ð it □
VOC □ð blood □ð tests "□ð determine □ð exposure □ð or □ð guide □ð delivery □ð of □ð medical □ð care □ð
due □ð to □ð the □ð varying □ð half-lives □ð of □ð these □ð compounds, □ð they □ð tend □ð to □ð leave □ð the □ð body
days □ð and □ð are □ð very □ð difficult □ð to □ð identify □ð through □ð laboratory □ð tests." □ð Fact □ð Sheet □ð
concluded: "No □ð treatment □ð exists □ð for □ð the □ð VOC □ð chemicals □ð is □ð recommended[.]

Independent Position

BP □ð and □ð government □ð methods □ð to □ð limit □ð medical □ð treatment □ð to □ð basic □ð primary
residents □ð desperate □ð for □ð medical □ð who □ð would □ð at □ð minimum □ð recognize □ð the □ð severity □
problems, □ð and □ð at □ð best □ð help □ð them □ð to □ð get □ð better. □ð According □ð to □ð LEAN □ð
percent □ð of □ð the □ð individuals □ð interviewed □ð had □ð access □ð to □ð medical □ð care, □ð while □ð
insurance. □ð Of □ð the □ð total □ð individuals □ð participating □ð in □ð the □ð survey, □ð 20 □ð percent
result □ð of □ð the □ð BP □ð spill, □ð thus □ð (likely) □ð lacking □ð medical □ð insurance. □ð The □ð
overwhelming □ð majority □ð of □ð witnesses □ð participating □ð in □ð LEAN □ð reported □ð that □ð BP □ð EM
hospitals □ð completely □ð failed □ð to □ð address □ð their □ð health □ð problems.

LEAN □ð again □ð filled □ð the □ð void, □ð this □ð time □ð through □ð access □ð to □ð medical □ð treatm
While □ð hospitals □ð across □ð the □ð Gulf □ð turned □ð a □ð blind □ð eye □ð to □ð the □ð health □ð problems □ð as
BP □ð spill, □ð Dr. □ð Michael □ð Robichaux, □ð an □ð ear □ð nose □ð and □ð throat □ð doctor □ð with □
Raceland, □ð Louisiana, □ð was □ð seeing □ð patients □ð on □ð the □ð clock. □ð After □ð drawing □ð blood □ð fro
workers □ð and □ð residents □ð in □ð 2011 □ð at □ð the □ð request □ð of □ð LEAN, □ð he □ð quickly □ð
health □ð problems, □ð their □ð descriptions □ð of □ð exposure □ð to □ð oil □ð and/or □ð dispersant, □ð a
their □ð blood. □ð While □ð the □ð mention □ð of □ð BP □ð made □ð other □ð physi□ð on □ð sick □ð indi
Dr. □ð Robichaux □ð went □ð on □ð a □ð crusade □ð to □ð try □ð and □ð get □ð his □ð patients □ð prope
to □ð the □ð state □ð and □ð federal □ð government □ð to □ð take □ð action □ð in □ð the □ð midst □ð of
greatest □ð public □ð health □ð crisis, □ð LEAN □ð and □ð Dr. □ð Robichaux □ð teamed □ð up □ð to □ð take □ð m
hands, □ð through □ð the □ð creation □ð of □ð the □ð Gulf □ð Coast □ð Detoxification □ð Project □ð (GCDP

The □ð GCDP, □ð run □ð out □ð of □ð Dr. □ð Robichaux's □ð home, □ð was □ð modeled □ð after □ð a □ð popular □ð detoxificati
used □ð for □ð sick □ð 9/11 □ð first □ð responders. □ð It □ð employed □ð basic □ð exercise, □ð saunas, □
Vitamin □ð B □ð to □ð help □ð expel □ð chemicals □ð from □ð the □ð body. □ð Akin □ð to □ð the □ð bl
the □ð support □ð of □ð Jim □ð Woodworth, □ð head □ð of □ð responders □ð successful □ð 9/11 □ð program, □ð
in □ð order □ð to □ð offer □ð the □ð treatment □ð at □ð no □ð cost. □ð LEAN □ð also □ð secured □ð a
sick □ð individuals □ð outside □ð of □ð Louisiana □ð to □ð undergo □ð the □ð treatment. □ð The □ð GCD
2012, □ð after □ð having □ð exhausted □ð its □ð funding □ð to □ð treat □ð over □ð 50 □ð patients □ð with □ð remarkabl
reported □ð that □ð their □ð chronic □ð symptoms, □ð such □ð as □ð skin □ð rashes, □ð memory □ð losses □ð and
largely □ð had □ð subsided □ð since □ð undergoing □ð treatment, □ð allowing □ð them □ð (in □ð the □ð sl
functional □ð again. □ð Unfortunately, □ð the □ð impacts □ð of □ð chemical □ð exposure □ð are □ð still □ð un

Whistleblower Record

a. Medical Response by BP, Government and Hospitals

"BP had a release form for health effects related that the spill got It s
BP had personnel at headquarters to get 't us find evaluated. If wrong they then
would be on our own to seek (Jorey medicanos, attention)

"I owe $40,000 for the three times I don't know how the hospital it.
December 2010 to I leave the house because we if did what I had was con
Every time I go to the hospital they have test the flu for the took flu; more
than I have in my Anonymous life #2, 5)

"When someone fell ill they could not go directly to the hospital;
through a private medical response center located in a tent ... It w
checking workers for symptoms of chemical exposure, but we were reg
seasickness or dehydration ... Most of the guys have worked on boats
weren't buying into the false Anonymous #2, 2 Ġ3)

"It was advertised as an independent Medical government where mobile workers and
residents could access freely and anonymously. However, that was not the
Venice to survey the medical unit, it was located at a BP compoun
in. I had to indicate who I was going, and wade through Louisiana state
Plaquemines Parish police and BP security. Then two BP representatives
government mobile medical unit ... The doctor was a fine gentleman, bu
chemical exposure looked like if it jumped up and hit him in his face
only General Practitioner The Ġ medical response was run by private Acadian company
hired by BP. Acadian screened the whole process and took your conta
worker got off a VoO boat and wanted to obtain support through
first have to report to Acadian would have behave a very difficult time
anonymous. Further, based on the clear lack of medical expertise for
medical clinic could adding the bad reported health Clint problems Ġ7)

"I went to the Health Clinic, located in Biloxi, MS. While I was in
staff member from the clinic came in and announced that the clinic
for $15,000. She proceeded to show us a giant sized check. The cl
NIEHS as well, in order to treat people who are sick from the
clinic he wanted medicals take pills anti. I never went back to the clin
like a scam John Gooding, 5)

"The cover up surrounding health problems extends to hospitals. West't Jefferson Hos
provide documentation to show that seven workers airlifted from the ves
the hospital and were chemically exposed from the Jefferson or dispersants.
Hospital documented it as heat stress, existing medical toxic solutions and exp
I stood in the hospital room with one of the men who had bee
was wrong, and she looked chemical him exposure, and it 't dish show up in any
of his medical records." (Clint Guidry, 4)

"It's been really hard to get an accurate diagnosis or treatment, bec
will even admit there is a problem. So consult have not doctor candidly
about the prospect of our illnesses being connected to the chemicals f

friend □ð of □ð mine □ð who □ð happens □ð to □ð be □ð a □ð well □ð doctor, □ð and □ð he □ð what □ð but □ð is □ð af
to □ð take □ð a □ð hard □ð (Shirley □ð on Tillman, □ð 10) □ð

"More □ð than □ð anything □ð at □ð that □ð time □ð I □ð wanted □ð to □ð have □ð peace □ð of □ð mind
test □ð and □ð other □ð medical □ð tests □ð if □ð his □ð health □ð related □ð problems □ð were □ð toxic □ð exposure. □ð I
had □ð so □ð many □ð doctors □ð this □ð impossibility □ð without □ð offering □ð any □ð basis □ð ... □ð Our □ð in
cover □ð this □ð type □ð of □ð blood □ð test, □ð because □ð ordered □ð from □ð his □ð regular □ð docto
didn't □ð see □ð it □ð as □ð a □ð need □ð Our □ð insurance □ð didn't □ð when □ð hospital □ð were □ð We □ð
probably □ð paid □ð $4,000 □ð to □ð $7,000 □ð out □ð of □ð pocket □ð – □ð because □ð we □ð don □ð of
money. □ð We □ð being □ð sent □ð to □ð collections □ð now □ð for □ð the □ð medical □ð bills, □ð but □ð t
(Anonymous □ð #3, □ð 3) □ð

"When □ð I □ð inquire □ð about □ð the □ð possibility □ð of □ð these □ð sudden □ð health □ð problems □ð bei
work □ð on □ð the □ð VoO □ð program, □ð doctors □ð have □ð not □ð made □ð any □ð connection □ð to
symptom □ð independently, □ð but □ð the □ð problems □ð (Sydney □ð to Schwartz, □ð 4) □ð

"I □ð now □ð people □ð in □ð this □ð area □ð that □ð have □ð had □ð these □ð health □ð problems, □ð too,
been □ð responsive □ð to □ð discussing □ð a □ð possible □ð connection □ð to □ð toxic □ð exposure □ð fro
tell □ð me □ð that □ð the □ð doctor □ð would □ð tell □ð them □ð they □ð have □ð given □ð them □ð respir
antibiotics □ð and □ð steroids □ð and □ð send □ð them □ð home. □ð I □ð had □ð heard □ð this □ð time □
coast." □ð (Lori □ð Bosarge, □ð 3) □ð

"In □ð September □ð 2010 □ð I □ð had □ð to □ð go □ð to □ð a □ð charity □ð hospital □ð in □ð Houma, □
bronchitis □ð and □ð a □ð chemical □ð cough □ð or □ð cold, □ð but □ð they □ð were □ð not □ð able □ð to
symptoms. □ð I □ð was □ð diagnosed □ð with □ð bipolar □ð disease, □ð schizophrenia, □ð chronic □ð bro
a □ð CT □ð scan □ð I □ð was □ð told □ð I □ð had □ð gastrointestinal □ð problems □ð these □ð Howe □ð diagnoses □ð all □ð
came □ð back □ð negative." □ð (Jerey □ð Danos, □ð 5) □ð

"Shortly □ð after □ð I □ð went □ð to □ð the □ð ER, □ð in □ð June □ð 2010 □ð the □ð medic □ð on □ð the
pickles □ð and □ð had □ð digested □ð too □ð much □ð potassium. □ð I □ð am □ð guessing □ð was □ð Katie □ð wo
located □ð at □ð the □ð front □ð of □ð the □ð barge □ð where □ð BP □ð staff □ð was □ð stationed. □ð I □
spasms □ð didn't □ð stop." □ð (Jamie □ð Griffin, □ð 6) □ð

"When □ð I □ð first □ð got □ð sick, □ð before □ð I □ð knew □ð the □ð cause □ð of □ð my □ð problems, □
Hutchinson □ð at □ð Lady □ð of □ð the □ð Sea, □ð in □ð the □ð fall □ð of □ð 2010. □ð I □ð asked □ð if □ð th
yes □ð and □ð took □ð my □ð personal □ð information. □ð Then □ð she □ð asked □ð me □ð what □ð the □
said, "I □ð not □ð positive □ð but □ð I □ð think □ð it □ð could □ð be □ð related □ð to □ð my □ð time
me □ð on □ð hold □ð for □ð about □ð two □ð minutes, □ð There □ð came □ð back □ð and □ð said □ð
she □ð hung □ð up." □ð (Jamie □ð Griffin, □ð 8) □ð

"I □ð saw □ð the □ð [Internal □ð Disease] □ð doctor □ð for □ð a □ð follow □ð Then □ð I □ð me □ð ... □ð
been □ð enough □ð medical □ð research □ð to □ð the □ð Corexit □ð problem □ð is, □ð I □ð felt □ð validated □
I □ð have □ð been □ð reaching □ð out □ð to □ð the □ð medical □ð field □ð to □ð help □ð the □ð people □
sick, □ð and □ð that □ð was □ð the □ð first □ð time □ð that □ð I □ð heard □ð say □ð Corexit." □ð
7) □ð

"My □ð family □ð recommended □ð a □ð doctor □ð they □ð have □ð been □ð treated □ð by □ð during □ð t
me □ð for □ð petrochemicals □ð and □ð identified □ð a □ð correlation □ð between □ð my □ð health □ð p
exposure □ð from □ð the □ð spill □ð ... □ð [H] □ð wrote □ð a □ð letter "It □ð is □ð my □ð professional □ð opinion, □ð
that □ð Mrs. □ð Bosarge's □ð health □ð problems □ð began □ð when □ð the □ð chemicals □ð were □ð used □ð du
They □ð caused □ð her □ð to □ð have □ð an □ð allergic □ð reactions □ð and □ð variety □ð of □ð health □
continually □ð exposed □ð to □ð these □ð (Lori □ð Bosarge, □ð 8) □ð

“I □ð was □ð particularly □ð concerned □ð with □ð the □ð plight □ð of □ð a □ð three □ð year □ð old □ð c
family □ð went □ð on □ð vacation □ð to □ð Orange □ð Beach, □ð Alabama. □ð □ð He □ð had □ð been □ð
was □ð beachside, □ð while □ð workers □ð were □ð cleaning □ð oil □ð soaked □ð booms □ð on □ð the □ð
home □ð he □ð became □ð violently □ð ill, □ð and □ð was □ð rushed □ð to □ð a □ð hospital □ð in □ð Bato
believed □ð that □ð he □ð was □ð suffering □ð from □ð a □ð severe □ð urinary □ð tract □ð infection, □ð and □ð they □ð even □ð performed
surgery □ð on □ð this □ð three □ð year □ð old □ð when □ð they □ð suspected □ð he □ð had □ð kidney
hospital, □ð his □ð father □ð asked □ð the □ð doctors □ð if □ð they □ð would □ð draw □ð blood □ð to □ð
might □ð not □ð have □ð been □ð exposed □ð him □ð to □ð chemical □ð compounds □ð resulting □ð in □ð his □ð illness. □ð Th
do □ð so, □ð and □ð abruptly □ð discharged □ð him □ð without □ð a □ð formal □ð diagnosis □ð (Final □ð Michael □ð Robinson, □ð 3
4) □ð

“After □ð the □ð incident □ð I □ð took □ð my □ð son □ð to □ð a □ð local □ð urologist. □ð I □ð explained □ð to □ð the
urologist, ‘Maybe □ð we □ð should □ð do □ð a □ð blood □ð test □ð for □ð Volatile □ð Organic □ð Compounds’ □ð immediately □ð a
wanted □ð to □ð know □ð why □ð I □ð brought □ð it □ð up. □ð I □ð told □ð him □ð the □ð same □ð thing
been □ð on □ð the □ð beach □ð where □ð Corexit □ð was □ð sprayed, □ð and □ð I □ð wanted □ð to □ð see □ð if □ð
chemicals □ð in □ð his □ð blood □ð that □ð could □ð help □ð explain □ð why □ð he □ð was □ð suddenly
problems. □ð The □ð urologist □ð reacted □ð as □ð if □ð my □ð suggestion □ð was □ð crazy □ð and □ð pro
needed □ð to □ð be □ð tested □ð for □ð Attention □ð Deficit □ð Hyperactivity □ð Disorder. □ð He □ð made
meeting □ð my □ð son □ð for □ð less” □ð (Anonymous □ð #3, □ð 2) □ð

“[W]e □ð shared □ð with □ð him □ð the □ð Volatile □ð Solvent □ð Profile □ð test □ð and □ð the □ð results
things □ð came □ð to □ð a □ð standstill. ‘I □ð have □ð to □ð tell □ð you □ð that □ð these □ð test □ð result
are □ð sharing □ð is □ð a □ð conflict □ð of □ð interest. □ð I □ð can’t □ð discuss □ð any □ð of □ð this we
have □ð a □ð lawyer. □ð I □ð told ’t, □ð hand □ð the □ð conflict □ð of □ð interest □ð and □ð
that □ð I □ð tell □ð you □ð I □ð would □ð not □ð be □ð able □ð to □ð proceed □ð testify □ð share □ð court □ð of □ð
had □ð a □ð lawyer □ð these □ð issues. □ð And □ð sitting □ð there □ð thinking, □ð wait, □ð I □ð am □ð here
about □ð my □ð son □ð being □ð sick, □ð that □ð was □ð we □ð needed □ð to □ð talk □ð about □ð conflicts □ð
lawyers, □ð this □ð is □ð getting □ð away ” □ð (Christine □ð Tillman, □ð 6). □ð

“I □ð have □ð worked □ð with □ð doctors □ð for □ð three □ð years, □ð and □ð I □ð have □ð never □ð wit
endured □ð while □ð we □ð tried □ð to □ð better □ð understand □ð the □ð problems. □ð It □ð felt □ð like □ð pulling
get □ð any □ð kind □ð of □ð feedback □ð whatsoever □ð from □ð our □ð doctors. □ð Every □ð doctor □ð co
we □ð brought □ð up □ð a □ð blood □ð test □ð our □ð chemicals □ð had □ð taken □ð that □ð showed □ð were
associated □ð with □ð the □ð oil □ð spill. □ð We □ð need □ð to □ð find □ð doctors □ð who □ð are □ð fam
to □ð respond □ð to □ð (Christina □ð Tillman, □ð 1) □ð

□ð “My □ð husband □ð had □ð a □ð frank □ð and □ð candid □ð conversation □ð with □ð him □ð at
that □ð he □ð could □ð write □ð anything □ð on □ð paper □ð to □ð identify □ð the □ð cause □ð of □ð James □ð
couldn’t □ð prove □ð that □ð BP □ð made □ð him □ð sick □ð with □ð the □ð dispersants □ð that □ð they
explained, □ð however, □ð that □ð something □ð happened □ð to □ð him □ð 30 □ð years □ð ago □ð when
medic □ð in □ð the □ð Vietnam □ð War. □ð He □ð was □ð sprayed □ð with □ð Agent □ð Orange □ð and
was □ð caring □ð for □ð had □ð similar □ð symptoms, □ð including □ð respiratory □ð problems □ð and □ð
that □ð James □ð and □ð were □ð sprayed □ð with □ð a □ð chemical □ð Agent □ð Orange □ð
government □ð authorized □ð and □ð there □ð is □ð no □ð proof □ð (Bessey □ð Millard, □ð 6) □ð

“The □ð man □ð who □ð drove □ð release □ð the □ð rope □ð when □ð it □ð got □ð stuck □ð on □ð our □ð
husband, □ð but □ð he □ð has □ð several □ð tears □ð coming □ð from □ð the □ð headaches. □ð Like □ð most □ð fish
he □ð does □ð not □ð have □ð insurance □ð so □ð he □ð does □ð not □ð go □ð to □ð the □ð hospital. □ð When □ð you □ð are □ð in □ð t
off □ð the □ð bat □ð if □ð you □ð have □ð no □ð insurance. □ð How □ð do □ð you □ð explain □ð to □ð hospital □ð staff □ð
about □ð the □ð working □ð conditions □ð with □ð BP? □ð They □ð look □ð at □ð you □ð like □ð they □ð
hospitals □ð don’t □ð know □ð what □ð to □ð look □ð for, □ð or □ð know □ð if □ð they □ð are □ð doing □ð the □ð right □ð protocol, □ð or □ð know □ð w

to ð address ð this ð type ð of ð chemical ð exposure. ð But ð I ð know ’t ð so ð nothing ð has my ð husband ð much ’ ð (Betsey ð Miller, ð 6)

b. Gulf Coast Detoxification Program

As ” ð an ð individual ð when ð a ð physician ð for ð over ð 40 ð years, ð I ð have ð often. ð However, ð the ð detoxification ð program ð has ð provided ð health ð improvements ð that ð amazing. ð ð Some ð of ð our ð more ð affluent ð patients, ð those ð with ð insurance ð an described ð seeing ð ten ð or ð more ð physicians ð in ð their ð quest ð to ð obtain ð relief and ð money ð spent ð in ð these ð quests ð have ð been ð as ð impressive ð as ð the ð p treatments. ð ð Few ð physicians, ð myself ð included, ð understand ð the ð toxic ð exposure ð an manner ð in ð which ð we ð become ð ill ð from ð these ð disorders. ð Even ð more ð ali is ð the ð manner ð in ð which ð people ð with ð toxic ð disorders ð are ð treated. ð ð treated ð as ð mainly ð individuals ð as ð we ð have ð at ð our ð modest ð detoxification ð clinic ð in Michael ð Robichaux, ð 9) ð

“I ð was ð one ð of ð the ð first ð people ð to ð go ð through ð the ð detox ð program. ð medicine ð had ð failed ð me. ð My ð routine ð during ð the ð program ð was ð very ð diet ð included ð all ð fresh ð vegetables. ð I ð took ð Niacin, ð a ð type ð of ð B ð vitamin, ð us minutes, ð got ð in ð a ð 180 ð degree ð sauna ð and ð sweat ð out ð the ð toxins. ð Old fever ð you ð have ð to ’ ð Boswell ð was ð in ð the ð fever ð and ” ð (Jorey ð Danos, ð 5)

By ” ð the ð second ð week ð [of ð the ð detox ð program] ð I ð began ð to ð realize ð tha effects ð from ð the ð damage ð already ð done, ð such ð as ð my ð skin ð rashes, ð but ð beginning ð to ð sleep ð and ð relax, ð my ð paranoia ð was ð decreasing ð and ð my ð ear abdominal ð pains ð and ð seizures, ð were ð subsiding. ð I ð was ð gaining ð my ð weight ð I ð was ð feeling ð noticeably ð better. ð ð I ð was ð able ð to ð eat ð healthy ð food ð and ð could ð of couldn’t ð since ð the ð job. ð I ð could ð do ð some ð yard ð work ð again. ð I ð was ð has ð a ð different ð phenomenon ð for ð each ð person ð … ð It ð taught ð me ð how ð through ð the ð way ð I ð exercise, ð awhile ð expelling ð as ð many ð of ð the ð toxins ð from If ð it ð is ð natural, ð it ð puts ð a ð sense ð of ð well ð being ð back ð in ð the ð bo spill ” ð (Jorey ð Danos, ð 6) ð

“On ð the ð successful ð side ð has ð been ð the ð improvement ð in ð memory ð loss, ð headaches, ð irritability ð and fatigue ð experienced ð by ð a ð large ð percentage ð of ð our ð patients ð have ð improved physician ð since ð 1971, ð I ð never ð have ð had ð a ð patient ð tell ð me ð that ð I ð one ð of ð the ð most ð common ð complaints ð I ð hear ð from ð our ð patients ð have ð expressed ð to the ð time ð they ð complete ð their ð treatment ð they ð are ð genuinely ð happy. ð Speakin confirmed ð great ð improvement ð in ð irritability, ð memory, ð and ð overall ” ð (Dr. ð Michael ð Robichaux, ð 9) ð

“One ð of ð our ð most ð amazing ð experiences ð involved ð a ð patient ð with ð multiple to ð the ð toxins ð through ð her ð job ð supervising ð the ð feeding ð of ð hundreds ð of contaminated ð boats. ð When ð she ð first ð began ð the ð program, ð she ð could ð barel … ð However, ð when ð she ð finished ð the ð program ð she ð was ð on ð the ð treadmill minutes. ð ð Her ð recovery ð was ð nothing ð short ð of ð amazing. ð (Dr. ð Michael ð Robichaux, ð 9) ð

“[T]here ð are ð those ð individuals ð who, ð although ð much ð improved, ð still ð suffer ð from ð long ð term ð medical ð damages ð that ð are ð difficult ð to ð treat ð and ð equally Additionally, ð many ð of ð our ð patients ð have ð to ð return ð to ð contaminated ð environments, ð

experiencing □ð problems □ð in □ð those □ð settings. □ð □ð One □ð female □ð boat □ð captain □ð can □ð
and □ð her □ð husband □ð and □ð fishing □ð partner □ð must □ð now (Dr. ð ron Michael ð Robichaux, ð ad ð)

□ð □ð

ED_001324_00007754-00054

6. Ecological Impact

"As an environmental scientist, I look at the way the government and BP are handling discussing the spill. [T]he government did not account for the increased toxicity of and Corexit." Scott Porter, Marine Biologist

Throughout the BP spill, the company and government justified dispersant reduce the disaster's overall environmental impact.[129] Their hypothesis, however, was based pretense that crude oil mixed with Corexit was more toxic than oil alone. That c be conclusively rebutted two years after the disaster, once the more t coated the Gulf seafloor and permeated ecological web and food chain. evidence has shown far greater damage than the government predicted at when it authorized unprecedented dispersant use. Coral, which are sensitive changes and play a central role in the Gulf ecosystem, are experienc unprecedented mortality in the wake of the event. BP and the govern dollars into research to assess the impacts of its environmental experime Gulf fishermen, divers and coastal residents to witness the devastation on a Corexit not only disrupted an entire ecosystem, but a way of life f recreate in the Gulf and survive on seafood for commercial and subsis

Of GAP witnesses, eye-관ġopening 76% expressed concern over the quality testing, and almost 60% reported *deformities* new first seafood. Nearly 80% of fishermen reported that their catch has decreased significantly since the s

BP Official Position

"Dispersants are used to minimize the environmental impact of a BP oil sheet on Corexit Ones. month into the disaster, BP announced that it million, year Ġopen research program study the impact and response efforts on Gulf marine and shoreline Their BP chief executive Tony Hayward remarked, "There is an urgent need to ensure that the scientific community has raw data it needs to" begin this work.

According to BP, the research would examine key questions about the environment, such as What are the impacts of the oil, the dispersed oil, biota of the seabed, the water column, the shoreline? What is the dispersant on the oil? Does it help These hinder biodegradation? that should have been addressed prior to use of Corexit command

In response to public concerns around contaminated seafood, BP acknowledg on humans theoretically could occur … through consumption of seafood t dispersants." It added, however, are being taken that human health impacts are minimized. BP explained that odor and chemical were threshold applied to determine whether seafood a disastrous that would quickly be undercut by government testing methods. response to warnings on the Material Safety

Data Sheet for Corexit about potential bioaccumulation, known respondents that of this dispersant are not expected to have a significant bioaccumulation rate at which dispersants are being applied offered in the Gulf assurance, since unprecedented amount of Corexit was thought used to subsurface in application the BP spill response's Website, stated that seafood is among the most rig tested sources of seafood on being made to today, testing as it heavily Gulf seafood during the 2012 Winter Olympics.

Government Official Position

Throughout the BP spill the EPA maintain the authority to stop the found that the environmental impact outweighed the benefits. This applied application of Corexit as well, which the EPA website still asserts, as significant ecological impact. The government argued that Corexit use was necess wildlife, fragile wetlands and Gulf shorelines from the oil. The National Administration (NOAA), while recognizing that coral harness could dispersed oil, explained that dispersant used in the vicinity of coral reefs is usually restri dispersed oil is unlikely to contact dressing. The future impact of Corexit organisms, Administrator Jackson stated effects on aquatic life are largely unknown and we must ensure that the dispersants that are used are Subsequent findings that the combination of crude oil is more than 50 than the oil alone poses new requestions about aquatic life, while sheddi on the documented Gulf impact. Furthermore, a GAO study on dispersant use that more dresear is needed to quantify the rate at which the chemicals environment, and cautioned that known about the application and effects o applied subsurface. Despite unknowns, the government remains absolute about environmental benefits of Corexit, as well as the safety of Gulf seafoo

More than one month before the well was capped, with oil still sp Obama posed for photos while eating Gulf seafood the President announced "comprehensive, coordinated and multi-agency initiative to ensure that seafood from t Mexico is safe to eat." After the well was capped, NOAA began reope fishing, and state fisheries were required. Then administrator Jane Lubchenco announced, NOAA is working to protect public safety while minimizing fishing industry. We are confident that seafood caught in this area is, from contamination. The Food and Drug Administration (FDA) commissioner I Hamburg added the testing that has been done as part of the agreed indicated any level of concern.

The criteria for NOAA to open an visible oil fishing be forgone required two weeks," and then samples would undergo sensory testing, inspector Gulf seafood.[147] Senator Barbara Mikulski after learning that the government was chemically testing Gulf seafood for dispersant, disperse: the oil placed but we

with another substance that has toxicity levels that is something that we ... seafood ... need to be concerned about.[148]

While agency heads announced their confidence in seafood, government Gulf scientists were joini... the senator in sounding the alarm – only their warnings didn't make it into the public dom... staff declined to sign off on EPA assertions that dispersants did not bioaccumulate... "Since we (CDC) were not privy to any information to substantiate [that the ... date do not bioaccumulate], we cannot concur with this statement."[149] FDA standards for seafood ... testing – based on a healthy 176 pound individual consuming approximately ... prompted concerns by an EPA staffer that the FDA underestimated the ... frequent seafood consumers: "I am not sure these data capture the population ... concerned about ... [D]o we have language about the resulting level ... consumer in the Gulf?"[150] Despite more conservative estimates that were considered ... government, it continued to use the lower, outdated criteria for the seaf... avidly promoting consumption.[151]

The government continues to actively promote Gulf seafood, and is wor... Louisiana Seafood Promotion and Marketing Board to purchase Gulf seafood[152] ... The Board, which received $30 million from BP and the government to ... Gulf seafood consumption, is hoping to expand its reach throughout the ... "whether it's the military or prison systems or school systems."[153] Conversely, just months before the government rolled out its plan to purchase Gulf seafood with taxpayer dollars, Sen... was warning that Gulf seafood safety is a nationwide concern: "The impact of the oil spill ... in the Gulf states. And the consequences of the safety of the seafood ... goes far and wide. ... An example of this would be ... the Gulf ... supplement popular Maryland Blue Crabs."[154] Underscoring the importance of the region to ... of the country, over 70 percent of the nation's shrimp catch, and 6... the Gulf.[155]

<u>Independent Position</u>

Over the past several years, the scientific and environmental community ... Senator's warnings with sound science and analyses absent from government ... More ... telling, the empirical ecological impact of the disaster could not be rev... government reports. Nearly three years after the explosion, it is increasingly ... reassurances are flunking the reality test. While BP's 10-year research program promises answ... dispersant use within the next decade, independent science already has fo... damage to our nation's most precious ecosystem. The most prevalent impacts, la... foreshadowed by GAP witnesses, include: record deaths of deep ... coral;[156] increased bacteria in ... Gulf waters;[157] an alarming increase of chemicals on the Gulf seafloor; tarballs ... beaches with contamination levels in excess of the carcinogenic high exposure limit;[158] mortality ... rates for dolphins, whales, and turtles;[159] wetland erosion at historic rates and a pe... salt marshes area in ...;[160] a dramatic impact on massive offshore microscopic life, which are ... the base of the food chain;[161] disturbing numbers of mutated seafood, ranging from eyeless ...

ED_001324_00007754-00057

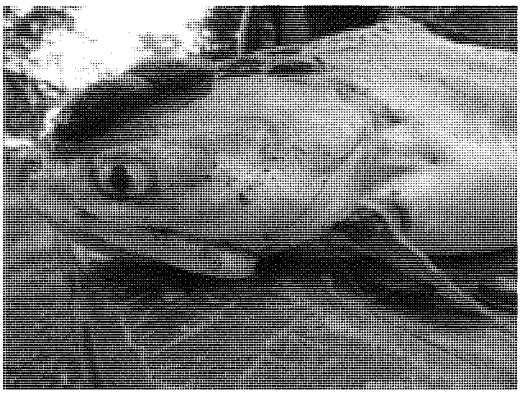


Photo by AP witness. Alabama catfish with lesions

to ð fish ð with lesions ð sharp ð declines ð in ð seafoo
catch, ð by ð as ð much ð as ð 80 ð percent ð in ð som
Furthermore, ð research ð has ð found ð that ð Corexit ð u
actually ð made ð it ð more ð difficult ð for ð the ð oil ð
by ð inhibiting ð the ð microbial ð degradation ð of ð hydr
in ð the ð crude ð oil.

In ð effect, ð chemical ð concentrations ð remain ð above ð
considered ð carcinogenic ð by ð government ð standards.
By ð dispersi ð the ð oil, ð rather ð than ð allowing ð it ð
concentrated ð through ð floating ð surface ð oil ð slicks, ð
chemicals can ð contaminate ð a ð much ð greater ð volume ð
water – ð harming ð more ð marine ð life. ð Experts ð warn ð that ð the ð degradation ð of ð the ð base ð
chain, ð resulting ð from ð Corexit ð use, ð will ð cause ð larger ð problems ð in ð the ð long ð ru
birds ð that ð were ð supposed ð to ð be ð spared ð through ð the ð dispersing ð of ð oil.

While ð NOAA ð was ð eager ð to ð reopen ð waters ð for ð fishing, ð seafood ð industry ð ð
more ð prudent ð measures ð in ð effort ð to ð ensure ð the ð integrity ð and ð longevity ð of ð
Louisiana ð Shrimp ð Association, ð concerned ð about ð the ð impact ð of ð Corexit ð on ð t
the ð health ð of ð fishermen ð working ð on ð the ð cleanup, ð and ð many ð challenged ð the
disaster. ð Unable ð to ð halt ð its ð use, ð they ð then ð cautioned ð against ð opening ð wa
first ð year ð of ð the ð well ð becoming ð capped ð so ð that ð the ð catch ð would ð have ð time
repopulate. ð The ð government ð insisted ð on ð proceeding ð without ð delay, ð causing ð ala
environmental ð and ð public ð health ð communities.

Corexit ð caused ð the ð dispersed ð oil ð to ð enter ð the ð
water ð column ð or ð settle ð on ð the ð seafloor, ð where ð
crustaceans ð bottom ð feeders, ð possibly ð
explaining ð the ð dramatic ð drop ð in ð shrimp, ð oysters ð
and ð crabs. ð In ð regions ð that ð were ð not ð heavily ð
impacted ð by ð the ð BP ð spill, ð their ð catch ð has ð not ð been ð
impacted ð to ð the ð degree ð of ð areas ð hit ð hardest ð by ð the ð
oil. ð Further, ð there ð is ð hope ð that ð annual ð crops ð such ð
as ð shrimp, ð which ð spawn ð each ð year ð and ð live ð only ð
about ð that ð long, ð will ð be ð able ð to ð recover ð in ð the ð
years ð to ð come ð (a ð primary ð reason ð the ð Louisiana ð
Shrimp ð Association ð wanted ð to ð delay ð openings ð
during ð the ð first ð year). ð However, ð in ð areas ð where ð
seafood ð catch ð remain ð low, ð fishermen ð can
to ð wait ð years ð for ð a ð recovery. ð
survey ð conducted ð by ð the ð EAN, ð fisher
reported ð losing ð $80,000 ð to ð $530,000 ð as ð a ð result ð of ð the ð BP ð spill, ð an
estimate ð 60 ð to ð 70 ð percent ð loss ð in ð the ð quantity ð of ð seafood ð harvested ð
ð

Photo by EcoRigs. Dispersed oil "mucus strands

The □ð same □ð study □ð that □ð found □ð oil □ð mixed □ð 50 □ð times □ð Corexit □ð to □ð be □ð have □ð the
cautioned □ð that □ð the □ð mixture □ð will □ð likely □ð have □ð a □ð large □ð impact □ð over □ð the □ð
out □ð of □ð the □ð BP □ð spill, □ð we □ð are □ð already □ð witnessing □ð these □ð impacts. □ð Corexit □
droplets, □ð making □ð highly □ð toxic □ð oil □ð mixture □ð "bioavailable" □ð to □ð small □ð organisms.
A □ð study □ð by □ð University □ð of □ð South □ð Florida □ð (USF) □ð released □ð in □ð April □ð 2013 □
plumes □ð from □ð the □ð BP □ð spill □ð were □ð responsible □ð for □ð the □ð widespread □ð damage □ð
form □ð the □ð basis □ð of □ð the □ð food □ð chain. □ð Additional □ð research □ð has □ð found □ð that □ð dispersants □ð
killed □ð plankton □ð and □ð other □ð small □ð organisms □ð that □ð live □ð in □ð the □ð water □ð column □ð and □ð bacteria □ð in □ð C
waters. □ð Meanwhile, □ð zooplankton □ð accumulated □ð polycyclic □ð aromatic □ð hydrocarbons □ð (PAH
derived □ð from □ð the □ð BP □ð spill, □ð and □ð have □ð entered □ð into □ð the □ð marine □ð food □ð
particularly □ð alarming □ð given □ð that □ð PAHs □ð are □ð known □ð carcinogens □ð and □ð developme
□ð
LEAN, □ð having □ð detected □ð PAH □ð levels □ð during □ð its □ð monitoring □ð of □ð the □ð environment □ð and □
Louisiana □ð coastal □ð estuaries □ð and □ð wetlands, □ð in □ð partnership □ð with □ð the □ð University
Medical □ð Branch □ð at □ð Galveston □ð to □ð examine □ð the □ð extent □ð and □ð impact □ð of □ð Gulf
an □ð eye □ð on □ð human □ð health. □ð According □ð to □ð LEAN, □ð the □ð results □ð will □ð be □ð presented □ð in □ð
community □ð partners □ð to □ð make □ð informed □ð decisions □ð on □ð a) □ð where □ð to □ð collect
their □ð families, □ð and □ð b) □ð how □ð frequently □ð to □ð consume □ð seafood □ð from □ð those □ð areas □ð by □ð their □ð families
without □ð resulting □ð in □ð increased □ð risk.
□ð
The □ð additional □ð research □ð is □ð urgently □ð needed, □ð as □ð a □ð 2011 □ð study □ð by □ð FDA □ð grossly
misrepresented □ð its □ð analysis □ð for □ð Gulf □ð seafood □ð safety □ð and □ð failed □ð to □ð include □ð chemicals □ð that □ð
undetected □ð by □ð government □ð testing □ð standards. □ð FDA □ð Deputy □ð Commissioner □ð for □ð Foods
Michael □ð Taylor □ð claim "Gulf □ð seafood □ð is □ð safe □ð to □ð eat, □ð and □ð it □ð is □ð safe □ð to □ð
found □ð that □ð FDA □ð flawed □ð assumptions □ð and □ð outdated □ð risk □ð assessment □ð methods □ð faile
for □ð pregnant □ð women □ð and □ð children, □ð and □ð allowed □ð up □ð to □ð 10,000 □ð times □ð too
seafood □ð according □ð to □ð NRDC □ð standard, □ð which □ð was □ð designed □ð to □ð be □ð protective □ð of □
populations. □ð Miri □ð Rotkin □ð, □ð one □ð of □ð the □ð report, □ð "We □ð cannot □ð not □ð wait □ð for □ð
people □ð to □ð get □ð sick □ð or □ð cancer □ð rates □ð to □ð rise, □ð we □ð need □ð FDA □ð to □ð act

The □ð impact □ð of □ð the □ð BP □ð spill □ð on □ð coral □ð should □ð be □ð given □ð careful □ð cons
play □ð a □ð unique □ð in □ð the □ð Gulf □ð ecosystem □ð deep □ð habitat □ð for □ð many □ð other □ð li
including □ð fish □ð and □ð invertebrate □ð species. □ð Corals □ð comprised □ð of □ð hundreds □ð of □ð
individual □ð animals □ð known □ð as □ð polyps, □ð are □ð extremely □ð sensitive □ð to □ð environ help □ð to □ð assess
full □ð impact □ð of □ð the □ð disaster. □ð Like □ð other □ð marine □ð life, □ð coral □ð often □ð pray □ð
in □ð the □ð water □ð column □ð such □ð as □ð the □ð contaminated □ð zooplankton. □ð Surveys □ð co
organization □ð EcoRigs □ð found □ð that □ð of □ð 125 □ð coral □ð colonies □ð collected □ð in □ð June □ð 2011
Isle, □ð Louisiana, □ð 60 □ð percent □ð showed □ð visible □ð signs □ð of □ð polyp □ð mortality. □ð Two □
coral □ð colonies □ð collected □ð from □ð the □ð same □ð location □ð showed □ð visible □ð signs □ð of

Findings □ð published □ð in □ð the □ð Proceedings □ð of □ð the □ð National □ð Academy □ð of □ð Science
and □ð its □ð underwater □ð plumes □ð were □ð responsible □ð for □ð the □ð widespread □ð damage □ð
sea □ð coral □ð community, □ð based □ð on □ð data □ð collected □ð in □ð late □ð 2010 □ð six □ð mil

Macondo ð well.[184] The ð report ð concluded ð that ð "the ð findings ð underscore ð the ð unprecedented ð nature ð spill ð in ð terms ð of ð its ð magnitude, ð release ð at ð depth,[185] ð and ð impact ð on ð footage ð by ð divers ð from ð Ecorigs ð revealed ð that ð the ð rich ð biodiversity ð and ð white ð the ð Florida ð Panhandle ð were ð replaced ð by ð deserted ð waters ð and ð a ð dark ð s were ð supported ð by ð the ð USF ð study, ð which ð found ð that ð the ð Gulf ð seafloor ð a ð mile ð deep ð had ð a ð amount ð of ð oil ð on ð it. ð The ð Ecorigs' ð divers ð warned ð that ð future ð storms ð would ð wash ð the ð sedentary ð oil ð onto ð t future – ð a ð predication ð that ð came ð true ð during ð Hurricane ð Isaac ð in ð Septembe Gone).[187] ð

Whether ð through ð the ð food ð chain ð or ð a ð toxic ð environment, ð public ð exposure Corexit ð and ð the ð crude ð could ð continue ð for ð decades. ð Experts ð argue ð that ð better ð preserved ð had ð the ð response ð employ ð mechanical ð cleanup ð methods ð such ð

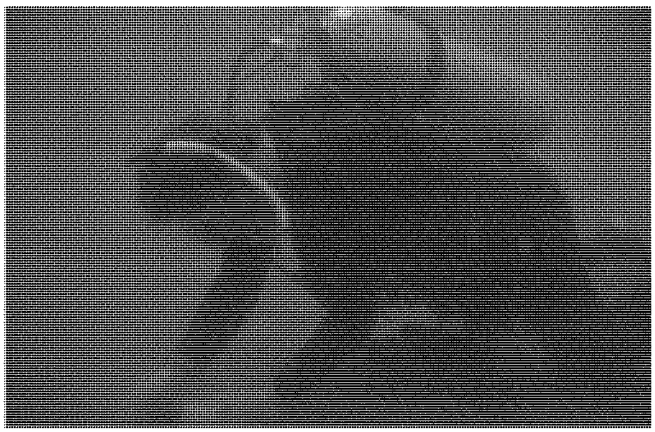


Photo by EcoRigs. Diver taking sample of Florida P seafloor July. 2011)

booming ð and ð skimming, ð while ð allowing ð natural ð bioremediation ð projects ð and ð Mother Nature ð to ð work.[188] However, ð by ð treating ð chemicals ð with ð chemicals ð that ð exponentiall increase ð the ð overall ð toxicity, ð the ð Unifie Command ð has ð magnified ð the ð largest ð environmental ð tragedy ð in ð U.S. ð history. ð Environmental ð and ð public ð health ð groups, ð including ð LEAN ð and ð the ð Louisiana ð Shrin Association, ð have ð filed ð a ð lawsuit ð against EPA ð under ð the ð Clean ð Water ð Act ð for Corexit ð during ð the ð BP ð spill, ð in ð an ð effo force ð the ð agency ð to ð develop ð more ð ro standards ð for ð future ð dispersant ð use.[189] A ð press ð release ð by ð the ð Texas ð Natural ð Resources ð Group ð [Natural ð Contingency] ð Plan ð governs ð responses ð t discharges ð of ð oil ð and ð hazardous ð substances. ð But ð the ð use ð of ð toxic ð dispe oil ð disaster ð was ð implemented ð without ð prior ð understanding ð of ð the ð effect ð o marine ð ecosystems ð and ð human ð health, ð that ð the ð EPA ð has ð yet ð to ð create ensure ð that ð dispersants ð are ð used ð safely ð in ð a ð future ð disaster. ð[190]

Whistleblower Record

a. Environmental Damage

"The ð spill ð happened ð in ð the ð worst ð place, ð because ð east ð of ð the ð river ð inshore ð and ð damaged ð some ð of ð the ð most ð pristine ð reefs. ð There ð are ð and ð dispersed ð oil ð [are] ð virtually ð impossible ð to ð recapture ð and ð could ð potent creatures ð from ð 5,000 ð feet ð down ð and ð up ð … ð When ð the ð spill ð occurred, ð first ð organisms ð to ð come ð in ð contact ð with ð the ð oil ð were ð fish ð and ð coral ð first ð reefs ð to ð be ð affected ð were ð the ð corals ð and ð oysters ð on ð the ð platfo continental ð slope ð and ð shelf ð … ð Ultimately ð the ð dispersed ð oil ð made ð its ð in ð the ð coastal ð zones ð ... ð My ð greatest ð critique ð with ð how ð the ð federal ð g spill ð is ð that ð agencies ð are ð not ð examining ð the ð reefs ð in ð the ð locations ð

dispersed □ð (Scott □ð Porter, □관Ġ4) □ð □ð

“The □ð most □ð standout □ð observation □ð throughout □ð my □ð Gulf □ð dives □ð in □ð the □ð aftermath □ð o
of □ð the □ð spill □ð on □ð coral. □ð I □ð observed □ð what □ð appeared □ð to □ð be □ð greater □ð than
offshore □ð barnacle □ð reefs □ð in □ð Louisiana □ð at □ð least □ð 20 □ð feet □ð below □ð the □ð surface.” □ð (Scott □ð Porter, □관Ġ7) □ð

“Six □ð scientists, □ð including □ð myself □ð and □ð Bob □ð Fitzpatrick □ð a □ð staff □ð [which] □ð includes □ð that □ð the □ð
levels □ð of □ð contaminants □ð in □ð water, □ð seafood, □ð biota, □ð and □ð sediments □ð are □ð all □ð
announced □ð levels □ð by □ð NOAA □ð and □ð other □ð federal □ð agencies □ð and □ð universities.” □ð (Stephen □ð Kohan, □관Ġ8)

“We □ð went □ð back □ð to □ð the □ð same □ð area □ð four □ð and □ð six □ð weeks □ð later □ð with □ð
plume □ð was □ð over □ð 30 □ð feet □ð thick. □ð At □ð that □ð point □ð it □ð is □ð something □ð we □ð chang
handle,’ □ð we □ð actually □ð have □ð an □ð environmental □ð disaster □ð of □ð the □ð proportions □ð magnitu
had □ð magnified □ð itself □ð to □ð three □ð times □ð the □ð amount □ð of □ð oil, □ð and □ð it □ð was □
experienced □ð dispersed □ð oil □ð plumes □ð as □ð large □ð as □ð 40 □ð feet □ð deep □ð plume □ð was
so □ð thick □ð that □ð it □ð blocked □ð out □ð most □ð of □ð the □ð light □ð in □ð the □ð shadow □ð of
was □ð so □ð dark □ð that □ð underneath □ð the □ð rig □ð at □ð high □ð noon □ð I □ð could □ð not □ð
Normally □ð it □ð would □ð be □ð clear □ð enough □ð to □ð read □ð a □ð book.” □ð (Scott □ð Porter, □관Ġ10, □ð 13) □ð

“One □ð of □ð the □ð concerns □ð has □ð been □ð the □ð protection □ð of □ð our □ð estua
don’t □ð understand □ð how □ð important □ð the □ð estuary □ð is. □ð Estuaries □ð are □ð the □ð kidney
where □ð all □ð the □ð pollutants □ð go □ð through, □ð and □ð your □ð estuaries □ð clean □ð all □ð of □
Gulf □ð or □ð whatever □ð body □ð of □ð water □ð is □ð the □ð nursery □ð for □ð the □ð whole □ð gulf □ð be
of □ð juvenile □ð fish □ð come □ð into □ð the □ð estuary □ð to □ð mature □ð and □ð [is] □ð projected □ð to
side □ð of □ð the □ð peninsula □ð so □ð several □ð fishermen □ð and □ð spent □ð much □ð of □ð the □ð
distance □ð of □ð the □ð coast □ð line □ð between □ð Venice □ð and □ð Grand □ð Isle, □ð there □ð was □
of □ð boom. □ð They □ð had □ð a □ð month □ð to □ð prepare □ð before □ð the □ð oil □ð was □ð projected
estuaries □ð in □ð southeast □ð Louisiana, □ð and □ð they □ð did □ð nothing □ð other □ð than □ð place □
(Kindra □ð Arnesen, □ð 11┐ □관Ġ12) □ð

“Before □ð the □ð spill, □ð the □ð water □ð was □ð typically □ð cobalt □ð blue □ð and □ð some □ð of □ð
located □ð there. □ð When □ð we □ð dove, □ð we □ð could □ð see □ð all □ð kinds □ð of □ð living □ð orga
rays, □ð angelfish □ð and □ð sharks. □ð After □ð the □ð spill □ð the □ð water □ð became □ð pastel □ð gre
color □ð … □ð The □ð contrast □ð is □ð shocking. □ð By □ð August □ð 2010 □ð I □ð was □ð noticing □ð an □ð ab
and □ð gobies □ð near □ð the □ð surface □ð during” □ð (Scott □ð Porter, □관Ġ3) □ð

□ð “A □ð week □ð after □ð the □ð oil □ð hit, □ð only □ð 200 □ð feet □ð of □ð donated □ð boom □ð was
a □ð week □ð in □ð August □ð 2010 □ð the □ð beach □ð was □ð lined □ð with □ð thousands □ð of □ð bab
had □ð been □ð soaked □ð in □ð bleach…In □ð 2011 □ð we □ð reported □ð a □ð total □ð of □ð three □ð
dolphin; □ð Bubba □ð has □ð been □ð crabbing □ð his □ð whole □ð life □ð and □ð he □ð has □ð never □ð
twice, □ð before □ð the □ð spill. □ð In □ð August □ð we □ð found □ð a □ð dead □ð sea □ð turtle □ð at □ð
Williams, □관Ġ2) □ð (Carrie □ð Lowman, □관Ġ1) □ð

□ð “In □ð April □ð 2011 □ð I □ð documented □ð 39 □ð dead □ð turtles, □ð and □ð from □ð January □ð tl
57 □ð dead □ð turtles □ð … □ð In □ð the □ð spring □ð of □ð 2011 □ð I □ð found □ð a □ð dead □ð armad
found □ð a □ð dead □ð raccoon □ð in □ð two □ð to □ð three □ð inches □ð of □ð water, □ð muskrats, □ð p
Hancock □ð County. □ð In □ð September □ð 2011 □ð after □ð tropical □ð Storm □ð Lee □ð there □ð were
beach □ð where □ð I □ð could □ð walk □ð within □ð 10 □ð feet □ð without □ð witnessing □ð a □ð dead □ð bird. □
it □ð was □ð that □ð way □ð everywhere □ð along □ð the □ð coast. □ð Maybe □ð we □ð would □ð see □ð
storm, □ð but □ð after □ð the □ð storm □ð the □ð tides □ð washed □ð up □ð lined □ð the □ð beach □ð …
peculiar □ð is □ð that □ð all □ð these □ð animals □ð lived □ð in □ð the □ð marshes. □ð It □ð was □ð unus

am ð concerned ð that ð the ð spill ð has ð also ð affected ð the ð wildlife ð that ð lives ð
marshes." ð (Shirley ð Tillman, ð 13) ð

"When ð the ð oil ð spill ð occurred, ð most ð of ð the ð local ð Gulf ð scientists ð were ð
had ð limited ð scientific ð freedom, ð because ð their ð findings ð needed ð to ð be ð approv
At ð EcoRigs ð we ð wanted samples, ð such ð as ð sponges, ð oysters, ð barnacles, ð but ð NOAA ð did
interest ð … ð In ð October ð 2010, ð we ð [a ð remotely ð operated ð vehicle] ð of ð the ð rig ð legs
on ð the ð Grand ð Isle ð platform. ð That ð location ð was ð supposed ð to ð be ð the ð clear ð and
dive, ð I ð snorkeled ð to ð study ð the ð barnacle ð reef ð populations ð that ð live ð at
depth ð and ð found ð an ð extremely ð high ð rate ð of ð mortality ð in ð the ð barnacles
blennies ð and ð cowfish[,] ð which ð are ð sensitive ð to ð environmental ð changes ð the ð
southwest ð of ð the ð Deepwater ð Horizon ð site." ð (Scott ð Porter, ð 5, ð 13) ð

"When ð controlled ð burns ð take ð place, ð TPHs ð and ð volatile ð compounds ð become ð a
quantities ð and ð therefore ð are ð dispersed ð into ð the ð atmosphere. ð The ð burning ð fr
crude ð oil ð at ð the ð surface ð releases ð toxic ð compounds ð into ð the ð environment,
even ð more ð dangerous ð when ð you ð put ð them." ð (Scott ð Porter, ð 4) ð

"EcoRigs ð later ð analyzed ð surface ð water ð samples ð for ð NPDA ð PAHs ð and ð
biomarkers ð specific ð to ð the ð MC ð 252 ð blowout ð crude ð oil. ð Concentrations ð of
to ð a ð thousand ð times ð greater ð than ð the ð EPA ð water ð quality ð benchmarks." ð (Steve ð
Kolian, ð 5) ð

"Other ð EcoRigs ð divers ð and ð I ð went ð diving ð in ð the ð Florida ð Panhandle ð in ð July
the ð Surfrider ð Foundation. ð That ð area ð is ð known ð as ð the ð Emerald ð Coast, ð fo
we ð went ð diving, ð however, ð the ð water ð had ð a ð brownish ð color ð that
offshore ð Louisiana ð at ð 30 ð feet ð below ð sea ð level. ð When ð we ð dug ð into ð th
we ð found ð anomalous ð material ð that ð resembled ð tar ð patties ð and ð oil ð … ð I
like ð that ð since ð I ð began ð diving ð in ð the ð Emerald ð Coast ð 20 ð years ð ago.
sand." ð (Scott ð Porter, ð 17) ð

"In ð the ð areas ð where ð the ð seafloor ð [in ð the ð Florida ð Panhandle] ð was ð cover
we ð noticed ð much ð less ð sea ð life. ð There ð were ð crabs ð and ð only ð some ð fish,
whereas ð we ð would ð normally ð see ð an ð abundance ð of ð organisms. ð It ð was ð d
noticeable ð drop ð in ð sea ð life ð during ð our ð 2010 ð and ð 2011 ð Louisiana ð dives.

"There ð are ð still ð tar ð balls ð and ð mats ð and ð strings ð washing ð on ð shore
Louisiana, ð Mississippi, ð Alabama ð and ð the ð panhandle ð in ð Florida. ð Grand ð Isle, ð
ball ð size ð tar ð bars, ð and ð is ð still ð full ð of ð oiled ð birds ð that ð are ð dead
washed ð on ð shore, ð the ð volatiles ð are ð still ð being ð released." ð (Dr. ð Wilma ð Subra, ð 10) ð

b. Seafood ð Safety

"[T]he ð federal ð government ð was ð meeting ð with ð seafood ð industry ð leaders ð to
areas ð that ð they ð opened ð were ð safe ð for ð commercial ð fishing. ð They ð held
before ð they ð reopened ð the ð fisheries. ð I ð am ð not ð a ð scientist; ð however, ð com
the ð federal ð government's ð seafood ð safety ð studies ð were ð flawed. ð The ð government ð w
smell ð test, ð but ð I ð know ð of ð experience ð that ð smell ð what ð is ð inside ð the ð shrin
addition, ð the ð FDA's ð testing ð is ð based ð on ð a ð 175 ð pound ð person ð eating ð four ð shrimp
pound ð woman ð or ð a ð kid ð eating ð shrimp ð and ð other ð seafood ð in ð few ð G
we ð eat ð pounds ð of ð it. ð At ð the ð meeting ð we ð said, ð industry ð leaders ð on

this? □ð Why’t □ð do you □ð take □ð the □ð additional □ð precautions □ð that □ð we □ð are □ð advocating □ð that □ð we □ð know □ð are □ð clean, □ð after □ð samples □ð have □ð been □ð proven □ð (A.C. Cooper, □ð 8) □ð □ð

“NOAA □ð and □ð the □ð FDA □ð relied □ð on □ð case □ð study □ð to □ð support □ð its □ð position □ð that □ð gulf seafood □ð is □ð safe □ð for □ð consumption. □ð As □ð an □ð oyster □ð biologist □ð and □ð forensic □ð means □ð you’t □ð want □ð to □ð find □ð any □ð contamination □ð … □ð Even □ð people □ð trained □ð to □ð smell □ð cannot □ð detect □ð them □ð at □ð low □ð levels. □ð The □ð aromatics □ð may □ð evaporate □ð and □ð but □ð when □ð ingested □ð they □ð tend □ð to □ð get □ð stored □ð in □ð fatty □ð tissues □ð and □ð biol seemed □ð to □ð only □ð be □ð sampling □ð the □ð organisms □ð that □ð were □ð healthiest □ð and □ð have □ð unsafe □ð contamination □ð levels □ð that □ð would’s □ð pass □ð the □ð sniff □ð test □ð method. Porter, □ð 7 (곱Ġ8) □ð

“The □ð FDA □ð developed □ð specific □ð PAH □ð in □ð shrimp, □ð crab □ð and □ð oysters. □ð Their □ð based □ð a □ð 175 □ð pound □ð person. □ð They □ð ignored □ð the □ð young, □ð the □ð elderly, □ð the □ð people □ð on □ð chemotherapy □ð and □ð HIV □ð patients. □ð They □ð also □ð based □ð their □ð conclusi consumption □ð rate □ð of □ð the □ð United □ð States, □ð of □ð four □ð shrimp □ð for □ð one □ð meal □ð only □ð eats □ð four □ð shrimp. □ð And □ð they □ð do □ð a □ð week □ð of □ð it; □ð they □ð eat □ð it (Dr. □ð Wilma □ð Subra, □ð 12 (곱Ġ13) □ð □ð

“FDA □ð and □ð local □ð and □ð state □ð wildlife □ð and □ð fisheries □ð use □ð that □ð data □ð to □ð est fishing □ð ground, □ð and □ð they □ð work □ð with □ð the □ð state □ð agency □ð to □ð determine □ð wha marsh; □ð how □ð much □ð of □ð the □ð water □ð should □ð be □ð closed □ð versus □ð all □ð the □ð rest □ð 2010 □ð I □ð was □ð standing □ð in □ð this □ð very □ð oily □ð marsh, □ð and □ð there □ð was □ð a □ð s shrimp. □ð The □ð shrimper □ð knew □ð what □ð the □ð buffer □ð zone □ð was; □ð he □ð was □ð right □ð this □ð day, □ð if □ð you □ð talk □ð to □ð the □ð fisherman □ð they □ð will □ð talk □ð to □ð you □ð about □ð their □ð traps □ð and □ð nets cages □ð full □ð of □ð oil. □ð But □ð they □ð don’t □ð want □ð to □ð speak □ð about □ð it □ð publicly, □ð because □ð the □ð res going □ð to □ð be □ð screaming □ð at □ð them □ð and □ð saying □ð that □ð they □ð are □ð killing □ð the □ð livelihood □ð concerns □ð about □ð safety □ð of □ð Gulf □ð seafood. □ð (Dr. □ð Wilma □ð Subra, □ð 13) □ð

□ð “In □ð late □ð July □ð of □ð 2010, □ð after □ð the □ð well □ð had □ð been □ð capped □ð and □ð they cleanup, □ð we □ð started □ð finding □ð oil □ð daily □ð on □ð the □ð bottom □ð of □ð the □ð bays □ð a realized □ð it □ð was □ð on □ð our □ð seafloor. □ð I □ð brought □ð it □ð to □ð BP □ð and □ð the □ð Coast □ð to □ð move □ð on □ð and □ð go □ð to □ð the □ð next □ð stage □ð of □ð the □ð cleanup. □ð How □ð do □ð finished □ð cleaning? □ð □ð I □ð invited □ð NBC, □ð MSNBC, □ð ABC, □ð BP □ð representative □ð Fred □ð of □ð the □ð Coast □ð Guard □ð down □ð here, □ð and □ð I □ð showed □ð them □ð where □ð it □ð was □ð pointed □ð out □ð the □ð oil, □ð in □ð August □ð Wildlife □ð and □ð Fisheries □ð opened □ð that □ð same concerned □ð about □ð that □ð … □ð If □ð boats □ð are □ð shrimping □ð and □ð one □ð boat □ð goes □ð into □ð ar dirty, □ð brings □ð potentially □ð tainted □ð catch □ð to □ð the □ð seafood □ð dock □ð and □ð runs □ð it all □ð use, □ð it □ð could □ð contaminate □ð the □ð whole □ð conveyor □ð and □ð affects □ð the □ð clean (A.C. □ð Cooper, □ð 7) □ð

“[W]e □ð have □ð stopped □ð crabbing □ð due □ð to □ð concerns □ð with □ð the □ð chemical □ð contamin resulting □ð from □ð the □ð oil □ð spill, □ð as □ð well □ð as □ð the □ð dramatic □ð decline □ð in □ð the 50 □ð percent □ð from □ð 2009 □ð to □ð 2011. □ð (Lorie □ð Williams, □ð 1) □ð

“Through □ð EPA □ð conference □ð calls □ð that □ð I □ð participated □ð in □ð on □ð an □ð ongoing □ð basis spill □ð [NOAA] □ð took □ð a □ð few □ð samples □ð for □ð Corexit. □ð Shortly □ð thereafter □ð to □ð m After □ð the □ð well □ð was □ð plugged □ð the □ð final □ð step □ð for □ð Corexit □ð that □ð application □ð was □ð July □ð 19, □ð ar testing □ð of □ð Corexit □ð as □ð a □ð toxin □ð to □ð establish □ð criteria □ð for □ð the □ð dispersants, □ð only □ð specific □ð seafood. □ð (Dr. □ð Wilma □ð Subra, □ð 12 (곱Ġ13) □ð

□ð "ð have □ð a □ð crabbing □ð license □ð and □ð we □ð sell □ð to □ð processors. □ð Some □ð of □ð the
have □ð black □ð thick □ð stuff □ð on □ð them. □ð When □ð they □ð reopened □ð crabbing □ð we □ð pull
them □ð home. □ð We □ð wanted □ð to □ð know □ð what □ð the □ð conditions □ð of □ð the □ð crabs □ð
them, □ð see □ð what □ð inside □ð and □ð video □ð tape □ð it. □ð When □ð we □ð did, □ð we □ð smelled □ð pet
hundreds □ð tiny □ð pink □ð two □ð headed □ð creatures □ð eating □ð crab's □ð lungs □ð from □ð inside □
then □ð we □ð have □ð opened □ð several □ð oiled □ð crabs □ð with □ð parasites □ð in □ð We □ð never □ð befo
the □ð spill □ð …" □ð (Lorrie □ð Williams, □ð 3) □ð

"In □ð the □ð Gulf □ð crabbing □ð industry, □ð about □ð 75 □ð % □ð of □ð the □ð catch □ð is □ð shipped
… □ð We □ð sell □ð 'Jimmy' □ð Crabs □ð to □ð Maryland □ð and □ð they □ð are □ð sold □ð as □ð Maryland □
raises serious □ð questions □ð as □ð to □ð whether □ð contaminated □ð Gulf □ð crabs □ð are □ð currentl
East □ð Coast □ð and □ð other □ð parts □ð of □ð the □ð country." □ð (Lorrie □ð Williams, □ð 2) □ð

"During □ð the □ð 2011 □ð season □ð offshore □ð fishers □ð were □ð catching □ð amberjack, □ð king □ð m
snapper □ð with □ð holes □ð in □ð the □ð walls □ð of □ð the □ð stomach, □ð and □ð black □ð sludge □ð i
be □ð leaking □ð into □ð the □ð meat. □ð We □ð caught □ð fish □ð with □ð lesions □ð and □ð growths □ð that □ð looked
miniature □ð brain. □ð One □ð of □ð the □ð fish □ð looked □ð like □ð one □ð big □ð eye □ð with □ð no □ð eyes □ð from
shrimp □ð with □ð no □ð eyes, □ð and □ð crabs □ð that □ð have □ð black □ð inside □ð of □ð the
(Kindle Annalen, □ð 3) □ð

"When □ð crabbing □ð was □ð opened □ð in □ð 2010 □ð we □ð would □ð not □ð crab, □ð because □ð we □ð
questions. □ð Mississippi □ð Governor □ð Barbour □ð said □ð that □ð everything □ð was □ð fine, □ð and □ð a
was □ð not □ð necessary □ð … □ð On □ð September □ð 10, □ð 2010 □ð during □ð a □ð public □ð meeting
director □ð of □ð the □ð Department □ð of □ð Marine □ð Resources] □ð about □ð the □ð prospect □ð of □
contaminated □ð from □ð the □ð dispersant □ð Corexit. □ð He □ð explained □ð that □ð they □ð were □ð n
in □ð the □ð seafood. □ð This □ð greatly □ð concerns □ð me, □ð because □ð people □ð are □ð still □ð pu
brown □ð substances. □ð It □ð is □ð normal □ð for □ð crabs □ð to □ð have □ð something □ð different □ð in □ð them, □ð When
I □ð was □ð crabbing □ð I □ð could □ð scrape □ð this □ð substance □ð off □ð the □ð shell. □ð When □ð I
like □ð we □ð do □ð now, □ð I □ð could □ð see □ð the □ð meat □ð underneath □ð it. □ð (Lorrie □ð Williams, □ð 4) □ð

"What □ð is □ð really □ð disgusting □ð is □ð that □ð the □ð government □ð is □ð shipping □ð the □ð Gulf
across □ð the □ð country □ð at □ð the □ð military □ð commissaries. □ð I □ð saw □ð it □ð on □ð the □ð ne
feed □ð Gulf □ð seafood □ð to □ð these □ð soldiers □ð and □ð their □ð families. □ð (Jane □ð Green, □ð 8) □ð

"My □ð local □ð supermarket □ð has □ð fresh □ð seafood □ð catch. □ð During □ð my □ð most □ð recent □
shrimp □ð sold □ð in □ð the □ð market □ð had □ð no □ð eyes. □ð I □ð have □ð seen □ð photos □ð of □
not □ð in □ð person. □ð I □ð know □ð what □ð to □ð look □ð for □ð on □ð shrimp; □ð their □ð eyes □ð g
shrimp □ð did □ð not □ð even □ð have □ð eye □ð sockets. □ð The □ð red □ð snappers □ð for □ð sale □ð had □ð black □
and □ð lesions □ð all □ð over □ð their □ð scales, □ð right □ð here □ð in □ð Thibodaux. □ð Before □ð the □
snapper; □ð it □ð should □ð be □ð a □ð solid □ð pink □ð color □ð … □ð I □ð have □ð never □ð seen □ð
7) □ð (Jaye Dennis, □ð 7) □ð

"Before □ð the □ð oil □ð made □ð it □ð to □ð the □ð shores, □ð I □ð went □ð fishing □ð three □ð times □
supposedly □ð still □ð safe □ð according □ð to □ð government □ð officials □ð to □ð be □ð in □ð the □ð w
one □ð of □ð the □ð trips □ð I □ð caught □ð a □ð grilled □ð redfish. □ð It □ð was □ð not □ð a □ð healthy □ð looking □
lesions. □ð I □ð ate □ð it □ð and □ð went □ð to □ð sleep. □ð When □ð I □ð woke □ð up □ð I □ð was □ð i
After □ð that □ð experience □ð I □ð decided □ð I □ð would □ð not □ð eat □ð any □ð more □ð fish □ð that □ð I □ð
he □ð needed □ð to □ð stop □ð eating □ð shrimp □ð and □ð seafood □ð … □ð After □ð he □ð got □ð real
the □ð seafood □ð was □ð not □ð safe, □ð because □ð when □ð he □ð ate □ð it □ð he □ð observed □ð that
worse. □ð It □ð is □ð difficult □ð to □ð know □ð what □ð is □ð safe, □ð but □ð after □ð my □ð body □ð responded □ð adversely □
fish, □ð I □ð cannot □ð take □ð any □ð more □ð risks. □ð (John □ð Green, □ð 8)

ED_001324_00007754-00064

[A] "□ð lot □ð of □ð the □ð coastal □ð community □ð populations □ð depend □ð on □ð fishing □ð both □ð
their □ð families. □ð You □ð have □ð the □ð Vietnamese □ð Americans □ð and □ð the □ð African □ð Americans □ð a
coastal □ð areas. □ð Before □ð they □ð had □ð the □ð ability □ð to □ð feed □ð their □ð families □ð based
suddenly □ð they'□ð don □ð lot □ð of □ð the □ð organisms □ð have □ð been □ð depleted □ð and □ð contam
spill. □ð In □ð lot □ð of □ð cases □ð these □ð people □ð are □ð hungry □ð because □ð they □ð can □ð do
to □ð poison □ð their □ð family □ð by □ð eating □ð it, □ð and □ð they □ð have □ð no □ð other □ð source
these □ð concerns □ð with □ð me □ð directly. □ð (Dr. □ð Wilma □ð Subra, □ð 8) □ð

"I □ð know □ð personally □ð [crabs] □ð have □ð tested □ð for □ð oil □ð because □ð where □ð I □ð work □ð there
for □ð a □ð local □ð lab. □ð She □ð told □ð me □ð that □ð the □ð little □ð blue □ð crabs □ð who □ð have
them. □ð She □ð told □ð me □ð that □ð we □ð have □ð to □ð live □ð off □ð only □ð the □ð freezer □ð used □ð to □ð stay □ð stock
it's □ð like, □ð 'I □ð don □ð bring □ð that □ð stuff □ð scared □ð me □ð off □ð it, □ð and □ð I □ð do □ð feed □ð it □ð to □ð my □ð k
grandchildren. □ð Still, □ð it □ð is □ð a □ð lot □ð of □ð people □ð who □ð have □ð been □ð fishers □ð in □ð the □ð Bay □ð Mill
(Betsy □ð Miller, □ð 8) □ð

"On □ð top □ð of □ð the □ð flawed □ð FDA □ð assumptions, □ð BP □ð is □ð giving □ð huge □ð monies □ð to □ð the □ð
state □ð to □ð promote □ð seafood. □ð The □ð federal □ð government □ð is □ð a □ð cheerleader □ð for
Administrator □ð Dr. □ð Jane □ð Lubchenco □ð stood □ð at □ð a □ð press □ð conference □ð on □ð September □ð 15, □ð 2010 □ð in □ð Kenne
with □ð all □ð of □ð the □ð seafood □ð bigwigs □ð standing □ð up □ð behind □ð her, □ð and □ð she □ð sa
'The □ð seafood □ð is □ð not □ð contaminated, □ð the □ð seafood □ð is □ð not □ð contaminated, □ð the
... □ð After □ð that □ð event, □ð Lubchenco □ð sent □ð a □ð message □ð that □ð stated □ð that □ð seafood □ð is □ð contaminated □ð with
PAHs, □ð and □ð according □ð to □ð calculations □ð FDA □ð it □ð is □ð below □ð the □ð acceptable □ð level □ð you
your □ð own □ð data □ð shows □ð that □ð 40% □ð to □ð 60% □ð of □ð the □ð oysters □ð are □ð contami
contaminated.' Shortly □ð thereafter □ð NOAA □ð changed □ð its □ð message □ð to □ð 'This □ð seafood □ð is □ð contaminated □ð but □
is □ð below □ð the □ð levels □ð we □ð have □ð established.' □ð However, □ð Dr. □ð Lubchenco □ð first □ð message □ð was □ð the
message □ð that □ð BP □ð and □ð the □ð seafood □ð industry □ð wanted □ð the □ð message □ð delivered
public □ð forum, □ð and □ð that □ð continued □ð to □ð be □ð repeated □ð (Dr. □ð Wilma □ð Subra, □ð 13) □ð

"After □ð we □ð received □ð some □ð of □ð the □ð results □ð back □ð from □ð our □ð samples, □ð in □ð
with □ð the □ð GCCF □ð discussing □ð our □ð findings. □ð The □ð GCCF □ð Administrator □ð Kenneth □ð
Feinberg □ð said □ð 'How □ð do □ð you □ð know □ð it □ð was □ð the □ð Macondo □ð oil?' □ð Feinberg □ð videos □ð c
underwater □ð clouds □ð of □ð dispersed □ð oil □ð he □ð responded □ð that □ð NOAA □ð was □ð on □ð him. □ð
He □ð asked □ð a □ð group □ð of □ð seafood □ð lawyers □ð in □ð the □ð meeting □ð why □ð the □ð state
on □ð its □ð seafood □ð program □ð if □ð the □ð seafood □ð was □ð not □ð safe? (Scott □ð Porter, □ð 7) □ð

"Even □ð before □ð the □ð well □ð was □ð plugged, □ð President □ð Obama □ð came □ð to □ð Grand □ð B
by □ð the □ð spill □ð on □ð June □ð 4 □ð and □ð ate □ð the □ð seafood. □ð The □ð state □ð and □ð feder
'Gulf □ð seafood □ð is □ð open □ð for □ð business □ð,' □ð I □ð said □ð to □ð a □ð group □ð of □ð people □ð who □ð
even □ð sell □ð anything. □ð We □ð only □ð have □ð one □ð shot □ð at □ð doing □ð this. □ð If □ð we □ð
whole □ð industry □ð We □ð wanted □ð them □ð to □ð keep □ð it □ð closed □ð for □ð 2011, □ð pay □ð the
that □ð year, □ð and □ð then □ð assess □ð the □ð situation. □ð They □ð could □ð find □ð where □ð the □ð
that □ð area □ð closed □ð and □ð go □ð forward □ð with □ð reopened □ð commercial □ð fishing □ð for □ð
that □ð the □ð food □ð chain □ð would □ð be □ð cleaned. (L.C. □ð Cooper, □ð 7) □ð

"The □ð community □ð is □ð struggling □ð to □ð survive □ð because □ð of □ð the □ð way □ð the □ð go
handled □ð the □ð cleanup □ð properly □ð and □ð responsibly □ð ... □ð the □ð threat □ð to □ð our □ð ma
history. □ð I □ð spoke □ð hard □ð and □ð loud □ð about □ð this. □ð We □ð begged □ð them □ð to □ð mov
responsibly. □ð We □ð mainly □ð focused □ð our □ð energy □ð at □ð the □ð state □ð level, □ð because □ð
rapport □ð with □ð Government □ð Bobby □ð Jindal. □ð In □ð 2009 □ð the □ð Governor □ð created □ð the
Force. □ð Its □ð role □ð is □ð to □ð study □ð and □ð monitor □ð the □ð shrimping □ð industry □ð and □ð to □ð
agencies □ð that □ð will □ð benefit □ð the □ð industry, □ð the □ð state □ð and □ð the □ð citizens. □ð Wild

approve ð reopening ð of ð the ð fisheries ð within ð three ð miles ð of ð the ð shoreline, ð the ð federal ð waters. ð Unfortunately, ð the ð Wildlife ð and ð Fisheries ð was ð taking ð on ð NOAA ð openings, ð and ð we ð felt ð they ð opened ð the ð fisheries ð too ð early.

"Contrary ð to ð the ð federal's ð government ð to ð quickly ð open ð the ð fisheries, ð we ð of ð the ð fish ð and ð seafood ð escape ð before ð the ð oil ð hit ð and ð the ð dispersant ð was ð have ð a ð better ð survival ð rate. ð When ð the ð areas ð were ð secure, ð they ð would University ð studies ð are ð showing ð that ð certain ð plankton, ð animal ð life, ð plant ð being adversely ð affected ð by ð the ð oil ð and ð dispersants. ð This ð is ð disturbing, ð because part ð of ð the ð food ð chain. ð We ð know ð there ð will ð be ð problems ð with ð repo Louisiana ð Shrimp ð is ð just ð one ð group ð of ð people ð that ð will ð be ð affected ð by ð all ð of ð our ð fishermen do ð that're ð protecting ð the ð community ð and ð the ð open ð public." ð (Mr. ð Chris ð Lee, ð 17) ð

"Honestly, ð we'd ð like ð our ð grandson ð go ð in ð the ð water, ð and ð even ð though ð fisherman, ð don't ð eat ð the ð seafood ð right ð now. ð Would ð you ð eat ð it? ð No. ð animals ð out ð there ð are ð catching ð that ð growing, ð and ð they ð smell ð funny, ð somethin wrong. ð I ð wish ð BP ð and ð our ð Marine ð Resources ð Department ð fishermen, ð here ð w because ð this ð is ð our ð backyard. ð They ð know ð these ð waters ð in ð and ð out ð this ð year, ð everything ð is ð off. ð The ð fish ð and ð shrimp ð are ð not ð growing, ð t I ð don't ð even ð know ð if ð we ð will ð have ð a ð crop ð next ð year. ð My ð husband think ð there ð is ð going ð to ð be ð anything ð next ð year ð to ð catch, ð and ð there ð either ð because ð no ð one ð can ð tell ð us ð what ð is ð going ð to ð be. ð With ð he ð is ð severe ð health ð problems ð and ð we ð don't ð know ð how ð his ð life ð is ð going ð to ð be." ð (Betsy ð Miller, ð 17) ð

"Several ð of ð the ð oyster, ð water ð and ð coral ð samples ð that ð we ð collected ð mat BP ð MC ð 252 ð oil. ð Oysters ð are ð big ð water ð filters, ð they ð can ð whatever ð in ð their skeletons. ð In ð September ð 2011, ð I ð collected ð oysters ð 30 ð to ð 40 ð miles ð north 80 ð miles ð north ð of ð the ð Macondo ð well. ð We ð sent ð the ð tissue ð in ð for ð TPH ð … ð Of ð course ð is ð the ð fact ð that ð NOAA ð allowed ð BP ð to ð choose ð wh taken ð from ð and ð then ð allowed ð BP ð to ð hire ð a ð laboratory ð on ð a ð contrac Throughout ð the ð oil ð spill, ð VoO ð captains ð would ð take ð scientists ð to ð collect VoO ð captains ð informed ð me ð and ð other ð scientists ð that ð BP ð instructed ð them the ð samples, ð and ð in ð turn ð they ð rarely ð encountered ð fresh ð oil. ð Captains ð to frequently ð from ð Louisiana ð Shrimp." ð (Scott ð Porter, ð 17) ð

"We ð have ð done ð a ð large ð amount ð of ð testing ð of ð the ð seafood. ð The ð minu to ð four ð hours ð that ð information ð is ð available ð to ð the ð community ð through ð provided ð to ð the ð federal ð and ð state ð agencies. ð The ð PAHS ð that ð we ð are ð finding ð in ð the match ð the ð fingerprint ð of ð the ð early ð oil ð from ð the ð BP ð spill ð … ð [F]our ð un these ð community ð involvement ð grants, ð one ð if ð which ð was ð University ð of ð Texa Galveston ð (UTMB) ð have ð developed ð the ð analytical ð method, ð similar ð to ð the test, ð used ð to ð look ð for ð the ð PAHs ð in ð the ð blood ð and ð urine ð of covering ð in ð their ð study; ð the ð people ð who ð live ð and ð consume ð the ð seafood ð from ð the coastal ð areas. ð We ð are ð going ð to ð be ð assisting ð UTMB ð and ð sampling ð the PAHs. ð We ð going ð to ð be ð able ð to ð test ð for ð the ð PAHs ð in ð what ð they ð blood ð and ð their ð urine. ð These ð to ð be ð the ð PAHs ð that ð gulf ð coastal ð residen bioaccumulating." ð (Dr. ð Wilma ð Subra, ð 12) ð

"A ð UV ð light ð is ð like ð a ð metal ð detector ð for ð potential ð hydrocarbon ð contami used ð to ð identify ð hydrocarbons ð from ð the ð oil ð and ð dispersant ð that ð have ð attached ð to ð reef ð corals, ð or ð are ð in ð seafood ð … ð [M]any ð of ð the

yellow, □ð orange □ð and □ð tannish □ð brown. □ð They □ð are □ð the □ð same □ð colors □ð that □ð I □ð that □ð continue □ð toin □ð surface □ð nets □ð … □ð As □ð an □ð environmental □ð biologist, □ð I □ð ha potential □ð of □ð seafood □ð contamination □ð from □ð the □ð oil □ð spill □ð in □ð history. □ð As □ð an biologist, □ð I □ð am □ð telling □ð people □ð not □ð (Scott □ð Porter, □ð 16) □ð

As □ð study □ð leaders, □ð we □ð were □ð looking □ð out □ð for □ð the □ð best □ð interest □ð of □ð ev and □ð we □ð could □ð not □ð afford □ð to □ð take □ð risks □ð when □ð it □ð came □ð to □ð the □ð inte seafood, □ð and □ð I □ð wanted □ð to □ð risk □ð getting □ð anyone □ð sick □ð we □ð were □ð subject □ð to government □ð standards. □ð As □ð industry □ð leaders, □ð we □ð are □ð very □ð careful □ð that □ð our □ð locations. □ð Unlike □ð government □ð officials □ð and □ð politicians, □ð the □ð long □ð term □ð health □ð our □ð action. □ð (A.C. □ð Cooper, □ð 8) □ð

□ð □ð

7. Retaliation

"[W]hen a BP representative came up on the speedboat and asked if we need anyt explained my concerns about breathing in the Corexit and asked him for a respirator 'If you wear a respirator, it is bringing attention to yourself because no one else and you can get fired [illegible]." Worker Dianos, Worker

The culture of silence behind the Deepwater Horizon explosion suppressed threatened worker health throughout the BP spill response. On paper, BP takes im safety culture that encourages employees to speak up when they have who wanted to keep their jobs knew that their own health, and th take a backseat to a paycheck. Workers trying to protect themselves throu additional safety equipment frequently faced threats of termination, while the defended BP's actions through an OSHA policy based on questionable air public perception before health and safety, BP and the government ackno workers to wear respirators would look eyeball However, impulse from the were rare. As journalists, community activists tried to document the impact spill, they also became targets of retaliation.

Of GAP witnesses more than 46% reported that they were threatened with tried to wear respirators or additional safety equipment percentage reported that they received early termination after raising safety concerns 50 % the reported unusual phone and/or computer malfunctions when related engaged in communications.

BP Official Position

BP's Code of Conduct encourages workers to speak up and ask ques of that of "All of us at BP, without exception, are duty bound to Code of Conduct we must all remember that failure put BP and ours risk."[191] According to the company's policy, it is vital that workers who that the Code is "speak up and ask a question or share your co On paper, BP is almost sanctimonious about policy, stating zero tolerance policy on retaliation goes hand in hand with our belief that speaking do. If you voice a concern or report a misconduct in good investigation ethics and compliance – you are following our Code. Under no circumstances tolerate retaliation against you.[192]

The Code's broad free speech mandate does not exception – a significant, in communications with the public. Company's encouragement for employees "speak up" when a concern arises, early in the response cleanup workers were with BP stating that they would not speak to the media any info that would alert the public to the impact of the disaster, BP set affected shorelines, beaches and BP compounds to organizations out that were media documenting BP spill. After critique by news media that BP security was

knowledge □ð about □ð the □ð worst □ð environmental □ð disaster □ð in □ð history □ð while □ð gagging □ð operating □ð officer □ð Doug □ð Suttles □ð sent □ð a □ð letter □ð to "fully □ð pursue □ð legal □ð options □ð and □ð stating □ð tha defends □ð all □ð individuals □ð to □ð share □ð their □ð personal □ð thoughts □ð and □ð experiences □ð wi they □ð so □ð choose. □ð [196]

In □ð March □ð 2012, □ð GAP □ð and □ð LEAN □ð reported □ð to □ð the □ð BP □ð Ombudsman □ð that □ð termination □ð and □ð other □ð actions □ð when □ð they □ð attempted □ð to □ð wear □ð additional □ð PP cleanup, □ð including □ð respirators. □ð [197] BP □ð responded □ð that □ð it □ð was □ð unaware □ð of □ð any □ð instanc workers □ð were □ð threatened □ð with □ð retaliation □ð if □ð they □ð chose □ð to □ð use □ð PPE. □ð Du the □ð BP □ð Ombudsman □ð is □ð preparing □ð to □ð conduct □ð an □ð investigation □ð into □ð the □ð a

Government Official Position

While □ð BP □ð was □ð denying □ð retaliation □ð against □ð workers □ð who □ð tried □ð to □ð protect □ð government □ð was □ð excusing □ð its □ð conduct. □ð In □ð response □ð to □ð concerns □ð from □ð the □ð over □ð an □ð alert □ð it □ð received □ð from □ð GAP □ð and □ð LEAN, □ð *"Workers on the Spill that they will for Wearing Respirator*, □ð an □ð internal □ð dialogue □ð ensued □ð between □ð EPA □ð and □ð OSHA □ð Surprisingly, □ð however, □ð the □ð government □ð was □ð on □ð justifying □ð the □ð threats, □ð rather □ð company □ð accountable. □ð

The □ð director □ð of □ð National □ð Response □ð Team □ð remarked □ð to □ð this □ð article □ð to □ð the attention □ð of □ð OSHA, □ð it □ð should □ð be □ð pointed □ð out □ð that □ð the □ð headline □ð states "fired □ð for □ð wearing □ð respirator □ð provided □ð by □ð BP □ð correct □ð for □ð them □ð to □ð do □ð since □ð they □ð are □ð responsible □ð for □ð safety □ð sticking □ð to □ð its □ð position □ð that □ð heat □ð stress □ð was □ð a □ð greater □ð threat □ð to □ð w argued □ð that □ð it □ð was □ð BP □ð to □ð terminate □ð workers □ð who □ð tried □ð to □ð wear □ð res consulting □ð OSHA, □ð the □ð director □ð of □ð National □ð Planning □ð Preparedness □ð Division □ð weighed □ð time □ð with □ð concern □ð over □ð the □ð public □ð perception □ð of □ð respirator □ð use □ð reall air □ð data □ð that □ð demonstrates □ð the □ð need □ð so □ð BP □ð is □ð not □ð providing □ð respirators if □ð the □ð workers □ð had □ð their □ð own □ð respirators □ð that □ð they □ð are □ð already □ð fit However □ð BP □ð is □ð concerned □ð about □ð the □ð perception □ð of □ð respirators □ð would □ð depic when □ð there □ð is □ð no □ð documented □ð dialogue □ð did □ð not □ð consider □ð whet was □ð right □ð about □ð no □ð threat, □ð whether □ð there □ð were □ð safer □ð ways □ð than □ð respir whether □ð workers □ð could □ð sign □ð waivers, □ð or □ð generally □ð that □ð there □ð was □ð any □ð w workers □ð inhaled □ð chemicals □ð from □ð Corexit □ð or □ð the □ð crude □ð oil. □ð □ð

Meanwhile, government □ð officials □ð and □ð local □ð police □ð worked □ð with □ð BP □ð to □ð prevent □ð a joining □ð BP □ð private □ð security □ð patrols □ð beaches □ð and □ð areas □ð impacted □ð by □ð the □ð BP Guard □ð officials □ð went □ð so □ð far □ð as □ð to □ð detain □ð a □ð reporter □ð when □ð they □ð tried □ð to footage □ð of □ð an □ð oil □ð covered □ð beach □ð in □ð Louisiana, □ð explaining □ð that □ð the □ð Coast authority. □ð The □ð Times □ð reported □ð that □ð one □ð official □ð told □ð them □ð that □ð it □ð threatening BP's □ð rules, □ð "not □ð an □ð Admiral □ð Thad □ð Allen □ð press □ð conference □ð held □ð the □ð National □ð Commander, □ð he □ð stated □ð is □ð the □ð responsible □ð party, □ð but □ð as □ð coordinator □ð of □ð federal □ð on now □ð as □ð the □ð national □ð incident □ð commander, □ð I'm □ð bound □ð to □ð be □ð neutral □ð between □ð BP □ð and □ð the □ð government □ð [203] □ð left □ð workers □ð without □ð a □ð safe □ð outlet □ð to □ð report □ð h

ED_001324_00007754-00069

Media □ð and □ð residents □ð were □ð confused □ð about □ð what □ð to □ð do, □ð or □ð where □ð to □ð
encounters □ð related □ð to □ð the □ð BP □ð spill.

Independent □ Position □

After □ð LEAN □ð learned □ð that □ð workers □ð were □ð being □ð threatened □ð with □ð termination □ð
additional □ð PPE □ð that □ð it □ð distributed, □ð the □ð organization □ð sent □ð out □ð that □ð alert □ð the
government's □ð attention □ð admonishing □ð BP □ð for □ð its □ð actions □ð only □ð prudent □ð that □ð these □ð fish
provided □ð respiratory □ð protection □ð and □ð encouraged □ð to □ð use □ð it. □ð In □ð only □ð NOT □ð
provided □ð respiratory □ð protection, □ð they □ð have □ð been □ð threatened □ð with □ð being □ð fired
respiratory □ð protection. □ð Workers □ð confided □ð in □ð LEAN □ð and □ð GAP □ð that □ð they □ð were □ð
forward □ð about □ð the □ð lack □ð of □ð PPE □ð well □ð as □ð the □ð health □ð problems □ð that □ð they □
experiencing, □ð out □ð of □ð fear □ð that □ð they □ð would □ð be □ð fired □ð if □ð they □ð spoke □ð up
spill, □ð Time □ð magazine □ð Workers □ð also □ð may □ð fail □ð to □ð come □ð forward □ð out □ð of □ð fe
job – □ð they □ð already □ð shown □ð reluctance □ð to □ð talk □ð to □ð the □ð press □ð for □ð the □ð sam
effect □ð of □ð gag □ð orders □ð was □ð heightened □ð by □ð direct □ð threats □ð that □ð workers □ð rec
witnessed □ð against □ð coworkers □ð who □ð blew □ð the □ð whistle. □ð □ð

Throughout □ð AP's □ð investigation, □ð workers □ð explained □ð that □ð while □ð concerned □ð about □ð
being □ð during □ð the □ð cleanup, □ð it □ð was □ð not □ð an □ð option □ð to □ð put □ð their □ð health
reported □ð health □ð problems □ð or □ð protested □ð safety □ð conditions □ð system, □ð put □ð and □ð BP
never □ð called □ð back □ð for □ð work. □ð When □ð workers □ð tried □ð to □ð obtain □ð respirators □ð
they □ð were □ð told □ð directly □ð or □ð more □ð disingenuously □ð warned □ð that □ð doing □ð so □ð
termination. □ð The □ð reasons □ð echoed □ð the □ð internal □ð EPA □ð send □ð the □ð wrong □ð messa
public, □ð and □ð there □ð was □ð no □ð documented □ð threat □ð even □ð justify □ð the □ð government □ð
recommended □ð it □ð for □ð workers □ð burn □ð teams □ð due □ð to □ð the □ð increased □ð likelihood □ð
exposure, □ð workers □ð reported □ð being □ð denied □ð respirator □ð use □ð by □ð their □ð employers □ð

Regardless □ð of □ð rationale □ð or □ð circumstance, □ð workers □ð felt □ð they □ð had □ð to □ð swallow
replaced. □ð Due □ð to □ð closed □ð fisheries □ð and □ð the □ð moratorium, □ð there □ð were □ð jobs □ð down □ð
the □ð cleanup □ð were □ð competitive. □ð With □ð unenforceable □ð workplace □ð rights □ð and □ð famil
felt □ð they □ð could □ð not □ð afford □ð to □ð invitation □ð in □ð BP □ð of □ð Conduct. □ð Only □ð then, □ð
didn't □ð know □ð the □ð severity □ð of □ð their □ð exposure □ð also □ð be □ð reaching □ð their □ð families
neighbors, □ð resulting □ð in □ð long □ð health □ð problems □ð that □ð posed □ð more □ð dire □ð consequences
jobless. □ð

BP's □ð actions □ð have □ð long □ð been □ð its □ð policy □ð for □ð retaliation. □ð Weeks □ð before □ð the □ð
Horizon □ð oil □ð rig □ð exploded, □ð according □ð to □ð a □ð confidential □ð survey □ð of □ð workers □
rig □ð showed □ð that □ð of □ð them □ð were □ð concerned □ð about □ð safety □ð practices □ð and □ð feare
reported □ð mistakes □ð or □ð other □ð problems. □ð About □ð half □ð of □ð the □ð surveyed □ð feared □ð that □ð they □ð
would □ð be □ð retaliated □ð against □ð for □ð reporting □ð actions □ð that □ð could □ð heather □ð to □ð a
front, □ð press □ð accounts □ð indicated □ð an □ð employee □ð Coast □ð Restoration □ð Organization, □ð ta
with □ð developing □ð plans □ð to □ð clean □ð up □ð the □ð oil, □ð disclosed □ð that □ð BP □ð ordered □
remaining □ð locations □ð that □ð needed □ð to □ð be □ð more □ð quickly □ð a transition □ð to □ð a □ð nev
for cleanup and □ð oversight □ð that □ð would □ð be □ð beneficial □ð After □ð BP □ð stock □ð prices □ð whistle,

the employee reported that BP used scare tactics in effort to silence was being watched. Within months of going public, he was fired

Reports of retaliation and fear tactics have extended to whistleblowers workplac and activists vocal about impacts from the BP spill being reported: by police cars or unmarked vehicles; probate security or by local police off open public beaches after taking photos of oiled shorelines and dead broken into without attempted property theft; having phone calls suddenly clicking noise during calls that involve the BP spill; having computers m boxes emptied; being placed under surveillance being escorted government of a public fairness hearing for the Deepwater Horizon class action settlement, unsubstantiated allegations "live of streaming and being subjected to harassment by the BP America Facebook page, including threats and discriminatory viole remarks.[217]

Tireless Gulf organizer and journalist Cherri Foytlewalked from New Orleans DC to awareness around health and environmental problems emerging from captured the efforts to silence after whistleblower escorted out of the Deepw Fairness Hearing without justification citizen, a journalist, I was oil sick and [from dispersants]. I had a right to be in that courtroom. They target pe truth. It supposed to make you scared, but it ought to make you

Whistleblower Record

a. Workplace Chilling Effect

"Workers shared with me that they were concerned if they raised con they would lose their jobs didn't ask turn, "Cooper, 3)

"BP and BP contractors were not providing workers with respirators, or additional safety equipment on their own accord. The workers would go ordered protective ... However, workers told us they were not allowed to were informed on several occasions by workers that BP officials if would wear the respirators. The wives started speaking out and the workers were don't shut up, then they were going to be fired. This was shared LEAN did convey the information to state and federal government agencie to the information, but did not provide Wilma Subra, 4)

"Initially, LEAN oldest and largest environmental group purchased state of boots, gloves, suits and respirators to be worn by individuals working BP company policy resulted in the boat owners and workers being thr jobs should they wear respirators while working for the company. the Ever oil spill site were denied the usage of these protective devices. Th occasions by my patients. Michael Robichaux, 3)

"I had a conversation with the Coast Guard Deputy Safety Officer. I use of respirators for workers ... I asked him wear voluntary respirators said, 'Without the air sampling exceeding the limits, the workers still fell

BP □ð says □ð they □ð wear □ð respirators, □ð they □ð don't □ð a □ð job □ð if □ð they □ð wear □ð respirators
Arnesen, □ð 14┐ □괆Ġ15) □ð □ð

"During □ð my □ð early □ð efforts, □ð the □ð workers □ð were □ð threatened □ð with □ð termination □
wore □ð respirators. □ð In □ð May □ð I □ð bought □ð respirators □ð for □ð team □ð crew □ð headed □ð crew of □ð
Venice. □ð Several □ð workers □ð informed □ð me □ð that □ð when □ð they □ð brought □ð job □ð sites,
were □ð threatened □ð with □ð termination □ð by □ð their □ð supervisors □ð if □ð they □ð tried □ð to □ð
on □ð the □ð job □ð site. □ð If □ð you □ð them, □ð me □ð wearing □ð a □ð respirator □ð need □ð to □ð put □ð done
on.' The □ð safety □ð worked □ð for □ð Tiger □ð Safety, □ð a □ð BP □ð contractor □ð based □ð out □ð of □ð
that □ð incident, □ð he □ð was □ð one □ð of □ð the □ð seven □ð men □ð who □ð got □ð sick □ð on □ð th
to □ð a □ð hospital, □ð the □ð team □ð informed □ð me □ð that □ð after □ð the □ð safety □ð man □ð fired □ð
him □ð along □ð with □ð the □ð whole □ð company. □ð (Clint □ð Gandry, □ð 3) □ð

"[A] □ð month □ð and □ð a □ð half □ð into □ð the □ð job, □ð in □ð June □ð 2010 □ð when □ð a □ð BP □
and □ð asked □ð if □ð we □ð need □ð anything, □ð I □ð again □ð explained □ð my □ð concerns □ð about
asked □ð him □ð for □ð a □ð respirator. □ð He □ð started □ð laughing □ð and □ð said, □ð for, □ð that □ð
bad; □ð we □ð breathe □ð it □ð in't □ð all □ð day □ð anything □ð explained □ð you □ð wear □ð a □ð respirator
it □ð is □ð bringing □ð attention □ð because □ð you □ð one □ð else □ð is □ð wearing □ð respirators, □ð and
for □ð that □ð (Jorey □ð Danos, □ð 2) □ð

"When □ð I □ð was □ð fighting □ð for □ð better □ð working □ð conditions, □ð I □ð wanted □ð all □ð of □ð u
given □ð respirators. □ð Some □ð were □ð willing □ð to, □ð but □ð because □ð majority □ð could □ð not □ð tak
risk □ð of □ð being □ð fired. □ð All □ð of □ð the □ð fishing □ð areas □ð were □ð closed, □ð they □ð had
the □ð job □ð to □ð support □ð their □ð families. □ð They □ð knew □ð that □ð if □ð they □ð spoke □ð out
provided □ð safety □ð equipment □ð BP □ð would □ð just □ð replace □ð them □ð because □ð they □ð had □ð so
applications. □ð They □ð were □ð between □ð a □ð rock □ð (A.C. □ð Cooper, □ð 4) □ð place.

I □ð was □ð always □ð told □ð by □ð my □ð supervisors □ð X, □ð Y □ð and □ð Z, □ð they □ð would □ð fi
was □ð shrimp □ð season, □ð everything □ð was □ð shut □ð down □ð so □ð we □ð needed □ð you □ð work. □
can't □ð go □ð here, □ð we □ð don't □ð have □ð times □ð they □ð wanted □ð us □ð more □ð go □ð past □ð the □ð t
However, □ð I □ð know □ð those □ð waters □ð and □ð we □ð had □ð to □ð have □ð certain □ð equipment
withstand □ð the □ð conditions □ð out't □ð there □ð those □ð things □ð go, □ð I □ð would □ð to □ð put □ð my
crew □ð or □ð myself □ð at □ð risk. □ð That □ð is □ð when □ð (Anonymous □ð #1, □ð 3) □ð denied □ð work.

"In □ð hindsight, □ð I □ð realize □ð that □ð BP □ð paid □ð us □ð to □ð keep □ð our □ð mouths □ð shut □
could □ð make □ð $3,000 □ð every □ð ten □ð days, □ð should □ð we □ð pay □ð attention □ð the □ð
by □ð asking □ð for □ð additional □ð PPE? □ð People □ð around □ð there □ð kind □ð (Jorey □ð Danos, □ð 1) □ð

"During □ð Jamesond □ð week □ð on □ð the □ð job, □ð when □ð he □ð began □ð feeling □ð the □ð healt
he □ð asked □ð the □ð safety □ð inspector □ð with □ð BP □ð and □ð contractor □ð about □ð the □ð equipment
entitled □ð to □ð at □ð the □ð dock □ð before □ð they □ð went □ð out □ð on □ð the □ð water, □ð and □ð
that □ð if □ð he □ð ruffled □ð feathers, □ð his □ð contract □ð with □ð the □ð VoO □ð program □ð would
Throughout □ð his □ð time □ð on □ð the □ð job, □ð his □ð supervisors □ð made □ð it □ð clear □ð that
conditions, □ð you □ð could □ð lose □ð your □ð job. □ð The □ð jobs □ð were □ð scarce □ð and □ð comp
wanted □ð to □ð lose □ð their □ð jobs □ð (Betsey □ð Miller, □ð 1) □ð

"During □ð Jamesond □ð and □ð week □ð on □ð the □ð job, □ð these □ð boats □ð sprayed □ð dispersant □ð l
yards □ð from □ð him. □ð He □ð explained □ð to □ð me □ð that □ð he □ð would □ð have □ð to □ð move □ð his □ð b
wind □ð was □ð blowing □ð in □ð his □ð direction □ð and □ð the □ð dispersant □ð What □ð were □ð too
concerned □ð him □ð most □ð is □ð that □ð he □ð saw □ð these □ð boats □ð spray □ð dispersant □ð insid
close □ð as □ð one □ð mile □ð from □ð the □ð shoreline. □ð He □ð reported □ð this □ð to □ð the □ð saf

explained □ð that □ð he □ð wanted □ð to □ð videotape □ð them □ð spraying □ð so □ð that □ð spraying □ð so □ð close □ð to □ð the □ð shoreline. □ð However, □ð the □ð safety □ð director □ð told □ð trouble □ð if □ð he □ð videotaped □ð it. (Bedsey □ð Miller, □ð 2) □ð

If □ð any □ð of □ð the □ð workers □ð claimed □ð they □ð were □ð sick, □ð then □ð to □ð employers □ð would station, □ð or □ð if □ð they □ð were □ð severely □ð ill □ð they □ð would □ð send □ð them □ð to □ð a □ really □ð sick □ð and □ð could □ð anymore, □ð they □ð would □ð be □ð laid □ð off. □ð When □ð they □ð would □ð call □ð us □ð discreetly □ð report □ð their □ð health □ð problems, □ð but □ð then □ð they □ð rea speak □ð out □ð when □ð they □ð realized □ð there □ð no □ð longer □ð was □ð anything □ð to □ð lose being □ð victims. □ð They □ð were □ð too □ð sick □ð to □ð work, □ð and □ð had □ð no □ð medical □ð or Subra, □ð 7) □ð

"Mr. □ð Craig □ð had □ð held □ð a □ð morning □ð meeting, □ð and □ð said □ð that □ð if □ð anyone □ð wh they □ð needed □ð to □ð see □ð a □ð doctor, □ð they □ð first □ð have □ð to □ð see □ð the □ð [company] terminated. □ð □ð He □ð also □ð said □ð that □ð if □ð anyone □ð went □ð they □ð would □ð lose □ð th Then □ð he □ð asked □ð if □ð anyone □ð felt □ð they □ð needed □ð medical □ð attention, □ð and □ð no course □ð they □ð were" □ð (Jared □ð Griffin, □ð 11) □ð

"When □ð I □ð went □ð to □ð the □ð BP □ð Incident □ð Command □ð Center □ð in □ð August □ð 2010 □ð I one □ð of □ð our □ð NOAA □ð contacts □ð if □ð they □ð found □ð any □ð oil □ð in □ð the □ð last □ð sam back □ð negative □ð for □ð oil. □ð I □ð pressed □ð him □ð on □ð it □ð further, □ð and □ð asked □ð if □ð contamination □ð in □ð the □ð samples. □ð He □ð replied □ð that □ð they □ð did □ð not □ð find □ð anyt clean. □ð I □ð explained □ð to □ð him □ð that □ð was □ð surprising, □ð because □ð we □ð had □ð sent trip □ð to □ð [Arkansas □ð State □ð University] □ð and □ð they □ð found □ð contamination □ð He □ð resp them □ð analyzed □ð by □ð a □ð shortly □ð thereafter, □ð NOAA □ð wanted □ð to □ð work □ð with □ð us Porter, □ð 11) □ð

b. Strange □ □ Encounters □ □ □

"Mississippi □ð announced □ð on □ð July □ð 2, □ð 2010 □ð that □ð all □ð beaches □ð were □ð open □ð to Jetty □ð at □ð Lake □ð Mars □ð to □ð take □ð pictures □ð of □ð oil. □ð It □ð was □ð a □ð thick □ð nasty Everything □ð it □ð touched □ð it □ð killed. □ð I □ð have □ð been □ð walking □ð this □ð and □ð I □ð have anything □ð like □ð it. □ð I □ð was □ð approached □ð by □ð BP □ð and □ð Coast □ð Guard □ð officials. □ð approached □ð me □ð and □ð asked □ð what □ð I □ð was □ð doing. □ð I □ð told □ð her □ð I □ð was □ð c asked, 'Are □ð you □ð finding?' □ð anything, □ð there □ð is □ð oil □ð all □ð over □ð the □ð place. □ð I □ð to □ð a Jackson □ð County □ð worker □ð in □ð a □ð truck. □ð Within □ð minutes □ð an □ð officer □ð with □ð the Department □ð told □ð me □ð that □ð it □ð was □ð closed □ð and □ð I □ð would □ð seemed □ð like □ð w photos □ð either □ð the □ð Mississippi □ð Department □ð of □ð Environmental □ð Quality, □ð the □ð Coast sheriff's □ð department □ð showed □ð up. (Lorrie □ð Williams, □ð 9) □ð

"In □ð July □ð 2010 □ð my □ð husband □ð and □ð I □ð … □ð drove □ð down □ð to □ð the □ð BP □ð comm Batre. □ð A □ð Bayou □ð La □ð Batre □ð police □ð officer □ð pulled □ð out □ð behind □ð us. □ð It □ð was police □ð leave □ð the □ð command □ð post. □ð The □ð police □ð officer □ð followed □ð us □ð real □ð clo thought □ð he □ð was □ð going □ð to □ð pull □ð us □ð over. □ð He □ð even □ð Rosalye, □ð 8) □ð

If □ð someone □ð gets □ð on □ð the □ð [BP □ð America] 'I □ð Facebook □ð page □ð and □ð say □ð people □ð attack □ð that □ð person. □ð They □ð have □ð made □ð comments □ð that □ð the □ð people □ð who □ð take □ð the □ð Volatile □ð Solvent □ð Pest □ð are □ð trying □ð to □ð make □ð money □ð off □ð c friend □ð with □ð a □ð young □ð son □ð who □ð has □ð fallen □ð sick □ð since □ð the □ð spill. □ð He □ð wrote □ð that □ð he □ð and □ð other □ð people □ð are □ð sick, □ð and □ð he □ð was □ð attacked. □ð One identified □ð his □ð friends □ð and □ð family □ð and □ð sent □ð them □ð nasty □ð messages. □ð Based □

compared □ð experiences □ð with, □ð anyone □ð who □ð takes □ð a □ð stand □ð against □ð BPA □ð Face
(Shirley □ð Tillman, □ð 14) □ð

"At □ð one □ð point □ð the □ð BPA □ð Facebook □ð page □ð seafood. □ð I □ð made □ð a □ð comment □ð th
not □ð to □ð eat □ð it. □ð One □ð of □ð the □ð trolls □ð replied □ð that □ð the □ð FDA □ð has □ð tested
consumption. □ð I □ð responded □ð that □ð the □ð last □ð time □ð I □ð saw □ð that □ð FDA □ð had □ð o
compounds, □ð and □ð I □ð choose □ð not □ð to □ð eat □ð the □ð seafood. □ð The □ð next □ð day □ð I □
page □ð … □ð When □ð I □ð was □ð removed □ð from □ð the □ð page, □ð (Shirley □ð Tillman, □ð posts □ð w
14) □ð

□ð "From □ð December □ð 2011 □ð through □ð March □ð 2012, □ð my □ð picking □ð started. □ð The □ð t
call □ð would □ð hang □ð up □ð when □ð I □ð would □ð discuss □ð specifics □ð about □ð BP, □ð about □
Bosarge, □ð 9) □ð

□ð □ð

8. Ongoing Threat Versus The Marathon Public Relations

"Every time I check, there is still oil on the beaches and in the estuary systems the marshes. People go to the beaches and swim in the gulf, and report to me stained with a brownish tan color that they weren't [illegible] — Sandra, Macchemist, 🏆 Genius 🏆 Award 🏆 Recipient

The 🏆 government 🏆 opened 🏆 Gulf 🏆 beaches 🏆 and 🏆 fisheries 🏆 months 🏆 weeks 🏆 of 🏆 BP capped. 🏆 Rather 🏆 than 🏆 dealing 🏆 with 🏆 the 🏆 damage, 🏆 it 🏆 joined 🏆 BP 🏆 in 🏆 a 🏆 campaign 🏆 to 🏆 lure 🏆 tourists 🏆 back 🏆 to 🏆 the 🏆 Gulf, 🏆 with 🏆 advertisements 🏆 featuring 🏆 pristine 🏆 white 🏆 and 🏆 fresh 🏆 seafood, 🏆 designed 🏆 to 🏆 attract 🏆 tourists, 🏆 contrasted 🏆 sharply 🏆 with 🏆 ne spewing 🏆 into 🏆 the 🏆 Gulf 🏆 for 🏆 a 🏆 consecutive 🏆 87 🏆 days. 🏆 Eventually, 🏆 however, 🏆 overwhelmed 🏆 our 🏆 memory. 🏆 Mainstream 🏆 media 🏆 provided 🏆 virtually 🏆 no 🏆 coverage 🏆 emerging 🏆 from 🏆 the 🏆 BP 🏆 spill. 🏆 The 🏆 government 🏆 report 🏆 on 🏆 the 🏆 ongoing 🏆 threat paired 🏆 with 🏆 media 🏆 continued 🏆 radio 🏆 silence 🏆 on 🏆 the 🏆 health 🏆 crisis 🏆 in 🏆 the 🏆 G in 🏆 harm 🏆 way 🏆 especially 🏆 children 🏆 and 🏆 other 🏆 populations 🏆 most 🏆 sensitive 🏆 to 🏆 chemical 🏆 exposure. 🏆 Meanwhile, 🏆 residents 🏆 already 🏆 stricken 🏆 by 🏆 severe 🏆 illness 🏆 after 🏆 the 🏆 sicker 🏆 from 🏆 continued 🏆 exposure 🏆 to 🏆 toxin 🏆 environment. 🏆 Dormant 🏆 oil 🏆 continues 🏆 to 🏆 l the 🏆 aftermath 🏆 of 🏆 storms 🏆 and 🏆 hurricanes. 🏆 However, 🏆 images 🏆 of 🏆 the 🏆 ongoing drowned 🏆 out 🏆 by 🏆 a 🏆 public 🏆 relations 🏆 strategy 🏆 that 🏆 serves 🏆 as 🏆 a 🏆 smokescre crisis. 🏆

Photo by Scott Porter. Oil on public Louisiana Hurricane Isaac (September 2012)

Of 🏆 GAPs 🏆 witnesses, 🏆 62% 🏆 reported 🏆 that 🏆 th evidence 🏆 of 🏆 oil 🏆 or 🏆 oil 🏆 debris 🏆 after 🏆 BP Guard 🏆 announced 🏆 that 🏆 clean 🏆 up 🏆 operations 🏆 complete. Sixty-seven 🏆 percent 🏆 reported 🏆 that 🏆 they 🏆 primarily 🏆 depend 🏆 on 🏆 social 🏆 media 🏆 to 🏆 obta and/or 🏆 share 🏆 related 🏆 information.

BP Official Position

After 🏆 the 🏆 disaster, 🏆 BP 🏆 launched 🏆 a 🏆 multim dollar 🏆 ad 🏆 campaign 🏆 that 🏆 saturated 🏆 the 🏆 na television, 🏆 radio 🏆 and 🏆 social 🏆 media 🏆 with 🏆 G tourism 🏆 ads. 🏆 The 🏆 ads, 🏆 highlighting 🏆 2011 🏆 a best 🏆 tourism 🏆 season" 🏆 in 🏆 years 🏆 Gulf 🏆 and 🏆 reaching 🏆 more 🏆 than 🏆 50 🏆 percent 🏆 of 🏆 the 🏆 population, 🏆 featured 🏆 families 🏆 on 🏆 pristine 🏆 whi beaches 🏆 and 🏆 eating 🏆 fresh 🏆 seafood. 🏆 BP 🏆 representative 🏆 Iris 🏆 Cross 🏆 exclaimed 🏆 to 🏆 report 🏆 that 🏆 all 🏆 beaches 🏆 and 🏆 waters 🏆 are 🏆 open 🏆 for 🏆 everyone 🏆 to 🏆 enjoy BPs Restoration 🏆 Organization, 🏆 boasted 🏆 are 🏆 pleased 🏆 to 🏆 be 🏆 able 🏆 to 🏆 expand 🏆 the 🏆 r the 🏆 entire 🏆 country 🏆 and 🏆 by 🏆 doing 🏆 so 🏆 hopefully 🏆 encourage 🏆 even 🏆 more 🏆 pe Gulf." 🏆 The 🏆 ads 🏆 pose 🏆 questions "What's 🏆 the 🏆 most 🏆 part 🏆 about 🏆 a 🏆 Gulf 🏆 Coast it 🏆 the 🏆 great 🏆 outdoors 🏆 of 🏆 Mississippi? Louisiana? 🏆 The 🏆 serene 🏆 beaches 🏆 of 🏆

Florida? □ð Maybe □ð it □ð beauty □ð BP □ð Alabama □ð produced □ð a □ð series □ð of □ð video □ð vignettes
Gulf □ð residents □ð opportunity □ð to □ð share □ð their □ð personal □ð story □ð about □ð what □ð makes
Coast □ð so □ð special □ð for □ð them □ð are □ð then □ð promoted □ð on □ð the □ð BP □ð America □ð

Government □ð studies □ð are □ð currently □ð assessing □ð health □ð long □ð ecological □ð impact □ð of □ð
spill.[223] However, □ð once □ð the □ð well □ð was □ð capped □ð and □ð after □ð months □ð of □ð the □ð n
spewed □ð into □ð the □ð Gulf, □ð wait □ð for □ð scientific □ð support. □ð The □ð company □ð immediately
unrestrained □ð campaign □ð with □ð an □ð undisguised □ð goal: □ð restore □ð public □ð confid

Government □ð Official □ð Position

The □ð government □ð is □ð also □ð invested □ð in □ð public □ð perception □ð of □ð the □ð Gulf □ð Coast
billion □ð in □ð tourism □ð visitors □ð by □ð government □ð officials □ð to □ð the □ð Gulf □ð were □ð frequent □ð in □
during □ð and □ð after □ð spill □ð to □ð generate □ð positive □ð media □ð coverage □ð and □ð sound □ð b
messaging. □ð In □ð August □ð 2010 □ð during □ð President □ð visit □ð to □ð the □ð Gulf □ð since □ð the
and □ð one □ð month □ð after □ð was □ð capped, □ð now, □ð announced: □ð resultve □ð of □ð the □ð massi
operation □ð that □ð has □ð already □ð taken □ð place, □ð a □ð recent □ð report □ð by □ð our □ð top □ð
of □ð oil □ð has □ð now □ð evaporated □ð or □ð been □ð burned, □ð or □ð skimmed, □ð or □ð recovered □ð from
wellhead."[225] The □ð president □ð continued, □ð a □ð result □ð the □ð cleanup □ð effort, □ð beaches □ð all □ð along
Coast □ð are □ð clean □ð and □ð safe □ð and □ð open □ð that □ð business □ð an □ð act □ð of □ð reassura
White □ð House □ð released □ð a □ð photo □ð of □ð the □ð President □ð and □ð his □ð daughter □ð Sasha
Florida.[227] Contrary □ð to □ð public □ð perception, □ð independent □ð reports □ð later □ð revealed □ð that
taken □ð in □ð the □ð Gulf □ð of □ð Mexico, □ð but □ð rather □ð propose □ð of □ð elected □ð officials □ð eating
Gulf □ð seafood □ð and □ð swimming □ð in □ð the □ð government □ð public □ð relations □ð campaign □ð
to □ð replace □ð images □ð of □ð oil □ð gushing □ð into □ð the □ð ocean □ð and □ð dead □ð sea □ð life
fun. □ð

In □ð November □ð 2011 □ð the □ð Coast □ð Guard □ð announced □ð the □ð Shoreline □ð Cleanup □ð Con
agreement □ð to □ð wind □ð down □ð the □ð BP □ð spill □ð cleanup □ð effort, □ð after □ð declaring □ð th
Gulf □ð coast □ð was □ð clean □ð plan □ð relieves □ð BP □ð of □ð responsibility □ð for □ð cleaning □ð up □ð
shores □ð unless □ð Coast □ð Guard □ð officials □ð can □ð prove □ð government □ð officials □ð Macondo □ð oil.
Gulf □ð states □ð agreed □ð to □ð the □ð plan, □ð with □ð the □ð exception □ð of □ð Louisiana, □ð which
not □ð be □ð held □ð accountable □ð for □ð the □ð continued □ð oiling □ð of □ð marshes □ð and □ð beach
of □ð the □ð BP □ð impact. □ð The □ð government □ð contended □ð that □ð the □ð plan □ð would □ð allow □ð BP
into □ð restoration □ð efforts, □ð and □ð it □ð took □ð effect □ð in □ð respective □ð of □ð Louisiana

In □ð July □ð 2012 □ð the □ð President □ð signed □ð into □ð law □ð the □ð Resources □ð and □ð Ecosyste
Opportunities □ð Revived □ð Economies □ð of □ð the □ð Gulf □ð Coast □ð States □ð Act □ð of □ð 2012 □ð
established □ð the □ð Gulf □ð Coast □ð Ecosystem □ð Restoration □ð Council □ð (Council), □ð which □ð is
Secretary □ð of □ð Commerce □ð and □ð comprised □ð of □ð Gulf □ð state □ð governors □ð U.S. □ð agency
Departments □ð of □ð Interior, □ð Commerce, □ð Agriculture, □ð Homeland □ð Security, □ð the □ð Army □
RESTORE □ð Act □ð designates □ð 80 □ð percent □ð of □ð BP □ð spill □ð the □ð Clean □ð Water □ð Act
Gulf □ð region □ð for □ð ecological □ð and □ð economic □ð recovery □ð to □ð the □ð Council, □ð the □ð penal
will □ð likely □ð be □ð used □ð to □ð generate □ð investments □ð in □ð economic □ð development, □ð tourism □ð promotion,

ED_001324_00007754-00076

science-based natural resource restoration. These priorities do not include the ongoing public health threats facing the Gulf.

Independent Position

Less than a year after the government [illegible] Hurricane Isaac swept across the Gulf, unearthing large amounts of dormant BP oil before hurricane hit, LEAN released an alert, "The [illegible] public contains residual levels of toxic Polynuclear Aromatic Hydrocarbons. Pathways of expo consist of absorption through skin contact, ingestion and inhalation of t oil, arriving in tar mats (thick mixtures of heavy hydrocarbons) as lar tarballs small enough to get wedged toes, [illegible] for BP Macondo forcing closures of public and beach [illegible] More startling, the amount of oiled that washed up on Louisiana shorelines in the [illegible] 565,000 Hurricanes was greater than the amount of oil collected during Louisiana previous eig Coastal Protection and Restoration Authority chair Garret Graves testified bef "Some of the areas that experienced [illegible] hurricane are the same that BP was pushing to remove from [illegible] operations just statement is consistent with warnings by [illegible] Gulf [illegible] BP Organization that the company was trying to wipe its hands clean of cleanup operations prematurely.

The [illegible] of oil did not surprise monitoring groups and concerned cit members from Coden, Alabama identified what resembled dispersed oil foa shorelines. Samples tested by LEAN came back nearly identical to the prompting concerns around fresh oil [illegible] 2011 [illegible] 2012, the nonpro organization On Wings of [illegible] protection and preservation of wild habitat, and natural [illegible] extensive subsurface plumes and some oil sheen around the Macondo Fresh oil slicks around the well, as late as stirred fears by Gulf residents and Congress that the impact of the fresh oil coming from the [illegible] BP CEO Robert Dudley, Representatives Edward Markey (D-MA) [illegible] new oil slick from the [illegible] questions [illegible] the long-term impacts of [illegible] 2010 oil spill."

Even in the wake of mounting evidence that oil and dispersed oil flood the nation while the growing health crisis remains unreported in paradox does not surprise Gulf residents, who have observed a dearth the human cost of the disaster from its beginning. With the exception and online news outlets that have provided [illegible] impact has been "one of the [illegible] of the ongoing [illegible] Gulf, Juhasz, author of Black Tide: the Devastating [illegible] Gulf Oil musician Drew Landry, [illegible] BP General Meeting, [illegible] from there was not really a cleanup effort, it was a PR campaign

human ð health ð issues ð have ð been ð completely ð ignored ð by ð our ð government ð an
The ð havoc ð that ð the ð BP ð spill ð wreaked ð throughout ð the ð Gulf ð to ð the ð a
rest ð of ð the ð nation ð media ð associate ð Kirby ð of ð the ð few ð reporters ð to ð provi
hitting ð coverage ð from the ð frontlines ð of ð the ð disaster ð spill's ð two-year ð anniversary: ð
"As ð the ð second ð memorial ð to ð the ð country's ð greatest ð oil ð disaster ð comes ð
thousands ð of ð lives ð still ð struggling ð in ð these ð fishing ð communities ð will ð fade ð
further ð from ð media ð attention." ð

Frustrated ð by ð the ð lack ð of ð denial ð by ð government ð officials ð and ð hospitals, ð re
community ð organizations ð created ð their ð own ð support ð networks ð to ð cope ð with
and ð educate ð the ð public ð about ð the ð growing ð health ð crisis ð in ð the ð Gulf, ð
online ð videos ð and ð personal ð blogs. ð Their ð individual ð efforts ð are ð bound ð together ð by ð
experience ð of ð encountering ð BP ð health ð and ð environmental ð problems, ð while ð servi
resources ð for ð the ð greater ð public. ð Their ð continuous ð to ð disclose ð ongoing ð
medical ð impact ð felt ð most ð severely ð by ð cleanup ð workers ð and ð coastal ð comm
hit ð by ð the ð onslaught ð of ð oil ð and ð dispersant ð chemicals, ð and ð who ð continu
basis ð through ð contaminated ð air ð and ð seafood. ð However, ð they ð also ð include ð repeated
from ð public ð health ð experts ð and ð scientists ð that ð Gulf ð tourists ð are ð susceptible
swim ð Gulf ð waters ð and ð enjoy ð Gulf ð seafood. ð

Dispersed ð oil ð has ð settled ð into ð shallow ð waters ð and ð possibly ð beachgoers, ð
according ð to ð a ð study ð by ð The ð Surfport ð Foundation ð dedicated ð to ð the ð
protection ð and ð enjoyment ð of ð oceans, ð waves ð and ð ultraviolet ð light, ð dispersed ð oi
chemicals ð can ð be ð Gulf ð waters ð as ð far ð as ð Florida ð premiere ð tourist ð destinat
A ð study ð published ð in ð November ð 2012 ð found ð that ð Corexit ð caused ð chemicals
penetrate ð beaches ð more ð deeply ð while ð expanding ð the ð lifespan ð of ð PAHs ð in
While ð BP ð ads ð what ð your ð favorite ð Gulf ð beach ð James ð Kirby ð posed ð a ð more
relevant ð question ð for ð [W]ould ð you ð let ð your ð kid ð play ð in ð the ð shallow ð w
tar ð product? ð Would ð you ð rather ð have ð you ð sign ð that ð told ð hazardous ð in ð cer
spots?"[253] ð ð

Belying ð BP ð ads ð of ð Gulf ð fisherman ð rejoicing ð over ð the ð rebound ð of ð their
are ð leaving ð fourth ð generation ð fishers ð unemployed ð as ð fishering ð struggle ð to ð
the ð BP ð ads ð propaganda, ð Louisiana ð Shrimp ð Association ð President ð Clint ð Guidry
you ð have ð a ð lot ð of ð money, ð you ð can ð pretty ð kind ð of ð get ð like ð any ð point ð ad
indoctrination."[255] ð ð

Corexit's ð camouflage ð of ð ongoing ð oil ð in ð the ð Gulf ð coupled ð between ð public ð b
relations ð campaign ð to ð camouflage ð its ð ongoing ð consequences. ð Both ð have ð invest
advertising ð blitz ð for ð false ð appearances. ð Speculation ð over ð the ð BP ð spill
impact ð is ð being ð replaced ð with ð empirical ð research ð and ð continued ð human ð s
right ð to ð know ð the ð real ð cost ð and ð threats ð from ð Corexit ð and ð other ð dis
that ð the ð oil ð disappeared. ð For ð this ð to ð occur, ð the ð government ð must ð shift
maintaining ð appearances ð to ð protecting ð public ð health. ð While ð BP ð may ð be ð profit, ð

words □ð of □ð Franklin □ð Delano □ð Roosevelt □ð stated □ð that □ð *"the □ð concern □ð should □ð be □ð the □ð health □ð of □ð its □ð people."*

Whistleblower □ð Record □ð

a. Oil □ð Not □ð Gone □ð

"In □ð February, □ð 2012 □ð I □ð received □ð a □ð phone □ð call □ð from □ð a □ð neighbor □ð … □ð She □ð substance □ð washing □ð up □ð on □ð the □ð shore □ð at □ð Bayou □ð La □ð Batre. □ð After □ð the □ð decontamination □ð site □ð at □ð Bayou □ð La □ð Batre, □ð which □ð was □ð where □ð Corexit □ð c during □ð the □ð spill. □ð On □ð February □ð 27, □ð 2012 □ð I □ð went □ð down □ð to □ð the □ð locatio and □ð took □ð pictures. □ð The □ð city □ð of □ð Bayou □ð La □ð Batre □ð was □ð digging □ð up □ð arou get □ð it □ð ready □ð for □ð beach □ð traffic □ð during □ð spring □ð break. □ð As □ð they □ð dug, □ð a □ð thi oozing □ð out □ð of □ð the □ð sand □ð … □ð Marylee □ð Orr, □ð Director □ð of □ð the □ð LEAN, □ð called willing □ð to □ð take □ð samples. □ð I □ð agreed □ð to, □ð and □ð she □ð put □ð me □ð on □ð the □ð ph to □ð make □ð sure □ð that □ð I □ð collected □ð the □ð samples □ð correctly. □ð I □ð went □ð back □ð to water □ð and □ð sediment □ð samples □ð … □ð The □ð test □ð results □ð from □ð the □ð samples □ð wer results □ð for □ð BP □ð fingerprinted □ð oil □ð from □ð March □ð 9, □ð 2011." □ð (Jon Bonanza)

"[O]n □ð June □ð 23, □ð 2012 □ð … □ð while □ð we □ð were □ð out □ð there □ð [in □ð the □ð Gulf] □ð c substance □ð and □ð a □ð C □ð 130 □ð plane □ð fly □ð over □ð us. □ð I □ð also □ð witnessed □ð this □ð took □ð two □ð people □ð from □ð Washington □ð Cat □ð Island □ð on □ð July □ð 11, □ð 2012. □ð During □ð 5 □ð gallon □ð bucket □ð of □ð tar □ð logs □ð … □ð After □ð Hurricane □ð Isaac □ð on □ð September □ð and □ð I □ð found □ð thick □ð rubbery □ð tar □ð logs □ð and □ð what □ð looked □ð like □ð oil □ð sheen. Corexit □ð foam □ð flowing □ð through □ð the □ð water. □ð There □ð was □ð a □ð heavy □ð smell □ð fror saw □ð dead □ð birds □ð and □ð nutria □ð on □ð the □ð beach. □ð My □ð symptoms □ð got □ð worse □ð seizure □ð that □ð night, □ð and □ð I □ð was □ð incapacitated □ð for □ð a □ð few □ð days. □ð Since □ð started □ð hurting □ð real □ð bad. □ð The □ð pain □ð in □ð my □ð throat □ð is □ð extremely □ð painful feels □ð raw □ð … □ð What □ð concerns □ð me □ð most □ð is □ð that □ð since □ð Hurricane □ð Isaac □ð become □ð sick □ð with □ð symptoms □ð of □ð strep □ð throat □ð or □ð Coughing □ð fluid □ð 4, □ð 11) □ð (John Cochran)

"Every □ð time □ð I □ð check, □ð there □ð is □ð still □ð oil □ð on □ð the □ð beaches □ð and □ð in □ð the and □ð the □ð marshes. □ð People □ð go □ð to □ð the □ð beaches □ð and □ð swim □ð in □ð the □ð gulf, come □ð up □ð stained □ð with □ð a □ð brownish □ð tan □ð color. □ð" □ð (Dr. □ð Wilma □ð Subra, □ð 10) □ð

"Anyone □ð who □ð recreates, □ð fishes, □ð is □ð in □ð the □ð marsh □ð and □ð hunts □ð or □ð traps □ð contact □ð with □ð the □ð crude □ð on □ð an □ð ongoing □ð basis. □ð I □ð did □ð Mobile □ð Bay □ð samp time □ð we □ð were □ð out □ð the □ð fishermen □ð on □ð the □ð various □ð radios □ð were □ð calling □ was □ð like □ð 85 □ð and □ð 88 □ð degrees, □ð so □ð there □ð was □ð constantly □ð oil □ð coming □ð up constantly □ð and □ð tar □ð balls □ð and □ð oil □ð washing □ð in □ð to □ð the □ð barrier □ð islands. □ð concerned □ð about □ð that □ð sheen, □ð because □ð anything □ð they □ð harvested □ð and □ð picked □ contaminated □ð with □ð the □ð still □ð very □ð prevalent □ð" □ð (Dr. □ð Wilma □ð Subra, □ð 10) □ð

□ð "In □ð August □ð 2011 □ð there □ð were □ð several □ð reports □ð of □ð oil □ð slicks □ð from □ð the source, □ð we □ð knew □ð there □ð was □ð a □ð lot □ð of □ð fresh □ð oil. □ð On □ð August □ð 18, □ð 20 samples □ð from □ð Ship □ð Island, □ð Mississippi, □ð 103 □ð miles □ð to □ð the □ð North □ð of □ð where □ð the □ð Macondo fresh □ð oil. □ð I □ð also □ð saw □ð what □ð looked □ð like □ð dispersed □ð oil □ð … □ð Pilot □ð Bonny Care □ð is □ð conducting □ð flyovers □ð and □ð documenting □ð large □ð fresh □ð oil □ð plumes □ð close (Steve □ð Kolian, □ð 7) □ð

“In □ð addition □ð to □ð resistance □ð surrounding □ð medical □ð problems □ð resulting □ð from □ð the □ð spill
oil □ð washing □ð up. □ð To □ð this □ð day, □ð there □ð is □ð oil □ð out □ð by □ð Cat □ð Island, □ð Ship
Louis □ð you □ð can □ð go □ð on □ð one □ð of □ð the □ð bridges □ð right □ð now. □ð When □ð the □ð ti
see □ð the □ð oil □ð slick. □ð Where □ð are □ð the □ð people □ð who □ð are □ð supposed □ð to □ð be
(Donald □ð Tillman, □ð 14) □ð

Before □ð I □ð experienced □ð it □ð firsthand, □ð I □ð would □ð have □ð never □ð believed □ð that □ð y
Gulf □ð so □ð that □ð it □ð would □ð be □ð dangerous □ð for □ð me □ð to □ð swim □ð in □ð wet □ð are
seeing □ð dispersed □ð oil □ð at □ð the □ð surface □ð of □ð the □ð northern □ð Gulf □ð are □ð Isaac □ð
came □ð through, □ð went □ð with □ð Steve □ð Kolian □ð and □ð Louisiana □ð in □ð the □ð most □ð port, □ð
Port □ð Fourchon. □ð When □ð we □ð first □ð got □ð out □ð and □ð I □ð tarballs □ð in □ð sight. □ð How
walked □ð to □ð the □ð northern □ð end □ð of □ð the □ð beach □ð the □ð sand □ð got □ð darker □ð … □
precipitate □ð settling □ð out □ð of □ð water □ð running □ð off □ð of □ð it, □ð which □ð resembled □ð the □ð tar
encountered □ð during □ð the □ð spill □ð … □ð New □ð data □ð shows □ð that □ð the □ð latest □ð oil □ð
is □ð in □ð fact □ð BP □ð MC □ð 252 □ð oil.” □ð (Scott □ð Porter, □ð 16┐ □괆Ġ17) □ð

b. Media □ð Blackout□□□

“I □ð spoke □ð with □ð people □ð As □ð soon □ð as □ð I □ð would □ð share □ð a □ð list □ð of □ð the □ð sym
them □ð would □ð say □ð they □ð had □ð similar □ð problems □ð or □ð knew □ð someone □ð from □ð the
scope □ð of □ð associated □ð health □ð problems □ð is □ð not □ð well □ð known, □ð because □ð the □ð
are □ð not □ð discussing □ð (Lori □ð Bosarge, □ð 5) □ð

“Nearly □ð two □ð years □ð after □ð the □ð oil □ð spill □ð in □ð the □ð media □ð about □ð the □ð
Why □ð is □ð the □ð current □ð public □ð health □ð crisis □ð along □ð the □ð Gulf □ð on □ð Channel □ð 4,
have □ð to □ð go □ð the □ð internet □ð to □ð learn □ð what □ð is □ð taking □ð place. □ð I □ð have □ð to □ð g
Cherri □ð Foytlin, □ð who □ð walked □ð from □ð New □ð Orleans □ð to □ð DC □ð to □ð make □ð a □ð po
Kindra □ð Arnesen □ð has □ð been □ð vocal □ð about □ð the □ð health □ð problems □ð in □ð
her □ð community □ð in □ð Venice. □ð Why □ð do □ð they □ð have □ð to □ð go □ð to □ð Facebook □ð an
Why □ð is □ð Channel □ð 4 □ð interviewing □ð them □ð and □ð airing □ð this □ð coverage □ð during □ð th
grandparent □ð in □ð the □ð bayou?” □ð (Jorey □ð Danos, □ð 6) □ð

“My □ð best □ð friends □ð Ġ □괆Ġ Gold □ð went □ð to □ð the □ð beach □ð in □ð Biloxi □ð in □ð 2010. □ð The
is □ð fine, □ð you □ð all □ð Four □ð days □ð after □ð they □ð left □ð the □ð beach □ð her □ð daughter □ð sl
blisters □ð all □ð over □ð from □ð her □ð knees □ð to □ð her □ð toes, □ð between □ð Ġ □ð fingers □ð and □
her □ð arms □ð … □ð She □ð still □ð has □ð scars □ð all □ð over □ð and” (Kimbrake □ð Arnesen, □ð 6┐ □괆Ġ7) □ð □ð

“The □ð first □ð time □ð that □ð I □ð met □ð with □ð [Coast □ð Guard] □ð Lieutenant □ð Commander □ð
meeting □ð and □ð they □ð were □ð showing □ð me □ð all □ð of □ð these □ð maps □ð on □ð the □ð wa
member □ð walked □ð in, □ð threw □ð his □ð hands □ð Ponies □ð and □ð Balloons □ð and □ð Ponies □ð and □ð
Balloons’ … □ð I □ð did □ð not □ð understand □ð what □ð and □ð Balloons □ð by □ð I □ð witnessed □ð
staged □ð response □ð for □ð President □ð Obama □ð the □ð following □ð day □ð … □ð [W]hen □ð I □ð flew
response □ð everywhere; □ð boats □ð everywhere, □ð boom □ð everywhere, □ð people □ð everywhere. □ð
that □ð I □ð flew □ð at □ð 10:00 □ð am □ð that □ð morning, □ð and □ð President □ð Obama □ð flew □ð a
day □ð before □ð President □ð Obama □ð and □ð I □ð flew, □ð there □ð was □ð no □ð response □ð … □ð
was □ð to □ð appeased □ð an □ð community □ð member. Everything □ð that □ð I □ð saw □ð when □ð I □ð was □ð
ponies □ð and □ð balloons, □ð a □ð big □ð show □ð for □ð the □ð politicians. □ð It □ð was □ð a □ð show □
spot □ð at □ð the □ð end □ð of □ð South □ð Pass, □ð Louisiana □ð to □ð take □ð the □ð media. □ð A □
because □ð they □ð were □ð all □ð staging □ð areas □ð that □ð BP □ð wanted □ð (Kimbra □ð Arnesen, □ð 13┐ □괆Ġ14) □ð

ED_001324_00007754-00080

“Despite □ð our □ð thorough □ð coverage □ð of □ð the □ð impact □ð from □ð the □ð spill □ð … □ð the □ð
provide □ð EcoRigs □ð credit □ð for □ð the □ð footage □ð that □ð we □ð provided. □ð Further, □ð mainstre
not □ð report □ð on □ð the □ð questions □ð we □ð raised □ð about □ð dispersants. □ð In □ð my □ð interv
consistently □ð edited □ð the □ð portions □ð of □ð the □ð interview □ð where □ð I □ð mentioned □ð dis
it □ð is □ð because □ð they □ð did □ð not □ð want □ð to □ð tell □ð the □ð whole □ð story, □ð which □
(Scott □ð Porter, □ð 15┐□괇Ġ16) □ð □ð

□□□□ □□□□

9. Inadequate Compensation

"Most of our members right now who are sick are in litigation. They aren't go our medical bills to demonstrate that they were responsible for the actions they took didn't give us respirators to demonstrate that our working environment is unsafe." Vice President, Louisiana Shrimp Association

BP's compensation process to make individuals as disingenuous as its free speech policy and Gulf tourism campaigns. The Gulf Coast Claims Fund (G Oil Pollution Act to compensate individuals and businesses impacted by th health claims during its 18 months of existence. Sick residents, many and had lost their source of income, found themselves accepting cheap nominal cost them their right to later sue BP. When the Deepwater Horizon unprecedented medical compensation was included in the final settlement. Alt settlement was a significant precedent that underscores the human health countless of sick individuals have found themselves ineligible under th prior dealing with the GCCF or as a narrow term. Further, the settle does not account for the most serious health impacts resulting from d such as cancer or birth defects, and proportionate maximum award of is medical care. The settlement also fails to provide treatment for those rendered

Of GAPs witnesses, than 60% of GAP interviewees reported that the GCC Horizon classes settlement made an offer. Of those witnesses, 100% rep compensation was nominal compared to their medical and economic damag spill.

BP Official Position

In June 2010, BP created a $20 billion Deepwater Horizon Oil Spill faster and more fair way to pay damage claims for individuals and Oil Spill," as required under the Oil Spill Pollution Act. established during a meeting between President Obama and BP, would be used for individua resource damages, and state and local response costs, and was not a President Obama appointed Kenneth Feinberg, previous administrator of the U.S. governm Agent Orange Settlement Fund and Victim Compensation Fund, to administer $20 billion fund. In August 2010, BP created an Coast independent Facility to process individual and business claims, overseen by Mr. Feinberg. "Quick Pay" final payment from the GCCF were required to sign a r to sue BP. Having paid approximately $6.2 billion in claims, the GCCF closed in way to the Deepwater Horizon Court Supervised Settlement Program.

In March 2012, BP and the Plaintiffs agreed to committee largest class settlement in the history of oil spill cases. The class action, overseen by Barbier, included a medical benefits dimension that is unprecedented in t cases. The settlement does not have a cap, proximately $7.8 projects that

ED_001324_00007754-00082

billion.[264] In a BP statement, following final approval of the settlement, the Co
stated: "BP is pleased that the Court has granted approval to the PSC
substantial majority of legitimate medical claims stemming from the Deepw
accident."[265] BP continued: "[T]oday's decision by the Court represents yet another
forward for BP in meeting its commitment to economic and environmenta
Gulf and in eliminating the legal risk facing the company."[266]

During our July 2012 meeting at BP Headquarters in Houston, BP was
settlement includes medical claims, BP disputes the position that health
exposure to oil and dispersant.[267]

Government Official Position

Following Mr. Feinberg's appointment to administer the $20 billion escrow
announced, "I'm confident he will assure that claims are administered as
transparently as possible."[268] In spite of the confidence, in response to claimants'
complaints about the initial BPs claims process overseen by Mr. Feinberg,
GCCF, the House Judiciary Committee held a hearing with Mr. Feinberg.[269]

During the hearing, Representative Jerry Nadler posing questions pertaining to
Corexit use; covering issues that BP and the government had been mu
affair, and that sick Gulf residents want answers to Drawing a stark safet
assurances surrounding Corexit to those about Ground Zero after 9/11, th
identified the dangers of misleading the public:

> We now know that some of the information, such as the purpo
> dispersants being used, was demonstrably false. All over again. A dec
> ago – or less than a decade ago – EPA Administrator Christine Todd Whitman falsely
> assured the public that the air near Ground Zero was safe. We
> price for that deception. Some people are paying with their lives.[270]

Having witnessed his constituents, 9/11 first responders, suffer from the
Nadler inquired how Mr. Feinberg and the GCCF would handle medical
related to dispersant exposure:

> Will injuries caused by dispersants be covered by the compensation
> that the long-term effect of the oil spill and use of dispersants
> or 20-year event, what provisions will be made for claimants who may, for example
> seek compensation for economic loss but whose medical conditions
> exposure may not become manifest for five or 10 or 20 years?[271]

Representative Nadler zeroed in on a component of the GCCF that wo
claimants strongly – the requirement to waive their right to sue later, in
damages through the GCCF. "I do not want to see the taxpayers on the hoo
not want to see people with serious injuries have their rights and legit
claims nullified in the future."[272]

Mr. Feinberg, in response to concerns about medical claims do being process believe that the final protocol that I will administer claims, however, over exception for injury claims by workers on the Deepwater Horizon rig, *any* claims for medical compensation.[274] In April 2012, a Justice Department audit GCCF "significant errors" and owed an additional $64 million to approximat claimants who received less than the Justice Department announced:[275]

> While there no question that the independent GCCF labored under challenging circumstances to hugget number of payments processed successfully, the fact that this audit has resulted in tens of m made available to claimants who were wrongfully denied or shortch underscores the importance of the audit.[276]

Unfortunately, the audit also skipped the unprocessed claims filed with the compensation.[277]

Independent Position

Public health activists and community organizations were livid that the G unprecedented requirement of medical illness, failed BP to account for the hu of the BP spill. A report by the public interest law firm Advocates found that Mr. Feinberg's requirement of the "medical standard," broke from his past practices:[278]

> Feinberg did not require medical proof illness or disability was caused by being exposed to toxic air pollution resulting from the 2001 terrorist attacks or the toxic chemicals during Agent Orange spra Vietnam War. These disaster fund programs paid claimants based o they were in the vicinity where harmful chemicals were present a diagnosed illness or disability.[279]

The report concluded that the significantly of proof standard for illness c people exposed to toxic chemicals during the BP spill damage claims illnesses associated with exposure to the toxic BP crude oil and/or were applied to the oil spill.[280]

Sick workers and residents, unable to meet the GCCF medical burden economically devastated from the impact, spill frequently succumbed to the GCCF final payment option. The nonprofitrations Oxe People for Peace documented how GCCF particular to address the needs of historically underserved populations left without income or a food supply as a Ultimately 95,000 claimants spill. the ickup payments of $5,000, and 45,000 claimants accepted payments that However, as witnesses would share repeatedly stigmatizing GCCF payments barely dented their already accumulated medical bills and to cost bring them a future opportu lawsuit against BP for medical damages. Adding insult to injury, a ruli Barbier found that, contrary to assertions by BP and the administration,

independent □ð of □ð BP, □ð because for □ð lands on □ð behalf □ð of □ð BP □ð in □ð fulfilling □ð its □ð requ
responsible □ð party □ð under □ð the □ð Oil Pollution Act □ð raised □ð questions □ð about □ð th
overriding □ð agenda □ð of □ð the □ð GCCF, □ð which □ð intercepted □ð potentially □ð tens □ð of □ð thou
BP □ð in □ð Deepwater □ð Horizon □ð class □ð action □ð settlement □ð or □ð individual □ð lawsuits. □ð

The □ð class □ð settlement □ð should □ð be □ð given □ð credit □ð for □ð its □ð inclusion □ð of □ð medica
terms □ð of □ð this □ð significant □ð precedent □ð may □ð prevent □ð it □ð from □ð helping □ð spill □ð
During □ð the □ð July □ð 2012 □ð meeting □ð at □ð BP □ð headquarters, □ð company □ð lawyers □ð and
presentation □ð of □ð the □ð medical □ð claim □ð process, □ð highlighting □ð the □ð settlements □ð
However, □ð after □ð rigorous □ð questioning □ð it □ð became □ð of □ð benefits
prohibitively □ð narrow □ð in □ð application. □ð meeting □ð with □ð BP, □ð our □ð participants □ð pointed
individuals □ð sickened □ð by □ð the □ð Deepwater □ð Horizon □ð are □ð desperately □ð in □ð need □ð
treatment. □ð After □ð vigorous □ð questioning, □ð BP □ð confirmed □ð that □ð neither □ð is □ð provided □ð by □ð

The □ð Gulf □ð is □ð home □ð to □ð 21 □ð million □ð people. □ð Yet, □ð only □ð half □ð 110,000 □ð a □ð resid
one □ð mile □ð distance □ð of □ð the □ð coast, □ð or □ð live □ð medical □ð settlement, □ð qualify □ð unde
estimated □ð 140,000 □ð qualifying □ð cleanup □ð workers, □ð 90,000 □ð are □ð covered □ð under □ð the
settlement.[286] The □ð settlement □ð includes □ð a □ð short □ð list □ð of □ð specific □ð health □ð conditio
eye, □ð skin, □ð respiratory, □ð neurophysiological □ð and □ð gastrointenstinal □ð conditions. □ð However,
account □ð for □ð the □ð most □ð severe □ð health □ð problems □ð resulting □ð from □ð oil □ð and □ð di
cancer, □ð neurological □ð disorders □ð and □ð birth □ð defects, □ð amongst □ð others. □ð Region □ð
Outreach □ð Program □ð provides □ð primary □ð care □ð services □ð for □ð Gulf □ð residents; □ð however
EMS □ð that □ð sick □ð workers □ð were □ð required □ð to □ð use, □ð it □ð does □ð not □ð provide □ð t
medical □ð experts □ð in □ð chemical □ð exposure. □ð

The □ð medical □ð portion □ð of □ð the □ð settlement □ð $60,700 □ð for □ð eligible □ð parties, □ð which □ð is □ð
on □ð medical □ð documentation □ð and □ð the □ð extent □ð of □ð plaintiffs □ð illnesses. □ð receive □ð an □ð awa
even □ð the □ð maximum □ð payment □ð is □ð woefully □ð inadequate □ð to □ð cover □ð current □ð and
individuals □ð who □ð accept □ð the □ð settlement □ð are □ð unable □ð to □ð sue □ð BP □ð for □ð puni
cancel □ð or □ð another □ð deadly □ð illness □ð struck □ð them □ð later, □ð their □ð heirs □ð would □ð
later □ð timeline □ð turn, □ð eligible □ð parties □ð who □ð opted □ð out □ð of □ð the □ð settlement □ð and
been □ð left □ð to □ð pursue □ð individual □ð litigation □ð that □ð likely □ð will □ð result □ð in □ð years
can □ð afford □ð that □ð option. □ð Meanwhile, □ð individuals □ð already □ð sick □ð from □ð the □ð dis
latent □ð illnesses □ð of □ð which □ð Representative □ð Nadler □ð warned □ð will □ð not □ð be □ð their

Whistleblower Record

a. Gulf Coast Claims Fund

"I □ð first □ð met □ð Kenneth □ð Feinberg □ð on □ð August □ð 23, □ð 2010 □ð at □ð a □ð public □ð meet
my □ð existing □ð lung □ð disease □ð it □ð was □ð exacerbated □ð by □ð the □ð odor □ð from □ð the □ð oil
had □ð a □ð legitimate □ð claim, □ð along □ð with □ð people □ð who □ð have □ð asthma □ð or □ð breathi
just □ð needed □ð to □ð prove □ð it's □ð through □ð doctor. □ð My □ð wife □ð encouraged □ð hospital □ð to □ð g
that □ð night, □ð because □ð my □ð insurance □ð was □ð going □ð to □ð run □ð out. □ð I □ð went □ð to
saw □ð a □ð doctor □ð at □ð 1:00 □ð am □ð … □ð He □ð only □ð looked □ð once □ð at □ð seemy □ð throat
anything □ð that □ð was □ð wrong □ð … I □ð asked □ð for □ð a □ð note □ð saying □ð I □ð had □ð an □ð

I □ð further □ð explained □ð that □ð my □ð throat □ð has □ð been □ð raw □ð since □ð I □ð went □ð fishi
related □ð to □ð the □ð BP □ð oil □ð spill. □ð He □ð responded □ð that □ð he □ð would □ð not □ð write
lawsuit." □ð (John □ð Gooding, □ð 5, □ð 6, □ð 10) □ð

"Regarding □ð Ja'mea □ð health □ð problems, □ð we □ð had □ð to □ð file □ð a □ð separate □ð form □ð for □ð som
or □ð plausible □ð death, □ð □ð and □ð the □ð GCCF □ð sent □ð back □ð another □ð counteroffer □ð of □
was □ð like, □ð are □ð you? □ð □ð We □ð had □ð over □ð $200,000 □ð dollars □ð worth □ð of □ð medic
under □ð the □ð class □ð action □ð suit, □ð James □ð was □ð offered □ð a □ð $60,000 □ð medical □ð settl
because □ð we □ð have □ð over □ð $360,000 □ð ins □ð medical □ð bills □ð to □ð make □ð a □ð dollar
If □ð we □ð could, □ð we □ð would □ð give □ð every □ð penny □ð we's □ð health □ð back □ð to □ð BP □ð to
money □ð is □ð anything □ð if □ð I □ð have □ð do □ð him. □ð know □ð where □ð to □ð go, □ð (Betsey □ð Miller, turn 5) □ð

□ð "I □ð again □ð saw □ð Mr. □ð Feinberg □ð at □ð a □ð public □ð meeting □ð on □ð January □ð 10, □ð
the □ð audience. □ð Feinberg □ð said □ð that □ð the □ð GCCF □ð had □ð only □ð received □ð approximatel
January □ð 10, □ð 2011. □ð At □ð that □ð meeting □ð I □ð read □ð him □ð a □ð note □ð about □ð how □
and □ð handicapped. □ð I □ð asked □ð why □ð the □ð GCCF □ð provides □ð an □ð attorney, □ð but □ð not
government □ð had □ð neglected □ð the □ð damages □ð caused □ð by □ð the □ð BP □ð syndrome □ð … □ð [
standing □ð up □ð and □ð saying □ð they □ð were □ð having □ð the □ð same □ð problems □ð with □ð the □
met □ð a □ð lot □ð of □ð other □ð sick □ð people, □ð and □ð we □ð started □ð getting □ð together □ð a
is □ð time □ð and □ð I □ð to □ð share □ð it. □ð Time □ð to □ð hold □ð the □ð government □ð accountable.
(John □ð Gooding, □ð 10) □ð

"I □ð used □ð to □ð make □ð on □ð average □ð $650 □ð day; □ð my □ð hourly □ð rate □ð was □ð $65.00 □ð
10 □ð hour □ð days. □ð Now □ð it □ð is □ð not □ð possible □ð for □ð me □ð to □ð make □ð that □ð work □
money. □ð Before □ð my □ð wife □ð lost □ð her □ð job □ð this □ð year, □ð she □ð had □ð a □ð job □ð m
benefits. □ð They □ð sent □ð my □ð wife □ð and □ð me □ð a □ð check □ð for □ð $11,000 □ð and □ð a □ð
we □ð would □ð accept □ð it. □ð However, □ð if □ð we □ð settled □ð then □ð I □ð would □ð waive □ð my
against □ð BP. □ð I □ð went □ð around □ð and □ð the □ð GCCF □ð trying □ð to □ð explain □ð that □ð their □
incorrect, □ð but □ð their □ð offer □ð did □ð not □ð change. □ð I □ð made □ð in □ð five □ð months □ð wh
months. □ð We □ð finally □ð reached □ð the □ð point □ð where □ð it □ð was □ð necessary □ð to □ð cash
did □ð not □ð accept □ð the □ð final □ð settlement □ð check, □ð but □ð I □ð was □ð still □ð denied □ð dis
health □ð back □ð and □ð return □ð to □ð work □ð than □ð take □ð BP □ð money. (John □ð Gooding, □ð 10) □ð

b. □□□Deepwater□□□Horizon□□□Class□□□Action□□□Settlement□□□□

"Every □ð time □ð you □ð read □ð end □ð up □ð top □ð responsible □ð cleanup □ð practices □ð and □ð ca
out □ð what □ð was □ð going □ð on, □ð it □ð likely □ð involved □ð efforts □ð to □ð protect □ð BPs □ð lia
the □ð sick □ð workers □ð by □ð denying □ð them □ð respiratory □ð protection □ð during □ð the □ð cle
recorded □ð that □ð there □ð were □ð unsafe □ð chemical □ð levels □ð on □ð the □ð Gulf □ð Coast □ð or
required □ð respiratory □ð protection, □ð they □ð would □ð have □ð had □ð to □ð face □ð in □ð court □ð
from □ð Key □ð West, □ð Florida □ð to □ð Brownsville, □ð Texas. □ð Exxon □ð got □ð away □ð with □ð co
medical □ð claims □ð 20 □ð years □ð ago □ð during □ð the □ð Exxon □ð Valdez □ð spill, □ð and □ð now □
responsibility □ð to □ð adequately □ð compensate □ð sick □ð workers. (Clint □ð Guidry, □ð 8) □ð

"[M]y □ð understanding □ð of □ð the □ð settlement □ð between □ð BP □ð and □ð the □ð PSC □ð is □ð that □ð it □ð le
victims □ð of □ð this □ð tragedy □ð without □ð any □ð legal □ð remedy □ð or □ð financial □ð compensatio
are □ð experiencing □ð … □ð The □ð first □ð problem □ð involves □ð the □ð Zones □ð designated □ð to □
were □ð exposed □ð to □ð noxious □ð materials □ð and □ð became □ð entitled □ð to □ð qualify □ð as □ð
compensation, □ð two □ð major □ð zones □ð of □ð residence □ð were □ð established. □ð The □ð firs
as 'certain □ð beachfront □ð areas □ð in □ð Louisiana, □ð Alabama, □ð Mississippi, □ð the □ð Florida □ð Panhandle □ð with
least □ð 1/2 □ð mile □ð of □ð the □ð water.' □ð Out □ð of □ð the □ð estimated □ð 105,000 □ð people □ð

designation, only 1,600 were from Louisiana, or approximately 1.6% of th
Zone B's parameters are clearly defined as certain wetlands within at least 1 mile o
(Dr. Michael Robichaux, 10-11)

"The next question that begs an answer is how does an individual
in the medical settlement? With reference to the "Chronic Conditions" category, the claimant must
submit – 'A declaration under penalty of perjury of the condition and the location
time of exposure AND medical records supporting the claim and ongoing care fo
condition' (emphasis added). Since a large portion of the people adversel
have no medical insurance, they also have few, if any, medical records to d
(Dr. Michael Robichaux, 12)

"The second travesty in the settlement involves the definition of chronic
relevant chemical exposure. The list of conditions that qualify for this more significa
designation concerns me because, while there is some overlap, it is no
symptoms that I have repeatedly observed with my… [patients] the most impacted b
exception of skin [disorders, these] are not among the major problems experienced
100 patients that I saw during the course of our treatment program.
frequent in the 100 or so other patients who I questioned following (Dr. Michael
Robichaux, 12)

"[T]his designation does provide some major benefits to BP. By avoid
long-term consequences of these toxic exposures and by minimizing the s
actually being experienced, BP avoids relegating to responsibility for the far more sign
symptoms that truly exist in a chronic setting, such as memory loss,
In other words, if the actual long-term symptoms were included in this category, BP
acknowledge that these problems actually existed. Understandably they were
Additionally, these chronic symptoms would certainly qualify for more compe
of this crisis." (Dr. Michael Robichaux, 12-13)

"The last aspect of the medical settlement with which I take issue is the 'Gulf Coast
Region Health Outreach Program.' Over $100 million dollars is being put aside
clinics, supposedly to study and treat the Gulf States population. However, to the
knowledge, not a nickel of that money is designated to either study
rendered ill by exposure to the gumbo of chemicals resulting from the
impacted by the spill requires clinics that specialize in chemical exposure. H
outreach program focuses on primary care, which is a fine service for
does not address the victims of this spill." (Dr. Michael Robichaux, 13)

"Most of our members who are sick are in litigation. BP right now won't step up and
wrongdoing, so it has become a legal battle. If BP starts paying th
admitting guilt. They're going to sufficiently pay our medical bills to demo
responsible for the actions they took, just as the respirators did to demonstrate
working environment was unsafe. Our members who got sprayed are still
bills." (A.C. Cooper, 8)

10. Recommendations

"Five to ten years down the road these studies may determine that the federal gov workers and the public in harm's way through inadequate PPE and the use of Core and unacceptable; we need people treated at Guidry, President, Louisiana Shrimp Association

i. Provide Medical Treatment

The greatest priority must be medical treatment for individuals sickened government has launched the largest oil spill known to study the Gulf Long Follow Up (GuLF) STUDY, over a 10-year period to assess the long health impact of the BP spill on the workers. This is certainly valuable, due absence of medical care address the current health crisis unfolding in t nation witnessed through the delayed treatment for 9/11 first responders their rising health toll, those impacted by their toxic environments cannot receive medical treatment. This could be accomplished through legislation, similar Health and Compensation Act, that mandates medical monitoring and treatme ill by the BP spill.

ii. Fill the Research Gap

Independent studies must also be conducted, in addition to the government assess the Deepwater's Horizon impact and document effective treatment pro findings should inform BP spill medical treatment programs and future oi Those most familiar with the impact of the BP spill should be co remedy the health crisis, along with medical experts such as toxicologists, chemical exposure. To date, no organization or physician has been more public on the health problems associated with the BP spill and treatin related illnesses as LEAN and Dr. Michael Robichaux.

iii. Ban Chemical Dispersants

The government must take measures to prevent this health crisis from chemical dispersants, in particular Corexit. The more fundamental reform is future damage until the research on dispersants Nadler and Representative Bishop (NY) introduced the Ban Toxic Dispersants Act of 2011, which would r moratorium on the use of dispersants until rulemaking and a study complete.[293]

Toxicologist Riki Ott, who documented the impact of Corexit use during the Exxon through her book Sound Truth and Corporate Myth, is a campaign calling for municipalities to ban dispersants within their jurisdictions.

iv. Reform Dispersant Policy

For starters, the government must reform dispersant policy so that we are

ED_001324_00007754-00088

public health dilemma during the next oil spill. Administrator Jackson, in dispersant use, concedes: "As we emerge from this response, to I believe the contingency plans and the product schedules that we need to revisit."[295] The former dispersant administer concludes: "We need more information on all dispersants, and that is problem."[296] It is not only reckless but unethical to continue allowing the knowing the harm that their use can result in.

The EPA relies solely on's testing, manufacturer does not independently assess health and environmental impacts of the dispersant before it is approved. Dated makes the public vulnerable to industry standards that would be unacc The FDA is required to independently test pharmaceuticals or drugs before commerce, and the United States Department of Agriculture (USDA) does owner's word that meat is free of contamination. However, there is data or government testing in the case of dispersants.

It has taken an oil spill of epic proportion, and the health and topic to even enter the public debate on dispersant use. Disclosure is Concluding the hearing on use, Senator Lautenberg [I]t's very obvious the law ought to be changed to give the public the right to know a of chemicals in the dispersants.[297] He proceeded to introduce the Safe Dispersants Act would require more testing, approval, and disclosure of the health and of dispersants used under the National Contingency Plan.[298]

In response to dispersant legislation introduced in 111 Congress, Administrator Jackson recognized the need for reform of the current legal constraints that "If the EPA also believe the law would give us critical transparency and openness EPA cannot provide legislation, while desperately needed, takes time to pa interim, the EPA can demonstrate its commitment to dispersant reform

v. Hold Congressional Hearings and Investigations on Public Health Impact

Congress has a responsibility to expand the g public health impacts associated with dispersant use. It can begin by holding hearings to investigate th public health crisis throughout the Gulf Coast. There are a variety of categories ranging from the health impacts susceptible populations such as children, to th Deepwater Horizon has taken on - from first clean responders to the coastal residents whose health symptoms persist and are getting worse.

This report should also serve as a catalyst for congressional investigations into the heal problems resulting from chemical exposure linked to the BP Gulf oil spill. The Chairma House Oversight and Government Reform Committee released a 2011 investig BP spill that highlighted Dr. Robichaux's findings of health symptoms associated event, such as seizures and severe stomach pains. It is time for Co wealth of knowledge by Dr. Robichaux, Dr. Shubra and another's wide health problems since the BP spill, which are likely to continue for

vi. Implement Public Notification Policy for Dispersant Use

If dispersants continue to be used, the public has a right to know notice and warnings. Many residents and workers believe that dispersant long as it remains a legal option for industry, there is currently no requirement for the government or oil companies to notify the public During the meeting at BP headquarters, BP stated that they will conti the government's authorization to do so. However, BP Vice President Keller st consider a public notification policy that GAP and LEAN have proposed. not tangibly followed through on this step despite numerous requests to progress reports. Adopting such a policy would support it BP's not currently Corexit on the BP spill.

vii. Enfranchise the Public

In March 2012, NOAA and the Coastal Response Research Center released Initiative, and doc intended to guide planning and decision making in future observations and science from the BP spill. Among other findings, it st "establishing factual information synthesis (e.g., dispersant components, worker safety), establishing hazard identification and exposure scenarios, underst workers and public safety, and communicating the risk successfully, and u offs of using dispersants with respect to human health"[30]

Whistleblowers should be the pioneer witnesses providing a foundation for GAP's investigation they provided clear warnings and practical solutions tha reduced the disaster's health environmental impact. They began by warning not to chemicals with chemicals, a premise that was ignored. It is not too such as those below to prevent a tragic rerun of Deepwater Horizon

Whistleblower Record

If "something like this ever happens again, the responsible party and involve the industry leaders and make sure that we are active partn still have plans with boats, and ready. If equipment include us in the pla ahead of time, I feel we would be able to respond to a future they try to exclude us again, we will have a repeat of the turm spill." (A.C. Cooper, 2009)

We "are a coastal parish and we have marsh and tons of mosquit truck. When it gets really bad a federal plane comes in to spray. point where they allow of notify sensitive populations before they spray, so chose to leave the area. Further, they put it in the newspaper, s when they are going to spray from dispersant and buy it toxic. Until this is implemented at the federal level, it is only a partial solution ... T dispersant use, because there is no requirement that BP has to record Wilma Subra, 15)

ED_001324_00007754-00090

“During our lunch, the main discussion [OSH Michaels] pushed back on inv
of respirators … I have organized a lot of emergency response activiti
wearing of a respirator induces heat stress then alternatively you put
suit. This way the workers do not get overheated, and they do r
chemicals that are in their workplace. Wilma Subra, (Dr. 6) 5

Five to ten years down the road these studies may determine that
put workers and the public in harm inadequate PPE and the use o
too late and unacceptable; we need people treated as well. What abou
and those who already have died? people who concerned that sickest will
an unreasonable burden in trying to prove the connection between their
chemical exposure. This is a longstanding problem in the petrochemical
not readily diagnosed chemical exposure and in turn they tend to diagnose
It is a common practice in oil producing states. We need trained r
are willing to diagnose and treat chemical exposure.” (Clint Guidry, 8)

“I’m to get my son properly examined and treated, and have his
the research done on the toxins in his pancreas o
liver. What are going to be the repercussions 10 20 years
cancer?” (Anonymous #3, 3)

“Unfortunately the impact on the community from cancer alley has not
and it is important that the same mistake is not made with those
of the impacted communities are comprised of poor and minority populat
to health care…[A] lot of the people can’t afford the doctor because money for
the gas to get to the doctor’s cards that were developing the scope
NIEHS Gulf Study to examine the health of people who helped clean
their proposal. You were going to ask people what health symptoms they h
going say, ‘we’ll get you to the doctor and pay completely medical care.’
inappropriate to ask them what their health symptoms are, but then
(Dr. Wilma Subra, 6, 7, 11, 12)

“In September 2011, Dr. Kaye Kilburn, an 80 year old physician and
Meadow, Louisiana and conducted studies on 14 people who had a his
toxins. Dr. Kilburn is a distinguished physician and scientist, and sinc
chemicals and the human brain. He has published over 250 scientific
he left to return to his home in California, this my enti
professional career, and this is the greatest public health crisis of my lifetime.
Since that time Dr. Kilburn, LEAN chemist Dr. Wilma Subra, and I
funds to perform studies on the victims of the spill and to docume
treatment endeavors…There is an enormous need for us to be able to
information on the cause and treatment of the health problems we
Michael Robichaux, 13)

---

[1] United States Coast Guard, On Scene Coordinator Report *Deepwater* Horizon Oi
http://www.uscg.mil/foia/docs/dwh/fosc_dwh_report.pdf.

[2] For example, Dr. Riki Ott, in her book Sound Truth and Corporate Myth$: Spill, systematically investigates the impacts of Exxon Valdez oil spill.; Riki Truth and Corporate Myth$: The Legacy of the Exxon Valdez Oil Spill (Dragon

[3] *Id.*

[4] □ð Marine □ð Management □ð Organisation, □ð Oil □ð Spill □ð Treatment □ð Products □ð Approved □ð for □ð Use □
http://www.marinemanagement.org.uk/protecting/pollution/documents/approval_approved_products.pdf □ð
(last □ð visited □ð Apr. □ð 14, □ð 2013); □ð Bonn □ð Agreement, □ð Counter □ð Pollution □ð Manual □ð (Bonn □ð Ag
available □ð *at* □ð http://www.bonnagreement.org/eng/html/counter-pollution_manual/chapter23_dispersants.htm. □ð

[5] □ð U.S. □ð Fish □ð and □ð Wildlife □ð Service, □ð FWS □ð National □ð Contingency □ð Plan, □ð
http://www.fws.gov/contaminants/FWS_OSCP_05/fwscontingency/8-ICManagementStructure-05.htm □ð (last
visited □ð Apr. □ð 14, □ð 2013). □ð □ð

[6] This □ð report □ð does □ð not □ð cover □ð the □ð full □ð range □ð of □ð BPs □ð alleged □ð misconduct □ð or □ð ongoing
it □ð does □ð not □ð cover □ð the □ð Justice □ð Department's □ð prosecution □ð to □ð date. □ð However, □ð with □ð
how □ð much □ð oil □ð was □ð actually □ð released □ð during □ð the □ð BP □ð spill □ð and □ð the □ð Clean □ð Water □ð Act □ð fines □ð ranging □ð from □
each □ð barrel □ð of □ð oil □ð spilled □ð to □ð $4,300 □ð (if □ð BP □ð is □ð found □ð to □ð be □ð grossly □ð neglig
could □ð fall □ð on □ð taxpayers.; □ð *Michael Muskal, Questions □ð BP □ð Management's □ð Motives □ð Linger □ð Two □ð Years □ð After □ð Gulf*
Angeles □ð Times, □ð Feb. □ð 26, □ð 2013, □ð http://articles.latimes.com/2013/feb/26/nation/la-na-nn-questions-bp-management-motives-linger-two-years-after-gulf-20130226. □ð □ð

[7] □ð For □ð clarification, □ð we □ð have □ð omitted □ð citations □ð from □ð the □ð original □ð affidavits □ð within □
frequently □ð used □ð for □ð terms □ð included □ð in □ð the □ð glossary. □ð □ð

[8] □ð Louisiana □ð Environmental □ð Action □ð Network □ð Home □ð Page, □ð http://leanweb.org/ □ð (last □ð visited

[9] □ð A □ð small □ð portion □ð of □ð statements □ð were □ð provided □ð as □ð non □ð legal □ð statements, □ð due □
the □ð witnesses. □ð □ð

[10] □ð BP □ð Meeting □ð Agenda, □ð July □ð 10, □ð 2012 □ð (on □ð file □ð with □ð Government □ð Accountability □ð

[11] □ð http://www.youtube.com/watch?v=t6rvkMie22s □ð

[12] □ð Clifford □ð Krauss, □ð *Deepwater Oil Drilling Picks Up Again as BP Disaster Fades*, □ð N.Y. □ð Times, □ð Mar. □ð 4, □
2012, □ð http://www.nytimes.com/2012/03/05/business/deepwater-oil-drilling-picks-up-again-as-bp-disaster-fades.html?pagewanted=all&_r=0. □ð

[13] □ð U.S. □ð Environmental □ð Protection □ð Agency, □ð Oil □ð Pollution □ð Act □ð Overview □ð (2011), □ð
http://www.epa.gov/osweroe1/content/lawsregs/opaover.htm. □ð

[14] □ð Press □ð Release, □ð U.S. □ð Senator □ð Barbara □ð A. □ð Mikulski, □ð Mikulski □ð Chairs □ð Hearing □ð on □ð
Dispersants □ð Used □ð in □ð Gulf □ð Oil □ð Spill □ð Cleanup □ð (Jul. □ð 15, □ð 2010), □ð
http://www.mikulski.senate.gov/media/record.cfm?id=326554. □ð

[15] James □ð Nachtwey, *The Agent Orange Syndrome*, □ð Vanity □ð Fair, □ð Jul. □ð 24, □ð 2006, □ð
http://www.vanityfair.com/politics/features/2006/08/nachtwey_photoessay200608#/intro.; □ð University □ð of □ð
Virginia □ð Health □ð System, □ð Gulf □ð War □ð Syndrome, □ð
http://web.archive.org/web/20081011144938/http://www.healthsystem.virginia.edu/UVAHealth/adult_environ/gulf.cfm □ð (last □ð visited □ð Apr. □ð 14, □ð 2013).; *The Valdez Crude*, □ð Mother □ð Jones, □ð □ð Mar. □ð 1, □ð
available □ð *at* □ð http://www.motherjones.com/politics/2003/03/valdez-crude; *Health Problems Rose*, □ð
Linger in 9/11 First Responders, □ð Take Part, □ð Sept. □ð 11, □ð 2012, □ð
http://www.takepart.com/article/2012/09/11/health-problems-linger-911-first-responders. □ð

[16] □ð Kate □ð Sheppard □ð & *Hey EPA: Know Thy Dispersant*, □ð Mother □ð Jones, □ð Jun. □ð 23, □ð 201
http://www.motherjones.com/environment/2010/06/epa-bp-toxic-oil-dispersant. □ð

[17] □ð BP □ð p.l.c, □ð Gulf □ð of □ð Mexico □ð Restoration: □ð Offshore, □ð
http://www.bp.com/sectiongenericarticle800.do?categoryId=9036585&contentId=7067606 □ð (last □ð visited □ð
Apr. □ð 14, □ð 2013). □ð

[18] BP □ð p.l.c, □ð Bob □ð Dudley □ð at □ð the □ð Chief □ð Executives' □ð Club □ð of □ð Boston, □ð
http://www.bp.com/genericarticle.do?categoryId=98&contentId=7061937 □ð (last □ð visited □ð Apr. □ð 14, □ð 2013). □

[19] □ð U.S □ð Department □ð of □ð Commerce, □ð National □ð Oceanic □ð and □ð Atmospheric □ð Administration, □ð
http://coralreef.noaa.gov/aboutcrcp/news/featuredstories/may10/oilspill_coral/welcome.html □ð (last □ð visited □ð
Apr. □ð 14, □ð 2013). □ð

[20] BP, □ð Dispersant □ð Background □ð and □ð Frequently □ð Asked □ð Questions □ð (Jun □ð 19, □ð 2010), □ð
http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/incident_response/STAGING/local_assets/downloads_pdfs/Dispersant_background_and_FAQs.pdf. □ð

[21] *Id.* □ð □ð

ED_001324_00007754-00092

[22] □ð BP □ð p.l.c, □ð Offshore, □ð http://www.bp.com/sectiongenericarticle800.do?categoryId=9036585&contentId=7067606 □ð (last □ð visited □ð Apr. □ð 14, □ð 2013). □ð

[23] *Id.* □ð □ð □ð

[24] □ð U.S. □ð Environmental □ð Protection □ð Agency, □ð Alphabetical □ð List □ð of □ð NCP □ð Product □ð Schedule □ð Technical □ð Product □ð Summaries, □ð http://www.epa.gov/osweroe1/content/ncp/product_schedule.htm □ð (last □ð visited □ð Apr. □ð 14, □ð 2013). □ð

[25] □ð U.S. □ð Environmental □ð Protection □ð Agency, □ð National □ð Contingency □ð Plan □ð Product □ð Schedule □ð Toxicity □ð and □ð Effectiveness □ð Summaries, □ð http://www.epa.gov/emergencies/content/ncp/tox_tables.htm □ð (last □ð visited □ð Apr. □ð 15, □ð 2013).; □ð Paul *Lavelle*, □ð *Dispersants □ð Lose □ð Out □ð in □ð BP □ð Spill*, □ð N.Y. □ð Times, □ð May □ð 13, □ð 2010, □ð http://www.nytimes.com/2010/05/13/business/energy-environment/13greenwire-dispersants-lose-out-in-bp-spill-81183.html?scp=5&sq=Corexit%20BP%20Oil%20Spill&st=cse&_r=0. □ð

[26] □ð Directive □ð from □ð EPA □ð to □ð BP □ð on □ð Using □ð Less □ð Toxic □ð and □ð *more* □ð *effective* □ð Dispersants, □ð http://www.epa.gov/bpspill/dispersants/directive-addendum2.pdf. □ð

[27] □ð David □ð Biello, □ð *Dispersants □ð on □ð the □ð BP □ð Gulf □ð Oil □ð Spill □ð Fighting □ð Pollution □ð with □ð Pollution*, □ð Sci. □ð American, □ð Jun. □ð 18, □ð 2010, □ð http://www.scientificamerican.com/article.cfm?id=dispersants-fighting-pollution-with-pollution. □ð

[28] □ð Directive □ð from □ð EPA □ð and □ð the □ð Coast □ð Guard □ð on □ð Reducing □ð the □ð *use* □ð of □ð Dispersants, □ð *available* □ð *at* □ð http://www.epa.gov/bpspill/dispersants/directive-addendum3.pdf, □ð We □ð are □ð going □ð to □ð continue □ð to □ð use □ð those □ð two □ð DOD □ð C130s □ð and □ð we □ð will □ð fly □ð and □ð deliver □ð dispersants □ð whenever □ð we □ð have □ð a □ð significant □ð stockpile □ð of □ð dispersants □ð and □ð we've □ð gone □ð back □ð to □ð the □ð supply □ð ramping □ð up. □ð They □ð were □ð not □ð producing □ð any □ð and □ð we □ð we're □ð relying □ð on □ð stock □ð the □ð supply □ð chain □ð through □ð British □ð Petroleum, □ð they've □ð increased □ð their □ð production □ð to □ð Pursuant □ð to □ð FOIA □ð Request □ð #□ð 00645-10, □ð FOIA □ð 00647-10, □ð From □ð Joint □ð Information □ð Center □ð to □ð Steve □ð Mason, □ð Region □ð 6, □ð U.S. □ð Environmental □ð Protection □ð Agency, □ð Subject: □ð briefing □ð on □ð ongoing □ð response □ð to □ð oil □ð spill □ð (May □ð 1, □ð 2010, □ð 19:25:21 □ð CST) □ð (on □ð Project). □ð

[29] □ð U.S. □ð Environmental □ð Protection □ð Agency, □ð National □ð Contingency □ð Plan □ð Product □ð Schedule □ð toxicity □ð and □ð Effectiveness □ð Summaries, □ð http://www.epa.gov/emergencies/content/ncp/tox_tables.htm □ð (last □ð visited □ð Apr. □ð 15, □ð 2013).; □ð Paul *Lavelle*, □ð *Dispersants □ð Lose □ð Out □ð in □ð BP □ð Spill*, □ð N.Y. □ð Times, □ð May □ð 13, □ð 2010, □ð http://www.nytimes.com/2010/05/13/business/energy-environment/13greenwire-dispersants-lose-out-in-bp-spill-81183.html?scp=5&sq=Corexit%20BP%20Oil%20Spill&st=cse&_r=0. □ð

[30] □ð Pursuant □ð to □ð FOIA □ð Request □ð #□ð 12-00369, □ð Memorandum □ð from □ð team □ð □ð member □ð Agency □ð for □ð Toxic □ð Substances □ð and □ð Disease □ð Control, □ð to □ð Carol □ð National □ð Centers □ð for □ð Center □ð for □ð Environmental □ð Health, □ð Subject: □ð Comments □ð on □ð NOAA/FDA □ð Protocol □ð (Jun. □ð 2, □ð Government □ð Accountability □ð Project). □ð □ð

[31] □ð Jonathan □ð Capehart, □ð *Oil □ð Spill □ð and □ð Use □ð of □ð Dispersants*, □ð Washington □ð Post, □ð Jun. □ð 3, □ð 2010, □ð http://voices.washingtonpost.com/postpartisan/2010/06/gulf_oil_spill_and_the_use_of.html. □ð

[32] □ð Statement □ð by □ð EPA □ð Administrator □ð Lisa □ð P. □ð Jackson □ð from □ð Press □ð Conference □ð on □ð Mexico □ð with □ð U.S. □ð Coast □ð Guard □ð Rear □ð Admiral □ð Landry □ð (May □ð 24, □ð 2010), □ð *available* □ð *at* □ð http://www.epa.gov/bpspill/dispersants/transcript-may24.pdf. □ð

[33] □ð U.S. □ð Coast □ð Guard, □ð Deepwater □ð Horizon □ð Oil □ð Spill □ð Incident □ð Specific □ð Preparedness □ð Review □ð (2011), *available* □ð *at* □ð http://www.uscg.mil/foia/docs/dwh/bpdwh.pdf. □ð

[34] *The □ð BP □ð Oil □ð Spill: □ð Responsive □ð Science □ð Supports □ð Emergency □ð Response*, □ð Sci. □ð Matters □ð Newsletter □ð (U.S. □ð EPA, □ð Washington, □ð D.C.), □ð Apr. □ð 2012, □ð *available* □ð *at* □ð http://www.epa.gov/sciencematters/april2012/spill.htm. □ð

[35] Roberto □ð Rico-Martinez, □ð *Synergistic □ð Toxicity □ð of □ð Macondo □ð Crude □ð Oil □ð and □ð Dispersant □ð Corexit □ð 9500A □ð to □ð Brachionus □ð Plicatilis □ð Species □ð Complex □ð (Rotifera)*, □ð Environmental □ð Pollution, □ð Feb. □ð 2013, □ð *available* □ð *at* □ð http://www.sciencedirect.com/science/article/pii/S0269749112004344.; □ð Julia □ð Whitty, □ð *Toxic □ð Dispersant □ð Made □ð BP □ð Oilspill □ð 52 □ð Times □ð More □ð Toxic*, □ð Mother □ð Jones, □ð Dec. □ð 4, □ð 2012, □ð http://www.motherjones.com/blue-marble/2012/12/chemical-dispersant-made-bps-oil-spill-52-times-more-toxic □ð

[36] □ð Committee □ð on □ð Understanding □ð Oil □ð Spill □ð Dispersants: □ð Efficacy □ð and □ð Effects, □ð Oil □ð Spill □ð Dispersants: □ð Efficacy □ð and □ð Effects (The □ð National □ð Academies □ð Press, □ð 2005). □ð

[37] □ð Douglas □ð Main, □ð *Dispersant □ð Makes □ð Oil □ð 52 □ð Times □ð More □ð Toxic*, □ð Live □ð Science, □ð Nov. □ð 30, □ð 2012, □ð http://www.livescience.com/25159-oil-dispersant-increases-toxicity.html. □ð

[38]Dr. □ð Susan □ð D. □ð Shaw, □ð Marine □ð Environmental □ð Research □ð Institute, □ð Consensus □ð Statement: □ð Use □ð of □ð Dispersant □ð Chemicals □ð in □ð the □ð Gulf *available* □ð (Jul. □ð 16, □ð 2010), □ð http://www.meriresearch.org/Portals/0/Documents/CONSENSUS%20STATEMENT%20ON%20DISPERSANTS%20IN%20THE%20GULF%20updated%20July%2017.pdf. □ð

[39]*Id.* □ð

[40] □ð Natural □ð Resources □ð Defense □ð Council, □ð Disaster □ð in □ð the □ð Gulf, □ð http://www.nrdc.org/energy/gulfspill/belowsurface.asp □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[41] □ð Seth □ð Borenstein, *Looking for the NOAA Says It's Mostly Gone* □ð Associated □ð Press, □ð *available* □ð 2010, □ð http://phys.org/news200145684.html. □ð

[42] □ð Christine □ð Dell'Amore, *Underwater Plume Confirmed Oil Not Degrading* □ð National □ð Geographic □ð News, □ð Aug. □ð 19, □ð 2010, □ð http://news.nationalgeographic.com/news/2010/08/100819-gulf-oil-spill-underwater-plume-science-environment/. □ð

[43] □ð National □ð Commission □ð on □ð the □ð BP □ð Deepwater □ð Horizon □ð Oil □ð Spill □ð and □ð Offshore □ð Drilling, □ð http://www.oilspillcommission.gov/media/restoration/ecological-oil-spill-gulf-shoreline.html □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[44] □ð Committee □ð on □ð Understanding □ð Oil □ð Spill □ð Dispersants: □ð Efficacy □ð and □ð Effects, □ð National □ð Dispersants: □ð Efficacy □ð and □ð Effects (The □ð National □ð Academies □ð Press, □ð 2005). □ð

[45] Elanor □ð Schwartz, *Ingredients of Controversial Dispersants Used in Gulf Oil Spill Are Not Secret* □ð N.Y. □ð Times, □ð Jun. □ð 9, □ð 2010, □ð http://www.nytimes.com/gwire/2010/06/09/09greenwire-ingredients-of-controversial-dispersants-used-in-gulf-oil-spill-are-not-s-42891.html. □ð

[46] □ð U.S. □ð Coast □ð Guard, □ð Deepwater □ð Horizon □ð Oil □ð Spill □ð Incident □ð Specific □ð Preparedness □ð Review (2011), *available* □ð at □ð http://www.uscg.mil/foia/docs/dwh/bpdwh.pdf. □ð

[47] □ð OSHA's □ð participation □ð in □ð the □ð Unified □ð Command □ð allowed □ð it □ð to □ð operate □ð beyond □ð its □ð extends □ð only □ð to □ð those □ð offshore.; □ð Sasha □ð Chanthadasith, *OSHA Director: Offshore Cleanup Workers Will Get More Training*, □ð ProPublica, □ð Jun. □ð 21, □ð 2010, □ð http://www.propublica.org/article/osha-director-offshore-cleanup-workers-will-get-more-training. □ð

[48] National □ð Commission □ð on □ð the □ð BP □ð Deepwater □ð Horizon □ð Oil □ð Spill □ð and □ð Offshore □ð Drilling, □ð Vessels □ð of □ð Opportunity, □ð http://www.oilspillcommission.gov/media/response/response-actions-vessels-of-opportunity.html □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[49] □ð U.S. □ð Environmental □ð Protection □ð Agency, □ð Odors □ð from □ð the □ð BP □ð Oil □ð Spill, □ð http://www (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[50] □ð Press □ð Release, □ð B.P. □ð p.l.c, □ð BP □ð Provides □ð $10 □ð Million □ð to □ð Support □ð Study □ð of □ð He 2010), □ð http://www.bp.com/genericarticle.do?categoryId=2012968&contentId=7064912. □ð

[51]BP □ð p.l.c., □ð BP □ð Took □ð Steps □ð to □ð Safeguard □ð the □ð Health □ð and □ð Safety □ð of □ð Thousands □ð Deepwater □ð Horizon □ð Response, □ð http://www.bp.com/IntermediateSearchAction.do?url=http%3A%2F%2Fwww.bp.com%2Fsectiongenericarticle800.do%3FcategoryId%3D9048926%26contentId%3D7082616&kw=worker+safety&currentPage=1&scope=BP&resultNumber=3&type=search&Host=http://www.bp.com&homeId=1 □ð (last □ð visited □ð Apr. □ð 15, □ð 2013

[52] □ð BP, □ð On-Shore □ð PPE □ð Matrix □ð for □ð Gulf □ð Operations □ð (Aug. □ð 14, □ð 2010), □ð http://www.osha.gov/oilspills/gulf-operations-ppe-matrix.pdf. □ð

[53] □ð Occupational □ð Safety □ð and □ð Health □ð Administration, □ð Deepwater □ð Horizon □ð Oil □ð Spill: □ð OSHA (2011), *available* □ð at □ð http://www.osha.gov/oilspills/dwh_osha_response_0511a.pdf. □ð

[54] Louisiana □ð Environmental □ð Action □ð Network, □ð BP □ð Tells □ð Fishermen □ð Working □ð in □ð the □ð Oil □ð Spill □ð Fired □ð for □ð Wearing □ð a □ð Respirator □ð (Jun. □ð 1, □ð 2010), □ð http://leanweb.org/index2.php?option=com_content&task=emailform&id=145&itemid=50. □ð

[55]Elana □ð Schor, *New BP Data Show Offshore Responders Exposed to Chemical that Sickened Valdez Workers*, □ð N.Y. □ð Times, □ð Jul. □ð 9, □ð 2010, □ð http://www.nytimes.com/gwire/2010/07/09/09greenwire-new-bp-data-show-offshore-responders-exposed-to-chemical-that-s-82494.html. □ð

[56] □ð Occupational □ð Safety □ð and □ð Health □ð Administration, □ð Hazard □ð Communication □ð Guidelines □ð for http://www.osha.gov/Publications/osha3111.html, □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[57] □ð OSHA □ð emphasizes □ð that □ð workers □ð must □ð have □ð direct □ð access □ð to □ð the □ð MSDSs.; □ð *Id.* □ð

ED_001324_00007754-00094

[59] During the Exxon Valdez oil spill, OSHA's standard 24-hour HAZWOPER hour training for emergency cleanup workers. Despite widespread critique that the ab outdated and inadequate, it was widely adopted during the BP oil spill cleanu

[60] Letter from David Michaels, PhD, MPH, Assistant Secretary of Labor for Occupational Department of Labor, to Eula Bingham, PhD, Professor, Department of Environmenta Cincinnati (Asst. Secretary of Labor for OSHA, 1977-1981) (Dec. 1, 2011) (Accountability Project).

[61] *Id.*

[62] U.S. Environmental Protection Agency, Odors from the BP Oil Spill, http://www (last visited Apr. 15, 2013).

[63] U.S. Environmental Protection Agency & Centers for Disease Control, Government Spill: Odors from the BP *available at* Jun. 2010, http://www.epa.gov/bpspill/reports/odorfactsheet.pdf.

[64] Occupational Safety and Health Administration, Frequently Asked Questions on Protections (Jul. 2, 2010), *available at* http://www.osha.gov/oilspills/interim-guidance-qa.html.

[65] One exception to the respirator policy involved the in-situ burnings (burning respirator access was recommended for close vicinity to the burns, and air qua to ensure worker safety. Occupational Safety and Health Administration, Deepwater Horizon Role in the Response *available at* http://www.osha.gov/oilspills/dwh_osha_response_0511a.pdf.

[66] Occupational Safety and Health Administration, Frequently Asked Questions on Protections (Jul. 2, 2010), *available at* http://www.osha.gov/oilspills/interim-guidance-qa.html.

[67] *Id.*

[68] The National Response Team, *Managing Worker Fatigue During Disaster Operations* (Apr. 2009), *available at* http://www.nrt.org/production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/SA-1049TADFinal/$File/TADfinal.pdf?OpenElement.

[69] PowerPoint: Worker Education and Training Program, National Institute of Health, Health and Human Services, *Oil Spill Response Training Tool: Oil Spill Cleanup Initiative, Health Awareness for Oil Spill Cleanup Workers* (May 2010), v2 (on file with Government Accou Project).

[70] National Institute of Environmental Health and Sciences, Worker Education and Improving Safety and Health Training for Disaster Cleanup Workers: Lessons Learned Deepwater Horizon Oil Spill *available at* (Feb. 2012), http://tools.niehs.nih.gov/wetp/newsbriefs/index.cfm?issue=Feb12/nb24Feb12.

[71] Letter from David Michaels, PhD, MPH, Assistant Secretary of Labor for Occ Department of Labor, to Eula Bingham, PhD, Professor, Department of Environmental Hea Cincinnati (Asst. Secretary of Labor for OSHA, 1977-1981) (Dec. 1, 2011) (Accountability Project).

[72] Louisiana Environmental Action Network, Fishermen Win Another Round (May 10, http://leanweb.org/our-work/water/bp-oil-spill/fishermen-win-another-round.

[73] *Id.*

[74] Gina Solomon, BP Coughs Up Another Drop of Air Quality Data: Not Re Resources Defense Council Staff. Blog, (Jun. 10, 2010), http://switchboard.nrdc.org/blogs/gsolomon/bp_releases_another_drop_of_ai.html

[75] Independent air monitoring by the LEAN found that Hydrogen Sulfide concentratio Reaction Symptoms concentrations by a factor of 100 to 120 times. VOC conc the Louisiana Ambient Air Standards for specific VOCs and may have exceeded Annual Average Standard by as much 50 times.; Louisiana Environmental Action Air Monitoring (May 10, 2010), *available at* www.leanweb.org/our-work/air-monitoring.

[76] Government Accountability Project, BP Ombudsman Correspondence, www.whistleblower.org/center/know-your-rights-campaign/the-resource-manual (last visited Apr. 15, 2013).

[77] Letter from Tom Devine, Legal Director, Government Accountability Project, and Director, Louisiana Environmental Action Network, to Judge Stanley Sporkin, Obudsman, Ombudsman Program (Mar. 2, 2010), *available at* http://www.whistleblower.org/storage/documents/GAPLEANletter.pdf

[78] □ð Letter □ð from □ð Tom □ð Devine, □ð Legal □ð Director, □ð Government □ð Accountability □ð Project, □ð and □ð Director, □ð Louisiana □ð Environmental □ð Action □ð Network, □ð to □ð Judge □ð Stanley □ð Sporkin, □ð Obudsman, □ð Ombudsman □ð Program □ð (Jul. □ð 20, □ð 2012), □ð http://www.whistleblower.org/storage/documents/GAP_LEAN_7.20.12_Letter.pdf □ð

[79] □ð Toxipedia □ð Consulting □ð Services □ð and □ð Earthjustice, □ð The □ð Chaos □ð Clean□ □관Ġ Up □ð 3 □ð http://earthjustice.org/sites/default/files/Oil_Dispersants_Report.pdf. □ð

[80] BP, □ð Monitoring □ð Summary □ð Report □ð (May □ð 20, □ð 2010), □ð http://usresponse.bp.com/external/content/document/2911/963907/1/monitoring_summary_report_may20_2010.pdf. □ð

[81] *Id.* □ð □ð

[82] BP, □ð Personal □ð Exposure □ð Monitoring □ð Results □ð Summary □ð (Jul. □ð 2010), □ð http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/incident_response/STAGING/local_assets/downloads_pdfs/health_monitoring_summary_report_july.pdf. □ð

[83] Elana □ð Schor, *New □ð BP □ð Data □ð Show □ð 20% □ð of □ð Offshore □ð Responders □ð Exposed □ð to □ð Chemical □ð that □ð Sickened Workers*, □ð N.Y. □ð Times, □ð Jul. □ð 9, □ð 2010, □ð http://www.nytimes.com/gwire/2010/07/09/09greenwire□ □관Ġ show□ □관Ġ 20□ □관Ġ Spill□ □관Ġ Responders□ □관Ġ e□ □관Ġ 82494.html. □ð

[84] New □ð Jersey □ð Department □ð of □ð Health □ð and □ð Senior □ð Services, □ð Right □ð to □ð Know □ð Hazardous □ð Substance □ð Fact □ð Sheet: □ð Butoxy □ð Ethanol □ð (Oct. □ð 15, □ð 2010), □ð http://nj.gov/health/eoh/rtkweb/documents/fs/0275.pdf. □ð

[85] □ð National □ð Institute □ð for □ð Occupational □ð Safety □ð and □ð Health, □ð Reducing □ð Occupational □ð Exposure with □ð Dispersants □ð During □ð the □ð Deepwater □ð Horizon □ð Response, □ð (Jul. □ð 2, □ð 2010), □ð http://www.cdc.gov/niosh/topics/oilspillresponse/dispersants.html. □ð

[86] □ð Nalco, □ð Material □ð Safety □ð Data □ð Sheet: □ð Corexit® □ð EC9527A □ð (Oct. □ð 15, □ð 2008), □ð http://www.doh.state.fl.us/chd/bay/Documents/Oilspill/Master_EC9527A_MSDS_539295.pdf.; □ð Nalco, □ð Material □ð Safety □ð Data □ð Sheet: □ð Corexit® □ð 9500 □ð (Jul. □ð 14, □ð 2005), □ð http://www.lmrk.org/corexit_9500_uscueg.539287.pdf. □ð

[87] □ð David □ð Hammer, *Clashes □ð with □ð Critics □ð in □ð Gulf □ð of □ð Mexico □ð Over □ð Oil □ð Spill □ð Response*, □관Ġ Picayune, □ð May □ð 2010, □ð http://www.nola.com/news/gulf□ □관Ġ Spill/index.ssf/2010/05/post_6.html. □ð

[88] □ð Advocates □ð for □ð Environmental □ð Human □ð Rights, □ð The □ð Human □ð Right □ð to □ð Health □ð Denied Illness □ð Claims □ð Break □ð with □ð Past □ð Practices □ð (Jul. □ð 27, □ð 2011), □ð http://www.ehumanrights.org/docs/FeinbergBreaksWithPastPracticesInRejectingBPIllnessClaims.pdf. □ð

[89] □ð Occupational □ð Safety □ð and □ð Health □ð Administration □ð , □ð Frequently □ð Asked □ð Questions □ð on □ð Protections □ð (Jul. □ð 2, □ð 2010), □ð http://www.osha.gov/oilspills/interim□ □관Ġ guidance□ □관Ġ qa.html. □ð

[90] Bradley □ð S. □ð King □ð & □ð John □ð D. □ð Gibbins, □ð National □ð Institute □ð of □ð Environmental □ð Health □ð Evaluation □ð of □ð Deepwater □ð Horizon □ð Response □ð (2011) http://www.cdc.gov/niosh/hhe/reports/pdfs/2010□ □관Ġ 0115□ □관Ġ 0129□ □관Ġ 3138.pdf. □ð

[91] *Id.* □ð □ð

[92] □ð Louisiana □ð Environmental □ð Action □ð Network, □ð Health □ð Impacts □ð Associated □ð with □ð Dispersants □ð Crude □ð (Jun. □ð 14, □ð 2010), □ð http://www.wvu.edu/□ □관Ġ oil□ □관Ġ spill□ □관Ġ health□ □관Ġ impacts□ □관Ġ associated□ □관Ġ with□ □관Ġ dispersants□ □관Ġ and□ □관Ġ sweet□ □관Ġ crude□ □관Ġ □ð

[93] Elizabeth □ð Grossman, *No □ð Comment*, □ð 25 □ð Earth □ð Island □ð Journal □ð (2010), □ð http://www.earthisland.org/journal/index.php/eij/article/no_comment/. □ð

[94] Centers □ð for □ð Disease □ð Control, □ð Dispersants □ð Quick □ð Facts □ð for □ð Coastal □ð Residents, □ð http://emergency.cdc.gov/gulfoilspill2010/2010gulfoilspill/dispersants_coastal_residents.asp □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[95] □ð Nalco, □ð Material □ð Safety □ð Data □ð Sheet: □ð Corexit® □ð EC9527A □ð (Oct. □ð 15, □ð 2008), □ð http://www.doh.state.fl.us/chd/bay/Documents/Oilspill/Master_EC9527A_MSDS_539295.pdf □ð

[96] Centers □ð for □ð Disease □ð Control, □ð Community □ð Fact □ð Sheet: □ð VOCs □ð in □ð Blood, □ð http://emergency.cdc.gov/gulfoilspill2010/voc_coastalresidents.asp □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[97] □ð Pursuant □ð to □ð FOIA □ð Request □ð # □ð 12□ □관Ġ 00369, □ð Memorandum □ð from □ð team □ð □ð member Agency □ð for □ð Toxic □ð Substances □ð and □ð Disease □ð Control, □ð to □ð Carol □ð Selman, □ð Centers □ð for □ð Center □ð for □ð Environmental □ð Health, □ð Subject: □ð Comments □ð on □ð NOAA/FDA □ð Protocol □ð (Jun. □ð 2, □ð Government □ð Accountability □ð Project).

ED_001324_00007754-00096

[98] Pursuant to FOIA Request # 12-00369, E-mail from staff member, Center for Environmental Health, to fellow staff members, Centers for Disease Co Dispersants (May 3, 2010, 12:18 PM) (on file with Government Accountability Pr

[99] *Id.*

[100] Sciencecorps, Gulf Oil Spill Health Hazards (2010), http://www.sciencecorps.org/Gulf_Spill_Chemical_Hazards_Report.pdf.

[101] Alex Woodward, *"Gulf Coast Syndrome"* Gambit, Apr. 19, 2011, http://www.bestofneworleans.com/gambit/gulf-coast-syndrome/Content?oid=1686262.

[102] Louisiana Environmental Action Network, Health Impacts Associated with Dispersants Sweet Crude (Jun. 10, 2010), http://www.bp.com/spill/health-impacts-associated-with-dispersants-and-louisiana-sweet-crude

[103] Louisiana Environmental Action Network, BP Spill Blood Test Results – Louisiana http://leanweb.org/our-work/community/public-health/bp-spill-blood-test-results-louisiana-residents.

[104] Louisiana Environmental Action Network, Results Environmental Action Network (LEAN) Survey of the Human Health Impacts Due to the BP Deepwater Horizon Disas http://leanweb.org/our-work/water/bp-oil-spill/results-of-the-louisiana-environmental-action-network-lean-survey-of-the-human-health-impacts-due-to-the-bp-deepwater-horizon-disaster.

[105] Nalco, Seven Facts About Corexit 9500 Oil Dispersant, http://www.nalco.com/news (last visited Apr. 15, 2013).

[106] Toxipedia Consulting Services and Earthjustice, The Upwindsle (2011), http://earthjustice.org/sites/default/files/Oil_Dispersants_Report.pdf.

[107] Abrahm Lustgarten, *Chemicals Meant to Break BP Oil Spill Present New Environmental Concerns* ProPublica, Apr. 30, 2010, http://www.propublica.org/article/dispersants-gulf-0430.

[108] Rob Stein, *Officials Ask BP to Protect Health of Workers Cleaning Up Oil Spill*, May 28, http://www.washingtonpost.com/wp-dyn/content/article/2010/05/28/AR2010052803872.html

[109] Louisiana Environmental Action Network, Health Impacts Associated with Dispersants and Sweet Crude (Jun. 10, 2010), http://www.bp.com/spill/health-impacts-associated-with-dispersants-and-louisiana-sweet-crude

[110] BP p.l.c, BP Took Steps Health Safeguard Safety of Thousands of Individuals In Deepwater Horizon Response, http://www.bp.com/sectiongenericarticle800.do?categoryId=9048926&contentId=7082616 (last visited Apr. 15, 2013).

[111] *Id.*

[112] Antonia Juhasz, Black Tide: The Devastating Impact of the Gulf Oil Spill 130, 2011).

[113] *Our Natural Resources at Risk: The Short and Long Term Impacts of the Deepwater Horiz the Subcommitee on Insular Affairs, Oceans and Wildlife of the H., Committee on Natural Resource* (2010)(written statement of Anne Rolfes, Founding Director, Louisiana Bucket Brigade), http://naturalresources.house.gov/uploadedfiles/rolfestestimony06.10.09.pdf.

[114] *Id.*

[115] Letter from Kathleen Sebelius, Secretary, U.S. Health and Human Services, to Lamar President, BP America Inc. (May 28, 2010), http://www.hhs.gov/news/press/2010pres/05/letter20100528.html.

[116] *Id.*

[117] Press Release, Department of Health and Human Services, Federal Mobile Med Louisiana (May 31, 2010), http://www.hhs.gov/news/press/2010pres/05/20100531a.html.

[118] *Our Natural Resources at Risk: The Short and Long Term Impacts of the Deepwater Horiz the Subcommitee on Insular Affairs, Oceans and Wildlife of the H., Committee on Natural Resource* (2010)(written statement of Anne Rolfes, Founding Director, Louisiana Bucket Brigade), http://naturalresources.house.gov/uploadedfiles/rolfestestimony06.10.09.pdf.

[119] Bradley S. King & John D. Gibbins, National Institute of Environmental Health Evaluation of Deep Horizon Response Workers, Available at (2011) http://www.cdc.gov/niosh/hhe/reports/pdfs/2010-0115-0129-3138.pdf.

[120] *Id.*

[121] *Id.* at 12-13.

[122] Centers for Disease Control, CDC/ATSDR Guidance on the Interpretation and Use Analyses for Volatile Organic Compounds *available at* (2010), http://emergency.cdc.gov/gulfoilspill2010/pdf/Clinician_VOC_FactSheet.pdf.

[123] Louisiana Department of Health and Hospitals, Oil Spill Health Effect Summary: Surveillance Report *(2010), available at* http://new.dhh.louisiana.gov/assets/docs/SurveillanceReports/OilSpillHealth/_OilSpillSurveillance2010_17.pdf.

[124] Matthew Brown and Nicholas Riccardi, *Black Sludge Washes Up on Gulf Oil Spill Workers Suffer*, Associated Press, Jun. 3, 2010, *available at* http://www.fox11online.com/dpps/green/national_green/gulf-oil-spill-workers-suffer-complaining-of-flulike-symptoms_3396834.

[125] Centers for Disease Control, CDC/ATSDR Guidance on the Interpretation and Use Analyses for Volatile Organic Compounds *available at* (2010), http://emergency.cdc.gov/gulfoilspill2010/pdf/Clinician_VOC_FactSheet.pdf.

[126] *Id.* at 3.

[127] Louisiana Environmental Action Network, Results of the Louisiana Environmental Survey of the Human Health Impacts Due to the BP Deepwater Horizon Disas http://leanweb.org/our-work/water/bp-oil-spill/results-of-the-louisiana-environmental-survey-of-the-human-health-impacts-due-to-the-bp-deepwater-horizon-disaster.

[128] Louisiana Environmental Action Network, Detoxification Program Addresses Gulf Coas (Feb. 7, 2012), http://leanweb.org/our-work/community/public-health/detoxification-program-addresses-gulf-coast-health-challenges.

[129] BP p.l.c., Dispersant Background and Frequently Asked Questions *available at* (Jun. 19, 2010), http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/incident_response/STAGING/local_assets/downloads_pdfs/Dispersant_background_and_FAQs.pdf

[130] *Id.*

[131] Press Release, BP p.l.c., BP Pledges $500 Million for Spill Independent Marine Research Environment (May 24, 2010), http://www.bp.com/genericarticle.do?categoryId=2012968&contentId=7062370.

[132] *Id.*

[133] *Id.*

[134] BP p.l.c., Dispersant Background and Frequently Asked Questions *available at* (Jun. 19, 201 http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/incident_response/STAGING/local_assets/downloads_pdfs/Dispersant_background_and_FAQs.pdf

[135] *Id.*

[136] BP p.l.c., Seafood Industry Recovery, http://www.bp.com/sectiongenericarticle800.do?categoryId=9048909&contentId=7082589 (last visited Apr. 15, 2013).

[137] Laurie Weighard, *Gulf Chefs Promote Seafood Safety, Olympics* (Jul. 29, 2012, http://www.examiner.com/article/bp-sponsored-gulf-chefs-promote-seafood-safety-at-olympics.

[138] U.S. Environmental Protection Agency, Questions and Answers on Dispersants, http://www.epa.gov/bpspill/dispersants-qanda.html (last visited Apr. 15, 2013).

[139] National Oceanic and Atmospheric Administration, What Are Some Environmental Dispersant Use http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/what-are-some-environmental-impacts-dispersants.html (last visited Apr. 15, 2013).

[140] *Review of the Use of Dispersants in Response to the Deepwater Horizon Oil Spill before Commerce, Justice, Science, and Related Agencies of the Senate Comm. on Appropriations* (2010), *available at* http://www.gpo.gov/fdsys/pkg/CHRG-111shrg63179/html/CHRG-111shrg63179.htm.

[141] Roberto Rico-Martinez, *Synergistic Toxicity Marine Crude Oil and Dispersant Corexit 9500A to Brachionus Plicatilis Species Complex (Rotifera)*, Environmental Pollution, (Feb. 2013), *available at* http://www.sciencedirect.com/science/article/pii/S0269749112004344.

[142] U.S. Government Accountability Office, Additional Research Needed, Particularly on Applications (May 30, 2012), *available at* http://www.gao.gov/products/GAO-12-585.

[143] Kori, Schulman, *Seafood from Open Gulf Waters is Safe to Whitehouse* House Blog, Aug. 13, 20
http://www.whitehouse.gov/blog/2010/08/13/seafood-open-gulf-waters-safe-eat.
[144] Frank Jasmes, *President Obama: Gulf Seafood, NPR, Safe* Jun. 14, 2010,
http://www.npr.org/blogs/thetwo-way/2010/06/14/127840705/president-seafood-gulf-safe.
[145] National Oceanic and Atmospheric Administration, NOAA Third Reopens Closed Gulf Fishing
(Jul. 22, 2010), http://www.noaanews.noaa.gov/stories2010/20100722_reopening.html.
[146] *Id.*
[147] National Oceanic and Atmospheric Administration, Study: Seafood Safe After Deepwa
2012), http://www.nmfs.noaa.gov/stories/2012/02/dwhpaper.html.
[148] *Review of the Use of Dispersants in Response to the Deepwater Horizon Oil Spill before the Commerce, Justice, Science, Related Agencies of the S. Comm. on Appropriations* 2 (2010),
available at http://www.gpo.gov/fdsys/pkg/CHRG-111shrg63179/html/CHRG-111shrg63179.htm.
[149] Pursuant FOIA Request # 12-00369, E-mail from staff member, Centers
Center for Environmental Health, to staff members, Centers for Disease Control, S
reopening protocol (Jun. 2, 2010, 11:44 PM) (on file with Government Accountab
[150] Natural Resources Defense Council, FDA provided to NRDC in response to a Fre
Information Act (FOIA) request, http://docs.nrdc.org/energy/files/ene_11101101a.pdf (last visited
2013).
[151] *Id.* Letter from P. Michael Bolger, Ph.D, Chief, Chemical Hazards Assessment, Staff,
Food and Drug Administration, to Don Kraemer, Acting Deputy Director, Center f
Nutrition, Food and Drug Administration, Subject: Levels of Concern for Select Gu
available at http://www.fda.gov/downloads/Food/FoodSafety/Product-
SpecificInformation/Seafood/UCM231697.pdf.
[152] Mary Foster, *Seafood Sales Get Boost from U.S. Military Associated Press, Oil Spill* 2,
2011, http://www.huffingtonpost.com/2011/02/07/seafood-sales-get-a-n_819549.html.
[153] Jonathan Tilove, *Armed Services are Urged to Stock Kitchen with Gulf Seafood* Picayune, Dec.
2010, http://www.nola.com/news/gulf-spill/index.ssf/2010/12/armed_services_are_urged_to_st.html.
[154] *Review of the Use of Dispersants in Response to the Deepwater Horizon Oil Spill before the Commerce, Justice, Science, and Related Agencies of the S. Comm. on Appropriations* (2010),
available at http://www.gpo.gov/fdsys/pkg/CHRG-111shrg63179/html/CHRG-111shrg63179.htm.
[155] Food and Water Watch, U.S. Seafood and BP Gulf Disaster (Jul. 201
http://www.foodandwaterwatch.org/factsheet/seafood-disaster/.
[156] Helen K. White, *Deepwater Horizon Oil Spill Water Coral Community in the Gu of Mexico* Proceedings of National Academy of Sciences (Feb.
http://www.pnas.org/content/early/2012/03/23/1118029109.abstract.; *Gulf Oil Spill: Coral Death Definitively Linked to BP Spill* Associated Press, Mar. 26, 2012,
http://www.huffingtonpost.com/2012/03/26/gulf-oil-spill-coral-death_n_1380712.html.
[157] Ben Raines, *Levels of Deadly Bacteria More Than 100 Times Higher in Gulf Waters During the* Register, Jul. 27, 2012, http://blog.al.com/live/2012/07/levels_of_deadly_bacteria_more.html.
[158] Press Release, Surfrider Foundation, Surfrider Foundation Releases Findings of Gu
(Apr. 16, 2012), http://emeraldcoast.surfrider.org/wp-content/uploads/2012/04/FindingsReleaseFinal.pd
More From Macondo? Fresh, Highly Toxic BP Oil Rolls Ashore in Alabama's Seafood Shop Blog, Apr. 3, 2012, http://www.stuarthsfoodshop.com/more-fresh-highly-toxic-bp-oil-rolls-ashore-in-alabama-seafood-capital/.
[159] National Oceanic and Atmospheric Administration, 2010-2013 Cetacean Unusual
Northern Gulf of Mexico, http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico2010.htm
(last visited Apr. 15, 2013); Leslie Kaufman, *Gulf Dolphin Exposed to Oil Are Seriously Ill, Agency Says* Times, Mar. 23, 2012, http://green.blogs.nytimes.com/2012/03/23/gulf-oil-are-seriously-ill-agency-says/; Jane Mcconnaughey, *Group: Dolphin, Turtle Deaths a Sign of Stock Gulf* Press, Apr. 2, 2013, http://news.yahoo.com/group-dolphin-turtle-deaths-sign-202226016.html.
[160] *Louisiana Bayou Slow to Recover from Gulf Oil Spill*, Living on Earth, Jul. 3, 2012
http://www.pri.org/stories/science/environment/louisiana-bayou-slow-to-recover-from-gulf-oil-spill-10502.html.; Brian R. Silliman, *Degradation and Resilience in Louisiana Salt Marshes After the BP Deepwater Horizon Oil Spill* 109 Proceedings of the National Academy of Sciences 11234

ED_001324_00007754-00099

available ð
http://www.pnas.org/content/109/28/11234.short?rss=1&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+pnas%2FSMZM+%28Current+Issue%29. ð

161 Brendan ð Kirby, *Gulf Oil Spill Had Dramatic Impact on Microscopic Life*, ð *Study Reveals*, ð Jul ð 10, ð 2012, ð http://blog.al.com/live/2012/07/gulf_oil_spill_had_dramatic_impact.html.; ð Pittman, *Three Years After BP Oil Spill, USF Research Finds Massive Bay Die-Off*, ð St. Petersburg Times, ð Apr. ð 4, ð 2013, ð http://www.tampabay.com/news/environment/water/gulf-oil-spill-billions-of-microscopic-creatures-at-base-of-food/2113157. ð

162 *Two Years After BP Spill, Deformed and Sick Fish Found in the Gulf*, ð Associated ð Press, ð http://www.nydailynews.com/news/national/2-years-bp-deformed-sick-guide-gulf-1.1064239.; Rocky ð Kistner, *Fossil Fuel Subsidies: The Answer Lies in Switchboard*, ð NRDC ð Staff ð Blog, ð Jun. ð 20, ð 2012, ð http://switchboard.nrdc.org/blogs/rkistner/fossil_fuel_subsidies_the_answ.html. ð

163 ð Dahr ð Jamail, *Fisheries Hit Hard After Oil Disaster*, ð Al ð Jazeera, ð Apr. ð 19, ð 2012, ð http://www.aljazeera.com/indepth/features/2012/03/20123571723894800.html.; Dan ð Flynn, *Sign of Oyster Recovery Two Years After the BP Spill*, ð Food ð Safety ð News, ð Mar. ð 30, ð 2012, ð http://www.foodsafetynews.com/2012/03/no-signs-of-oyster-recovery-two-years-after-bp-oil-spill/#.UTTzuFd4yp0. ð

164 Julia ð Whitty, *BP's Corexit Oil Tar Sponged Up by Mother Nature*, ð Mother ð Jones, ð Apr. ð 17, ð 2012, ð http://www.motherjones.com/blue-marble/2012/04/microbes-eating-oil-gulf-corexit-dispersant. ð

165 *Id.* ð ð ð

166 ð Richard ð A. *Oil Spill's Toxic Effects*, ð *Nature*, ð Nov. ð 10, ð 2010, ð http://www.nature.com/news/2010/101110/full/news.2010.597.html. ð

167 ð Stuart ð Fox, *Small Creatures Will Be Biggest Victims of Spill's Toxic Effects*, ð Live ð Science, ð Jun. ð 18, ð 2010, ð http://www.livescience.com/10708-small-creatures-oil-spill-biggest-victims.html. ð

168 ð Letter ð from ð Clint ð Guidry, ð President, ð Louisiana ð Shrimp ð Association, ð et. ð al, ð to ð United ð States ð (May ð 27, ð 2010), ð available ð at ð http://earthjustice.org/sites/default/files/library/signon/lpresobamadisbersants.pdf.; *Coast Guard Grounds Ships Involved in Spill Cleanup After Fall Oil; BP Reportedly Preventing Fishermen From We* ð Democracy ð Now!, ð May ð 27, ð 2010, ð http://www.democracynow.org/2010/5/27/coast_guard_grounds_ships_involved_in. ð

169 ð Christine ð Dell'Amore, *Oil Found Deep in Gulf Seafloor?*, ð ð National ð Geographic ð News, ð http://news.nationalgeographic.com/news/2010/08/100818-gulf-oil-seafloor-toxic-science-environment/.; ð Louisiana ð Environmental ð Action ð Network, ð Oil ð Spill ð Dispersants ð Are ð Not ð 4, ð 2010), ð http://leanweb.org/work/water/bp-oil-spill/oil-spill-dispersants-are-not-a-solution-magid-ð

170 ð Health ð and ð Economic ð Impacts ð of ð Toxic ð Exposure ð Caused ð by ð the ð Deepwater ð Wilma ð Subra. ð Present ð at ð the ð 2013 ð Gulf ð Gathering ð (on ð file ð with ð Government ð Account

171 ð Douglas ð Main, *Dispersant Make Oil 52 Times More Toxic*, ð Live ð Science, ð Nov. ð 30, ð 2012, ð http://www.livescience.com/25159-oil-dispersant-increases-toxicity.html. ð

172 *Id.* ð ð ð

173 ð Craig ð Pittman, *Three Years After BP Oil Spill, USF Research Finds Massive Bay Die-Off*, ð St. ð Petersburg ð Times, ð Apr. ð 2013, ð http://www.tampabay.com/news/environment/water/gulf-oil-spill-billions-of-microscopic-creatures-at-base-of-food/2113157. ð

174 *BP Oil Spill Dispersant May Have Hurt Gulf of Mexico*, ð Associated ð Press, ð *Fond*. ð 31, ð 20 http://www.nola.com/news/gulf-oil-spill/index.ssf/2012/07/bp_oil_spill_dispersants_may_h.html. ð

175 ð Sue ð Sturgis, *From BP Disaster Contaminated Ocean Research Chain* ð Confirms, ð Facing ð South, ð Ma 15, ð 2012, ð http://www.southernstudies.org/2012/03/from-bp-disaster-contaminated-ocean-food-chain-research-confirms.html. ð

176 ð Louisiana ð Environmental ð Action ð Network, ð BP ð Oil ð Spill ð Seafood ð Sampling ð Project ð 2011), ð http://leanweb.org/work/water/bp-oil-spill/seafood-safety/bp-oil-spill-seafood-sampling-project-results-overview. ð

177 ð Louisiana ð Environmental ð Action ð Network, ð Announcing ð GC-HARMS: ð UTMB's ð Study ð Seafood ð (Dec. ð 1, ð 2011), ð http://leanweb.org/work/water/bp-oil-spill/seafood-safety/announcing-gc-harms-utmb-study-of-pahs-in-people-and-seafood. ð

178 ð Health ð and ð Economic ð Impacts ð of ð Toxic ð Exposure ð Caused ð by ð the ð Deepwater ð
Wilma ð Subra. ð Presented at ð the ð 2013 ð Gulf ð Gathering ð (on ð file ð with ð Government ð Account

179 Miriam ð Rotkin-Ellman, *Seafood Contamination After the BP Gulf Oil Spill and Risks to Vulner*
Populations: A Critique of the FDA Risk Assessment, Environmental ð Health ð Perspectives ð 157 ð (Feb.
available at ð http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3279436/#r3. ð

180 ð Michael ð R. *Taylor, Gulf Seafood Safety After the BP Spill*, ð Jan. ð 11, ð 2012, ð
http://blogs.fda.gov/fdavoice/index.php/2012/01/gulf-seafood-safety/. ð

181 ð Press ð Release, ð Natural ð Resources ð Defense ð Council, ð FDA ð Allowed ð Unsafe ð Levels ð
after ð BP ð Oil ð Spill, ð Study ð Finds ð (Oct. ð 12, ð 2011), ð http://www.nrdc.org/media/2011/111012

182 ð National ð Oceanic ð and ð Atmospheric ð Administration, ð Ocean ð Exploration ð and ð Undersea
http://www.research.noaa.gov/oceans/t_deepseacorals.html ð (last ð visited ð Apr. ð 15, ð 2013). ð

183 ð Steve ð Kolian, *Deputation of Macondo (MC252) Oil Found in Heterotrophic Scleractinian*
(Tubastrea coccinea and Tubastrea micranthus) on Offshore Platform in the Mexico ð Gulf 25 ð
and ð Caribbean ð Research ð (April 2013), *available at* ð http://www.ecorigs.org/CoralDepurationBPoil.pdf. ð

184 ð Helen ð K. ð White, *Toxicity of the Deepwater Horizon Oil Spill on Deep-Water Coral Com*
of Mexico, ð Proceedings ð of ð National ð Academy ð of ð Sciences (2012), *available at* ð
http://www.pnas.org/content/early/2012/03/23/1118029109.abstract. ð

185 *Id.* ð ð ð

186 ð Craig ð Pittman, *Years After BP Oil Spill, USF Research Offers Massive Bailout*, ð Times, ð Apr. ð
2013, ð http://www.tampabay.com/news/environment/water/gulf-spill-recommendations-of-microscopic-
creatures-at-bottom-of-food/2113157. ð

187 ð SeasideC ð SI, ð "Alarming ð Find: ð BP ð Damage ð Found ð by ð Forensics ð Divers ð in ð FL
2011. ð https://www.youtube.com/watch?v=nvSL8TpOI5w. ð

188 ð Press ð Release, ð Gulf ð Oil ð Disaster ð Recovery ð Group, ð Gulf ð Oil ð Spill: ð Dispersants ð
Harm ð Than ð Good ð (May 11, ð 2012), *available at* ð http://www.prnewswire.com/news-releases/gulf-
dispersants-have-potential-to-cause-more-harm-than-good-93424899.html. ð

189 ð Bruce ð Alpert, *Environmental Group Sues EPA Over Dispersants Used During the Gulf Oil Spill*
Picayune, ð Aug. ð 6, ð 2012, ð http://www.nola.com/news/gulf-spill/index.ssf/2012/08/environmental_group_sues_epa_o.html. ð

190 ð Press ð Release, ð Earthjustice, ð Conservation, ð Wildlife, ð and ð Health ð Groups ð Seek ð Disper
6, ð 2012), ð http://earthjustice.org/news/press/2012/conservation-wildlife-and-health-groups-seek-
dispersant-rulemaking. ð

191 BP, ð BP ð Code ð of ð Conduct ð (2011), *available at* ð
http://www.bp.com/liveassets/bp_internet/globalbp/STAGING/global_assets/downloads/C/Code_of_Condu
ct_2011.pdf. ð

192 *Id.* ð ð

193 *Id.* ð at ð 14 ð

194 *Barriers to News Coverage of Gulf of Mexico Oil Spill Remain Despite Promises*, ð Jun. ð 16, ð
2010, ð http://www.nola.com/news/gulf-spill/index.ssf/2010/06/barriers_to_news_coverage_of_g.html.; ð

195 *Oil ð Natural Resources at Risk: The Short and Long Term Impacts of the Deepwater Horiz*
the Subcommitee on Insular Affairs, Oceans and Wildlife of the H. Comm. on Natural Resource
(2010)(written ð statement ð of ð Anne ð Rolfes, ð Founding ð Director, ð Louisiana ð Bucket ð Brigade),
http://naturalresources.house.gov/uploadedfiles/rolfestestimony06.10.09.pdf.; *Adam Rawnsley, BP Hires*
Mercs to Rock Daily Beaches, WIRED, ð Jul. ð 15, ð 2010, ð http://www.wired.com/dangerroom/2010/06/bp-
mercs-to-rock-oily-beaches/?utm_source=twitterfeed&utm_medium=twitter#ixzz0qvQN3iIg. ð

196 *Barriers to News Coverage of Gulf of Mexico Oil Spill Remain Despite Promises*, ð Jun. ð 16, ð
2010, http://www.nola.com/news/gulf-oil-spill/index.ssf/2010/06/barriers_to_news_coverage_of_g.html ð

197 ð Letter ð from ð Tom ð Devine, ð Legal ð Director, ð Government ð Accountability ð Project, ð and
Director, ð Louisiana ð Environmental ð Action ð Network, ð to ð Judge ð Stanley ð Sporkin, ð Obudsman,
Ombudsman ð Program ð (Mar. ð 2, ð 2012), *available at* ð
http://www.whistleblower.org/storage/documents/GAPLEANletter.pdf ð

198 ð Louisiana ð Environmental ð Action ð Network, ð BP ð Tells ð Fishermen ð Working ð on ð the ð
Fired ð for ð Wearing ð a ð Respirator ð (Jun. ð 1, ð 2010), *available at* ð http://www.prnewswire.com/news-releases/bp-tells-
fishermen-working-on-the-spill-that-they-will-be-fired-for-wearing-respirator-ð

[199] □ð Pursuant □ð to □ð FOIA □ð Request □ð 2010-HQ-FOI-01645, □ð FOIA □ð 2010-HQ-FOI-01647, □ð From □ð Mike □ð Faulkner, □ð Executive □ð Director, □ð National □ð Response □ð Team, □ð U.S. □ð Environmental □ð Protection □ð Age U.S. □ð Environmental □ð Protection □ð Agency, □ð Subject: □ð BP □ð Tells □ð Fishermen □ð Working □ð On □ð The Be □ð Fired □ð For □ð Wearing □ð A □ð Respirator □ð (Jul. □ð 1, □ð 2010, □ð 3:54 □ð PM) □ð (on □ð file □ð with □

[200] □ð Pursuant □ð to □ð FOIA □ð Request □ð 2010-HQ-FOI-01645, □ð FOIA □ð 2010-HQ-FOI-01647, □ð From □ð Mark □ð Mjoness, □ð Director, □ð National □ð Planning □ð and □ð Preparedness □ð Division, □ð U.S. □ð Environmental □ð Prot colleagues, □ð U.S. □ð Environmental □ð Protection □ð Agency, □ð Subject: □ð BP □ð Tells □ð Fishermen □ð Working □ð On □ð The □ð Oil □ð Sp They □ð Will □ð Be □ð Fired □ð For □ð Wearing □ð A □ð Respirator □ð (Jul. □ð 1, □ð 2010, □ð 4:04 □ð PM) □ð (on Project). □ð

[201] *Barriers □ð to □ð News □ð Coverage □ð of □ð Gulf □ð of □ð Mexico □ð Oil □ð Spill*, □ð Associated □ð Press □ð (Jun. □ð 16, □ð 2010, □ð http://www.nola.com/news/gulf-oil-spill/index.ssf/2010/06/barriers_to_news_coverage_of_g.html. □ð

[202] □ð CBS □ð Evening □ð News □ð With □ð Scott □ð Pelley, □ð "Coast □ð Guard □ð Under □ð 'BP's □ð Rules'", □ð cbs http://www.cbsnews.com/video/watch/?id=6496749n. □ð

[203] □ð Sam □ð Dolnick, □ð *Veteran □ð Vets □ð Arduous □ð Find □ð Task*, □ð N.Y. □ð Times, □ð May □ð 5, □ð 2010, □ð http://www.nytimes.com/2010/05/06/us/06allen.html?_r=0. □ð

[204] □ð Louisiana □ð Environmental □ð Action □ð Network, □ð BP □ð Tells □ð Fishermen □ð Working □ð on □ð the □ð Fired □ð for □ð Wearing □ð a □ð Respirator □ð (Jun. □ð 1, □ð 2010), http://www.laenvironmentalaction.org/bp-tells-fishermen-working-on-the-gulf-that-they-will-be-fired-for-wearing-a-respirator. □ð

[205] □ð Bryan □ð Walsh, □ð *The □ð Health □ð Effects □ð of □ð the □ð Spill*, □ð Time, □ð Jun. □ð 25, □ð 2010, □ð http://www.time.com/time/health/article/0,8599,1999479,00.html#ixzz2LkJT0hAC. □ð

[206] □ð BP □ð instituted □ð a □ð rotation □ð system, □ð allegedly □ð to □ð ensure □ð that □ð all □ð registered □ð vess on □ð the □ð Vessels □ð of □ð Opportunity □ð Program. □ð Boat □ð owners □ð would □ð be □ð hired □ð for □ð a □ð break □ð while □ð new □ð boat □ð owners □ð had □ð to □ð work □ð opportu □ð the □ð spill. □ð The □ð theory □ð was □ð tha would □ð continue □ð to □ð be □ð rotated □ð in □ð and □ð out □ð of □ð the □ð cleanup, □ð balancing □ð the □ð dur

[207] □ð Beth □ð Buczynski, □ð *BP □ð Refuses □ð to □ð Provide □ð Workers □ð With □ð Respirators, □ð Denies □ð Oil □ð Spill □ð Risks*, □ð Care2, □ð May □ð 30, □ð 2010, □ð http://www.care2.com/causes/oil-spill/bp-refuses-to-provide-workers-with-respirators-denies-oil-spill-risks-hospitalized.html. □ð

[208] □ð Centers □ð for □ð Disease □ð Control, □ð Interim □ð Guidance □ð for □ð Protecting □ð Deepwater □ð Horizon Volunteers, □ð http://www.cdc.gov/niosh/topics/oilspillresponse/protecting/respuse.html □ð (last □ð visited □ð Apr. □ð 2013). □ð

[209] □ð Ian □ð Urbina, □ð *Workers □ð Doomed □ð Rig □ð Voices □ð Concern*, □ð N.Y. □ð Times, □ð Jul. □ð 21, □ð 2010, □ð http://www.nytimes.com/2010/07/22/us/22transocean.html?pagewanted=all&_r=0. □ð

[210] *Id.* □ð □ð

[211] Jillian □ð Rayfield, □ð *Lawsuit □ð Claims □ð Former □ð BP □ð Employee □ð Was □ð Fired □ð For □ð Refusing □ð To □ð Skew □ð Clean* □ð TPMMuckraker, □ð Jan. □ð 25, □ð 2012, □ð http://tpmmuckraker.talkingpointsmemo.com/2012/01/lawsuit_claims_former_bp_employee_was_fired_for_re.php.; David □ð Hammer, □ð *Fired □ð BP □ð Worker □ð Files □ð Whistleblower □ð Suit*, □ð The □ð Times □ð Picauyne, □ð Jan. □ð 24, □ð 2012, □ð http://www.nola.com/news/gulf-oil-spill/index.ssf/2012/01/fired_bp_worker_files_whistleb.html. □ð

[212] Jillian □ð Rayfield, □ð *Lawsuit □ð Claims □ð Former □ð BP □ð Employee □ð Was □ð Fired □ð For □ð Refusing □ð To □ð Skew □ð Clean* □ð TPMMuckraker, □ð Jan. □ð 25, □ð 2012, □ð http://tpmmuckraker.talkingpointsmemo.com/2012/01/lawsuit_claims_former_bp_employee_was_fired_for_re.php. □ð

[213] □ð Dahr □ð Jamail, □ð *Dangerous □ð Allegations □ð in □ð the □ð Gulf*, □ð Al □ð Jazeera, □ð Oct. □ð 25, □ð 2011, □ð http://www.aljazeera.com/indepth/features/2011/10/201110145475045029 9.html. □ð

[214] □ð Gulf □ð organizer □ð Cherri □ð Foytlin □ð has □ð reported □ð increased □ð retaliation, □ð including □ð multiple □ð death □ð threat following □ð February □ð 2013 □ð trip □ð to □ð Washington □ð DC, □ð where □ð she □ð educated □ð government □ð effects □ð caused □ð by □ð the □ð BP □ð spill □ð and □ð the □ð need □ð for □ð medical □ð treatment. □ð □ð

[215] □ð Gulf □ð organizer □ð Cherri □ð Foytlin □ð reported □ð that □ð at □ð the □ð Deepwater □ð Horizon □ð Fairness alleged □ð she □ð was □ð live □ð streaming □ð the □ð hearing, □ð escorted □ð her □ð out □ð of □ð the □ð courtroom proceeded □ð to □ð show □ð her □ð a □ð printed □ð screenshot □ð of □ð her □ð Facebook □ð page □ð from □ð earli photo □ð of □ð her □ð and □ð other □ð Gulf □ð residents □ð impacted □ð by □ð the □ð oil □ð spill □ð standi McMahon, *BP □ð Disaster □ð Survivors □ð Removed □ð From □ð Federal □ð Courtroom □ð During □ð Bridge □ð Hearing*, □ð Gulf, □ð Nov. □ð 9, □ð 2012, □ð http://bridgethegulfproject.org/node/713. □ð

[216] □ð Ada □ð McMahon, *BP □ð Disaster □ð Survivors □ð Removed □ð From □ð Federal □ð Courtroom □ð During □ð Bridge □ð Hearing*, □ð For □ð the □ð Gulf, □ð Nov. □ð 9, □ð 2012, □ð http://bridgethegulfproject.org/node/713. □ð

[217] □ð The □ð facebook □ð page, □ð Citizens □ð Warning □ð Patrol □ð 411 □ð (CWP411), □ð was □ð created □ð by □ð provide □ð support □ð and □ð information □ð for □ð those □ð who □ð have □ð been □ð harassed □ð Facebook □ð Page survey □ð conducted □ð by □ð the □ð CWP411 □ð found □ð that □ð harassment □ð by □ð trolls □ð is □ð rampant □ð Page, □ð and □ð has □ð created □ð a □ð chilling □ð effect □ð on □ð its □ð page □ð and □ð comments □ð can □ð be □ð http://www.whistleblower.org/storage/documents/bpa_facebook_page_survey.pdf. □ð□ð

[218] □ð Ada □ð Mahon, *BP Disaster Survivors Removed From Federal Courtroom During Hearings Filtering* Gulf, □ð Nov. □ð 9, □ð 2012, □ð http://bridgethegulfproject.org/node/7132; □ð *Jessica Hyde, Angry Mom* □ð Rolling □ð Stones, □ð http://www.rollingstone.com/politics/lists/the-15-most-inspiring-people-we-meet-the-new-green-heroes□20130411/cherrie-mora□19691231 □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[219] □ð BP □ð p.l.c., □ð New □ð Ads □ð Promote □ð Tourism □ð Along □ð the □ð Gulf □ð Coast, □ð http://www.bp.com/sectiongenericarticle.do?categoryId=9039335&contentId=7072076# (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[220] □ð Cain □ð Burdeau, *Lures Gulf Ads Propaganda* □ð Associated □ð Press, □ð Jan. □ð 8, □ð 2012, □ð http://www.nbcnews.com/id/45919105/ns/business□oil_and_energy/t/lures-gulf-goods□gulf-propaganda/#.UToSUld4yp2. □ð

[221] *Id.* □ð□ð

[222] □ð BP □ð p.l.c., □ð New □ð Ads □ð Promote □ð Tourism □ð Along □ð the □ð Gulf □ð Coast, □ð http://www.bp.com/sectiongenericarticle.do?categoryId=9039335&contentId=7072076# (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[223] □ð National □ð Institute □ð of □ð Environmental □ð Health □ð and □ð Sciences, □ð GuLF □ð STUDY, □ð http://www.niehs.nih.gov/research/atniehs/labs/epi/studies/gulfstudy/ □ð (last □ð visited □ð Apr. □ð 15, □ð 2013); □ð Damage □ð Assessment, □ð Remediation, □ð & □ð Restoration □ð Program, □ð National □ð Resource □ð Damage □ð Assessment □ð Process, http://www.darrp.noaa.gov/about/nrda.html □ð (last □ð visited □ð Apr. □ð 15, □ð 2013). □ð

[224] □ð U.S. □ð Census □ð Bureau: □ð 2007 □ð Economic □ð Census, □ð Statistics □ð by □ð Economic □ð Sector. □ð Co counties. □ð

[225] □ð Ross □ð Colvin, *Swims in Gulf, Says Beaches Open* □ð Reuters, □ð Aug. □ð 15, □ð 2010, □ð http://www.reuters.com/article/2010/08/15/us-oil□idUSTRE65O5TA20100815. □ð □ð

[226] *Id.* □ð□ð □ð

[227] Koi □ð Schulman, □ð *Photo: Swim at Panama City Beach* □ð House □ð Blog, □ð Aug. □ð 14, □ð 2010, □ð http://www.whitehouse.gov/blog/2010/08/14/photo□swim□panama-city-beach□ð

[228] □ð Guy □ð *President Goes for Swim in Gulf* □ð Independent, □ð Aug. □ð 16, □ð 2010, □ð http://www.independent.co.uk/news/world/americas/president□goes□swim□gulf□ð does□he□2053567.html. □ð

[229] □ð Cain □ð Burdeau □ð and □ð *Dina Cappiello, Down Gulf of Mexico Oil Spill Cleanup Is Ready, Says*, □ð Associated □ð Press, □ð Nov. □ð 8, □ð 2011, □ð http://www.news.com/news/gulf□spill/index.ssf/2011/11/gulf_of_mexico_oil_spill_clean_4.html. □ð

[230] *Id.* □ð□ð □ð

[231] □ð Nikki □ð *Buskey, Criticizes Coast Guard Over Cleanup* □ð Comet, □ð Jul. □ð 21, □ð 2012, □ð http://www.dailycomet.com/article/20120721/ARTICLES/120729925/1320?p=2&tc=pg&tc=ar. □ð

[232] □ð In □ð late □ð 2012, □ð still □ð finding □ð BP □ð oil □ð in □ð Louisiana □ð wetlands □ð and □ð beaches, □ð en Plaquemines □ð Parish □ð P.J. □ð Hahn □ð contended, □ð "the □ð Coast □ð Guard □ð should □ð be □ð vigilant □ð and fire □ð on □ð oil □ð that's □ð washing □ð ashore. □ð BP's □ð looking □ð out □ð for □ð its □ð bottom □ð line □ð and public." □ð Even □ð 20 □ð years □ð after □ð the □ð Exxon □ð Valdez □ð spill, □ð Hahn □ð pointed □ð out □ð that □ð parts □ð of □ð Alaska; □ð Susan □ð Buchanan, *Louisiana Parishes Fault Coast Guard for Slow Removal of BP Oil*, □ð Huffington □ð Post, □ð Nov. □ð 5, □ð 2012, □ð www.huffingtonpost.com/susan□buchanan/louisiana□parishes□fault□coast□guard□for□slow□removal□of□bp□oil_b_2078670.html. □ð

[233] □ð United □ð States □ð Government, □ð Gulf □ð Coast □ð Ecosystem □ð Restoration □ð Council □ð to □ð Help □ð Ecosystems □ð and □ð Economies □ð in □ð the □ð Wake □ð of □ð the □ð Deepwater □ð Horizon □ð Oil □ð Spill □ð (N http://www.restorethegulf.gov/release/2012/11/30/gulf-coast-ecosystem-restoration-council-help□rebuild□gulf□coasts%E2%80%99-economies□ð

[234] *Id.* □ð□ð □ð

[235] □ð Louisiana □ð Environmental □ð Action □ð Network, □ð Topical □ð Storm □ð Isaac □ð Alert, □ð Possible □ð Oil 2012), □ð http://leanweb.org/work/community/public-health/hurricane-isaac-alert-possible-oil□contamination. □ð

[236] *Isaac Churned Up Old Oil From BP Spill*, in CBS/Associated Confirm Press, Sept. 6, 2012, http://www.cbsnews.com/8301-201_162-57507123/isaac-churned-up-spill-in-gulf-confirm/.

[237] Susan Buchanan, *Louisiana Parishes Fault Coast Guard for Slow Removal of Huffington Oil* Post, Nov. 5, 2012, www.huffingtonpost.com/susan/louisiana-parishes-fault-_b_2078670.html.

[238] *Assess Disaster Preparedness, Response and Recovery Efforts at the Federal, State, and Local Subcommittee on Homeland Security of the S Comm.*, on 1 Appropriation (2012) (written of Garret Graves, Chair, Coastal Protection and Restoration Authority of Louisiana), http://www.lacpra.org/assets/docs/homepage/Graves%20-%20Senate%20Homeland%20Security%20Subcom%20Testimony%209-25-12%20final.pdf.

[239] *More From Macondo Fresh, Highly Toxic BP Oil Rolls Ashore in Alabama's Seafood Capital"* Smith Blog, Apr. 3, 2012, http://www.stuartcommission.com/more-highly-toxic-bp-oil-rolls-ashore-in-alabama-seafood-capital/.

[240] On Wings of Care Home Page, http://www.onwingsofcare.org/ Dalas Hansard, Apr. *Settles While Macondo Seeps', Al Jazeera* 4, 2012, http://www.aljazeera.com/indepth/features/2012/03/20123313318459762.html.

[241] Press Release, Congressman Ed Markey, Markey, Waxman Press BP on Macon http://markey.house.gov/press-release/markey-waxman-press-bp-macondo-oil-slick.

[242] Letter from Edward Markey, Ranking Member, House Committee on Natural R Waxman, Ranking Member, House Committee on Energy and Commerce, to Robert Officer, BP (Oct. 16, 2012), http://democrats.naturalresources.house.gov/sites/democrats.naturalresources.house.gov/files/documents/2012-10-16_BP_OilSlick_Markey_Waxman.pdf.

[243] Al Jazeera and Mother Jones, along with blogs from the Natural Resources and The Institute for Southern Studies, were among the few news statutes of the Gulf after the well was capped.

[244] Antonia Juhasz, Black Tide: The Devastating Impact of the Gulf Oil Spill 2011).

[245] 28 Stones, "Drew Landry Addressing BP Shareholders at the BP AGM." You http://www.youtube.com/watch?v=qPvnPFQ4DYs.

[246] Rocky Kistner, *Series from the Gulf Reveal BP Disaster Switchboard*, NRDC Staff Blog, Apr. 2012, http://switchboard.nrdc.org/blogs/rkistner/when_bps_deepwater_horizon_wel.html.

[247] Real Coastal Warriors Facebook Home Page, https://www.facebook.com/RealCoastalWar visited Apr. 15, 2013).

[248] LEAN created a series of video testimonials by workers fallen and ill residents the BP See: http://leanweb.org/our-work/community/public-health/testimonials-of-gulf-residents. The nonprofit organization Ecorigs features videos from dives during and after the Deepwater the larger diving community on health risks associated with ecorigs.org. in the Gu

[249] Dr. Robichaux created a blog entitled "Betrayal: Thousands of Ill Dead Coastal Porpoises, Residents" in effort to educate the public about the current health crisis in witness Christina Tillman created the blog, "Truth Out on BP Illnesses" that chronicles medical care for her two year old son after he became ill from the BP very serious thing that is happening to our friends, our family, and our ch www.truthoutonbpillnesses.com.; Mississippi resident Charles Taylor documents oil that cont found buried under sand or that washes onto the shore after a storm. See https://bpoil.wordpress.com/2012/01/28/bp-update-how-does-the-coast-really-look/

[250] Press Release, Surfrider Foundation, Surfrider Foundation Releases Findings of Gu (Apr. 16, 2012), http://emeraldcoast.surfrider.org/wp-content/uploads/2012/04/FindingsReleaseFinal.pd

[251] Julia Whitty, *BP's Corexit Oil Tar Sponged Up by Mother Jones*, Apr. 17, 2012, http://www.motherjones.com/blue-marble/2012/04/microbes-eating-oil-beaches-thanks-corexit-dispersant.

[252] Julia Whitty, *BP's Dispersant Allowed Oil to Penetrate Beaches, Mother Deeply* Jones, Nov. 29, 2012, http://www.motherjones.com/blue-marble/2012/11/bps-makes-oil-mortal.

[253] Craig Pittman, *Deepwater Horizon Spill Still Causing Damage in the Gulf 2 Years Later, Find*, Tampa Bay Times, Apr. 14, 2012, http://www.tampabay.com/news/environment/water/oil-deepwater-horizon-spill-still-causing-damage-gulf-2-years/1225134.

[254] Cam Burdeau, *Locals Call BP's Ads Propaganda*, Associated Press, Jan. 8, 2012, http://www.nbcnews.com/id/45919105/ns/business-oil_and_energy/t/locals-call-bps-ads-gulf-propaganda/#.UToSUld4yp2.

[255] *Id.*

[256] The National Academies Press, The Governmental Public Health Infrastructure, http://www.nap.edu/openbook.php?record_id=10548&page=96 (last visited Apr. 15, 2013).

[257] BP Claims Fund Home Page, http://www.thebpclaimsfund.com (last visited Apr. 1; BP p.l.c., BP Pledges Collateral for Gulf of Mexico Oil Spill Trust (Oct. 1, http://www.bp.com/genericarticle.do?categoryId=2012968&contentId=7065280.

[258] Noah Brenner & Anthony Gaughan, *Haywards Upstream*, Jun. 17, 2010, http://www.upstreamonline.com/live/article218091.ece.

[259] BP Claims Fund Home Page, http://www.thebpclaimsfund.com (last visited Apr. 1

[260] *Id.*

[261] BP, BP Claims Frequently Asked Questions, *available at* (Feb. 5, 2013), http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/gom_response/STAGING/local_assets/downloads_pdfs/BP_Claims_Program_FAQ_English.pdf.

[262] BDO Consulting, Independent Evaluation of the Gulf Coast Claims Facility Exec 2012), *available at* http://media.nola.com/2010_gulf_oil_spill/other/BDO%20Executive%20Summary.pdf.; Deepwater Horizon Court-Supervised Settlement Program Home Page, http://www.deepwaterhorizonsettlements.com (last visited Apr. 15, 2013).

[263] The Plaintiffs Steering Committee (PSC) is a group of attorneys appointed by Judge Carl Barbier to represent all plaintiffs in the Deepwater Horizon class

[264] Deepwater Horizon Court-Supervised Settlement Program Home Page, http://www.deepwaterhorizonsettlements.com (last visited Apr. 15, 2013).

[265] Press Release, BP p.l.c., BP Statement on Approval of PSC Medical Settleme http://www.bp.com/genericarticle.do?categoryId=2012968&contentId=7083029.

[266] *Id.*

[267] Notes from BP Headquarters Meeting (July 10, 2012) (on file with Government Ac

[268] Matthew Jaffe, *After Feinberg Names BP Oil Spill Escrow Payout Czar*, ABC News, Jun. 17, 2010, http://abcnews.go.com/Business/bp-oil-spill-kenneth-feinberg-appointed-head/story?id=10933766.

[269] *Ensuring Justice for Victims of the Gulf Coast Oil Disaster Before the Committee on Judiciary*, 112th Cong. 2d Sess. (2012) (statement of Comm. *available at* http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg57558/html/CHRG-111hhrg57558.htm.

[270] *Id.*

[271] *Id.*

[272] *Id.*

[273] *Id.*

[274] Antonia Juhasz, *Investigation: Two Years After the BP Spill, Hidden Health Crisis Festers*, The Nation, Apr. 18, 2012, http://www.thenation.com/article/167461/investigation-two-years-after-bp-spill-hidden-health-crisis-festers#.

[275] Press Release, Department of Justice, Office of Public Affairs, Audit of Gulf $64 Million in Additional Payments (Apr. 19, 2012), http://www.justice.gov/opa/pr/2012/Ap 500.html.

[276] *Id.*

[277] BDO Consulting, Independent Evaluation of the Gulf Coast Claims Facility Exec 2012), *available at* http://media.nola.com/2010_gulf_oil_spill/other/BDO%20Executive%20Summary.pdf.;

[278] Natalie Walker & Monique Harden, Advocates for Environmental Human Rights, The H Health Denied: Feinberg's Rejection of BP Illness Claims Breaks With Past Practic *available at* http://www.ehumanrights.org/docs/FeinbergBreaksWithPastPracticesInRejectingBPIllnessClaims.pdf.

[279] *Id.*

[280] David Ferrara, Final Oil Spill Claim Payment Criteria Brings Skepticism from Register, Feb. 3, 2011, http://blog.al.com/live/2011/02/final_oil_spill_claim_payment.html.

ED_001324_00007754-00105

[281] Operation People for Peace, Inc. Home Page, http://operationpeopleforpeace.org (last visited Feb. 15, 2013).

[282] Antonia Juhasz, *Investigation: Two Years After the BP Spill, a Hidden Health Crisis Festers*, The Nation, Apr. 18, 2012, http://www.thenation.com/article/167461/investigation-two-years-after-bp-spill-hidden-health-crisis-festers#.

[283] John Schwartz, *Official Not Neutral, Judge Rules*, N.Y. Times, Feb. 2, 2011, http://www.nytimes.com/2011/02/03/us/03feinberg.html.

[284] Notes from Headquarters Meeting (July 10, 2012) (on file with Government Accountability Project).

[285] Antonia Juhasz, *Investigation: Two Years After the BP Spill, a Hidden Health Crisis Festers*, The Nation, Apr. 18, 2012, http://www.thenation.com/article/167461/investigation-two-years-after-bp-spill-hidden-health-crisis-festers#.

[286] *Id.*

[287] *Id.*

[288] Emily Spicker, *Dead Leaves Matters Unsettled for Some*, FuelFix, Aug. 20, 2012, http://fuelfix.com/blog/2012/08/20/spill-dead-leaves-matters-unsettled-for-some/.

[289] *Id.*

[290] National Institute of Environmental Health and Sciences, GuLF STUDY, http://www.niehs.nih.gov/research/atniehs/labs/epi/studies/gulfstudy/ (last visited Apr. 15, 2013).

[291] *50 Cancers Added to Zadroga*, Crain's, Sept. 10, 2012, www.crainsnewyork.com/article/20120910/HEALTH_CARE/120919986.

[292] *Id.*

[293] Press Release, Congressman Jerrold Nadler, Nadler and Bishop Call for Ban Cleanups (De. 6, 2011), http://nadler.house.gov/press-release/nadler-and-bishop-call-ban-dispersants-oil-spill-cleanups.

[294] Ultimate Civics, How You Can Help Make It Right for Real, http://www.ultimatecivics.org/index.php/2012/04/18/democracy/45-democracy/energy/ban-dispersants (last visited Apr. 15, 2013).

[295] *Review of the Use of Dispersants in Response to the Deepwater Horizon Oil Spill before the Commerce, Justice, Science, and Related Agencies of the S. Comm. on Appropriations* (2010), *available at* http://www.gpo.gov/fdsys/pkg/CHRG-111shrg63179/html/CHRG-111shrg63179.htm.

[296] *Id.*

[297] *Id.*

[298] Press Releases, Lautenberg Introduces 'Safe Dispersants Act' to Protect Public 28, 2010), http://lautenberg.senate.gov/newsroom/record.cfm?id=326743.

[299] *Review of the Use of Dispersants in Response to the Deepwater Horizon Oil Spill before the Commerce, Justice, Science, and Related Agencies of the S. Comm. on Appropriations* (2010), *available at* http://www.gpo.gov/fdsys/pkg/CHRG-111shrg63179/html/CHRG-111shrg63179.htm.

[300] Ultimate Civics, How You Can Help Make It Right for Real, http://www.ultimatecivics.org/index.php/2012/04/18/democracy/45-democracy/energy/ban-dispersants (last visited Apr. 15, 2013

[301] Coastal Response Research Center, Research Planning Incorporated, National Oceanic Administration, *The Future of Dispersant Use in Oil Spill Response* 36 (Mar. 2012), http://www.crrc.unh.edu/workshops/dispersant_future_11/Dispersant_Initiative_FINALREPORT.pdf.

Glossary □ð

Acute □ð effects: □ð Effects □ð having □ð a □ð short □ð time

Acute □ð hazard: □ð A □ð hazard □ð that □ð can □ð have □ð either □ð an □ð immediate □ð or □ð delayed
prolonged □ð consequences) □ð due □ð to □ð a □ð single □ð exposure □ð to □ð an □ð toxic □ð or □ð a
materials □ð

Aromatics: Hydrocarbons □ð characterized □ð by □ð unsaturated □ð ring □ð structures □ð of □ð carbon □ð
Commercial □ð petroleum □ð aromatics □ð include □ð benzene, □ð toluene, □ð and □ð xylene
□ð

Bioaccumulation: A □ð general □ð term □ð describing □ð a □ð process □ð by □ð which □ð chemicals □ð by □ð aqua
organisms □ð from □ð water □ð directly □ð or □ð through □ð consumption □ð of □ð food □ð containing □ð
□ð

Biomarker: In □ð general □ð a □ð substance □ð used □ð as □ð an □ð indicator □ð of □ð a □ð biological □ð

BOEMRE: □ð The □ð Bureau □ð of □ð Ocean □ð Energy □ð Management, □ð Regulation □ð and □ð Enforcem

Boom: A □ð temporary □ð floating □ð barrier □ð used □ð to □ð control □ð the □ð spread □ð of □ð oil □ð t
polluting □ð shorelines □ð and □ð other □ð resources, □ð as □ð well □ð as □ð to □ð concentrate □ð oil □ð
making □ð recovery □ð easier

C-130: A □ð military □ð transport □ð aircraft, □ð used □ð to □ð spray □ð dispersants □ð during
response □ð

CDC: □ð Centers □ð for □ð Disease □ð Control

Chronic: □ð Involving □ð a □ð stimulus □ð that □ð is □ð lingering □ð or □ð recurrent □ð for □ð a □ð long
from □ð several □ð weeks □ð to □ð years

Contingency □ð plan: A □ð document □ð that □ð describes □ð a □ð set □ð of □ð procedures □ð and □ð guidelin
cleaning □ð up □ð oil □ð spills

Crude □ð oil: A □ð fossil □ð fuel □ð that □ð comprises □ð organic □ð compounds □ð built □ð up □ð from □ð hy

Decontamination: Also □ð known □ð as □ð "decon", □ð to □ð make □ð safe □ð by □ð eliminating □ð poisonous □ð c
harmful □ð substances, □ð such □ð as □ð noxious □ð chemicals

Detoxification: □ð Also □ð known □ð as □ð "detox", □ð □ð the □ð physiological □ð or □ð medicinal □ð rem
from the □ð human □ð body

Dispersant: Chemicals □ð that □ð are □ð used □ð to □ð break □ð down □ð spilled □ð oil □ð into □ð small □

DHS: □ð Department □ð of □ð Homeland □ð Security

EPA: U.S. □ð Environmental □ð Protection □ð Agency

FDA: □ð Food □ð and □ð Drug □ð Administration

Federal On-Scene Coordinator (FOSC): Coordinates all federal containment, removal, and disposal efforts and resources during an oil or hazmat incident

GAO: Government Accountability Office

HAZMAT: An abbreviation for hazardous materials

HAZWOPER: Hazardous Waste Operations and Emergency Response

HHS: U.S. Department of Health and Human Service

Hydrocarbons: A large class of organic compounds containing only carbon and

In-situ burning: the ignition and controlled combustion of oil

Louisiana Sweet Crude: The type of oil released during the BP spill

Macondo well: The BP-leased well that oil flowed from during the spill, off the Louisiana coast

Material Safety Data Sheet (MSDS): An important component of product stewardship and occupational safety and health, that provides to workers and emergency personnel procedures for handling or working with that substance in a safe manner

Metametrix test: "Volatile solvent profile"

National Contingency Plan: The federal government's blueprint for responding to hazardous substance releases

National Oil Spill Commission: A presidential commission, established by Executive Order 13543 to examine the root causes of the Deepwater Horizon explosion to guard against, and minimize impact of, future oil spills in coastal waters with

National Institute of Environmental Health Sciences (NIEHS): A research institute under the National Institute of Health, HHS

National Institute for Occupational Safety and Health (NIOSH). Housed under the CDC, it is federal agency responsible for conducting research and making recommendations prevention of work injury and illness.

NOAA: National Oceanic Atmospheric Administration

Natural Resources Damage Assessment (NRDA). Housed under NOAA, it is a legal process determine the type and amount of restoration needed to compensate the resources and their human uses that occur as a result of an oil substance release

Oil plumes: Underwater globules of oil that do not float to the sur
of chemical dispersants, which breaks up surface oil, is said to have
these plumes

Oil Pollution Act (OPA): A law designed to prevent oil spills, ensure cleanup if
restore natural resources injured by these spills

OSHA: Occupational Safety and Health Administration

Polycyclic aromatic hydrocarbons (PAH): A family of chemical substances that are
types of oil include known carcinogens

Personal protective equipment (PPE): Equipment worn to minimize exposure to a
hazards

Plaintiffs' Steering Committee (PSC): An appointed group of attorneys representing privat
claimants in the Deepwater Horizon settlement class action s

Sediment: Loose particles of sand, clay, silt, and other substances that sett
water body

Sheen: very thin layer of oil on the water surface

Skimmer: A machine used to remove oil floating on the water

Slick: The common term used to describe the surface area where oil is thicker than
sheen

Tar balls: Dense, black sticky spheres of hydrocarbons; formed from weathered
Tar mats: dark brown to black, solid to viscous mixture of heavy hydrocar

Total petroleum hydrocarbons (TPH): A term used for any mixture of hydrocarbons th
in crude oil, such as hexane, benzene, toluene and xylenes

Toxicity: The inherent potential of a material to cause adverse effects on a living
organism

Tyvek suit: A suit used to protect people from chemical hazards and

Unified Command: The BP spill command structure, which integrates BP and
respond to the spill

Volatile organic compounds (VOCs): Include a variety of chemicals that evaporate quic
cause nerve damage and behavioral in humans when inhaled

Volatile solvent profile: A blood test used to help identify a patient's prolo
most commonly found volatile solvents that have been shown to cause health problems

Vessels of Opportunity (VoO) Program: Created to employ local boat operators during cleanup, ... it extended to near shore and offshore activities such as identifying oil, ... skimming.

Water column: conceptual column of water from surface to bottom sediments

Worker Education and Training Program (WETP): Housed under the NIEHS, program encourages innovation for training hard-to-reach populations by addressing issues such as litera... appropriate adult education techniques, training quality improvement, and other ... addressed directly by the private sector.

! " " # $ % & ' (

) * & + , - # . - / 0 # 1 ( ) & , $ # + + (2 , 3 , # 4 # $, + (

(

(

(

(

(

(

(

(

(

(

(

(

561 # + # $, # % (& $ (3 - " * 3 . # , & 7 3 - (/ 1 % # 1 8 (

(

) *&+,-#.-/0#1( )&,$#++(9&+,(

!:(://"#1;!"#$%d&'%(#)%*+!,-!+.%d/,0#(#1*1!2.'#3&!4((,$#1+#,*5!",6!$1&+1#*!!!

!$/$<4/=+(0*&+,-#.-/0#1(>?;(",6!$1&+1#*!1*)!7,'8%'!1+!)%$,*+13#*1+#,*!(#%d

!$/$<4/=+(0*&+,-#.-/0#1(>@;!",6!$1&+1#*!!

!$/$<4/=+(0*&+,-#.-/0#1(>A;!91+.%'!,-!(#$8!$.#:)!

B#,+#<(C&-#1;!;#%d,-!(#$8!",6!$.%1*0&!7,'8%'!

:*1&+,&$3(D&-43$;!<,+.%'!,-!(#$8!$.#:)!

**:-&$,(E=&%1<;**!='%(#)%*+!,-!+.%d/,0#(#1*1!2.'#3&!4((,$#1+#,*!

F1G(C&7*3#-(H/.&7*3=';!/,0#(#1*1!&.>(#$#1*!

F1G()&-43(2=.13;!?.%3#(+!-,'!+.%d/,0#(#1*1!@*A#',*3%*+1:!4$+#,*!B%+7,'8!

**I34&#(E1&J)&$;((**?,,8!1*)!$.%1*%'!-,'!C0*8.,0(%d0(%)!C>!7,'8%'(!1+!)%$,*+13#*1+#,*!(#%d!

I/*$(E//%&$K;!<#((#((#&&#!'%(#)%*+!7#+.!&'%D%E#(+#*F!.%1:+.!$,*)#+#,*!!

I/1#<(F3$/+;!",6!7,'8%'!

I/+#"*(E#/1K#;!",6!7,'8%'!

**L&$%13(!1$#++#$;**!/,0#(#1*1!'%(#)%*+!7#+.!(&%$#1:!1$$%((!+,!(&#:D'%(&,*(%d,&%'1+#,*(!

9/1&(B/+31K#;!4:1C13 1!'%(#)%*+!

9/11&#()&-&34+;!<#((#((#&&#!'%(#)%*+!

27/,,(6/1,#1;!G#A%'5!$,'1:!1*)!,>(+%'!G#,:,F#(+!!

2*&1-#<(D&-43$;!",6!7,'8%'!

F/$3-%(D&-43$;!",6!7,'8%'!

**2,#M#(L/-&3$;**!G#A%'5!-,0*)%'!,-!@$,H#F(!

2<%$#<(27*031,N;!",6!?1&+1#*!

!

A.C.

AFFIDAVIT

My name is A.C. Cooper. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I have been a fisherman in Venice, Louisiana all my life. I bought my first boat when I was 15 years old, and now I'm 50. I am vice president of the Louisiana Shrimp Association ("Louisiana Shrimp") and I'm president of Delta Commercial Fisheries in Plaquemines Parish. Delta Commercial Fisheries is a local organization within the parish. Louisiana Shrimp represents the whole state, members and nonmembers. What the fisherman can't get out there and say, we say for them. I feel that we did that in the cleanup with BP and officials at the state and federal level, and it wasn't heard. I worked on the Vessels of Opportunity program, as a team leader for fifteen vessels. My main goal was to make sure everyone went to work, and to be safe about it. BP dropped the ball on both. We feel that they abused their authority over us by making us go out there unprotected to clean up the oil. Now, a lot of our men are sick.

1. BATTLE FOR JOBS AND SAFETY

We worked hard to get our members jobs in the cleanup and through the VoO program or other parts of the cleanup, because our industry wasn't working. Louisiana Department of Wildlife and Fisheries ("Wildlife and Fisheries") closed the areas where we mostly worked in state waters, because those locations were getting hit hard by oil. By doing that they put all of the fishermen in a position where they couldn't pay their bills. We fought hard to get a job for survival, not to go out here and let them abuse us this way. When we found out they were being denied safety equipment, we spoke everywhere in the beginning to try and get them what they needed. We felt it was a big issue, because in getting these guys the jobs, it was on our backs to make sure that they were protected. We wanted them to go to work to pay their bills and be financially stable, but yet five or ten years down the road these guys pass and we have kids and grandkids with no fathers and grandfathers. We were very worried about the safety equipment issue, but it never got resolved.

25 to 30 percent of our members would talk to me directly about health problems or were in close communication. Especially when they were working, I was going back and forth. They had groups and maybe 25 boats in a group. I would talk to certain key people within that group to see how things were going, and if they needed something straightened out I could go to BP. There were a lot of issues we addressed that they had problems with. BP wanted to make us go three miles out, and our vessels are not equipped to go out that far. We had that concern and stopped it from happening, because our vessels couldn't take the rough waters from the outside with fuel and ice. We couldn't put our lives in danger and our vessels. However, we were not so successful on other, equally high stakes issues. As far as addressing health issues and providing us with Personal Protective Equipment (PPE), BP and the government wouldn't touch it.

A.C.

ED_001324_00007754-00114

H.C

I feel like the reason BP never responded to our call for proper safety equipment is because they would be admitting guilt; by passing the respirators out they would be conceding that the exposure was dangerous, that something was wrong. And the government allowed this. In addition to BP, I brought our concerns to the Occupational Safety and Health Administration (OSHA) and the Coast Guard numerous times. I testified before the President's Oil Spill Commission, and Representative Markey (D-MA) in Washington. I brought it to Wildlife and Fisheries and just about everybody we could talk to. Nothing changed.

2. VOO PROGRAM

There were different jobs associated with the cleanup; the burn unit, skimming, or in shore cleaning that stayed within state waters where the shoreline was impacted. The VoO program was broken into teams of vessels, and I was a team leader for 15 vessels working on in shore cleanup. However, I was communicating with workers from all portions of the cleanup, because we had members working in different units. Each team has a designated safety representative, who supposedly watched over everything. We wore a Tyvek suit so we didn't get the oil on our clothes or skin, and latex gloves or at times, thick blue gloves. The safety representative made sure that you wore safety glasses, kept a life jacket on all day, minor things like that. We're fisherman; we don't wear lifejackets all day unless we are in an area where we need them. What we needed were respirators.

Our contracts with the VoO program did not state anything about the PPE. Before we began working, we had a four hour HAZMAT course, and BP safety training after that for a couple hours. They went over how to handle the oil when it is unsafe, protective wear, and respirators to a certain point. They told you, if you think it's unsafe, not to do it. The reality is that when you're working and you have to do something, either you do it or you don't work. They did not cover the dangers associated with the dispersants; it was mostly about oil. We were hauling boom, which is used to contain and collect the oil. We were setting out boom, collecting boom, and putting it in bags on our vessels. At times we sat with the oil bags on our vessel in the heat for five plus hours until we got them offloaded. We could smell an oil stench while we were out there and we weren't even a part of the burn team, which had the greatest threat of inhaling toxic fumes.

3. BURNING OIL

By early May of 2010 BP had already started burning the oil. Some of our members were working for BP contractor Danos & Curole in the burn area, which was located only a couple miles from the site of the Deepwater Horizon explosion. Their well being was a big concern for us, because when they were doing the burns they did not have any safety equipment, including respirators. Toward the end of the burns, a few vessels were given respirators. We found it strange that they weren't properly equipped from the start, because OSHA's policy is for workers to be protected. Workers had air monitors, but sometimes BP or even the government

A.C

AC

cut them off. One worker is on the board of the Louisiana Shrimp, and he told me that the Coast Guard told him to turn off the air monitors because they were going off and malfunctioning. This happened several times.

The air monitors were supposed to measure the levels of chemicals in the air to ensure that they did not exceed permissible exposure limits (PEL). It was extremely dangerous for the workers not to have air monitors, because they were instructed to go out in the middle of the night and locate the fresh oil based on how much their eyes and noses would burn, and if they could smell the oil. How could they monitor how many toxins they were inhaling? When they located and burned it, the oil would burn for ten hours sometimes. By doing that, they were directly exposed to the chemicals within the oil, which is the worst type of exposure. Workers shared with me that they were concerned if they raised concerns about their exposure, they would lose their jobs. In turn, they didn't ask questions.

4. SPRAYED

Airplanes sprayed dispersant on our members on multiple occasions. After the first time it happened I reported it to OSHA (detailed below) and requested that they didn't spray when our vessels were out there. The Coast Guard had to approve the sprays each time. BP said they were not spraying inshore; however, they would have the VoO workers report the locations where oil was found, send them to a different location, and then spray the locations that they identified. The planes would spray from a distance but the wind would carry it over top and hit the vessels directly.

After they got hit with the dispersant, crews would go to a BP medical tent located at a BP work yard in Venice. They would first go through a decontamination ("decon") process, take off their contaminated clothes, get washed down and cleaned. After decon, they would go to the hospital. Workers who were most severely affected would go straight to the hospital; however, they also had tents set up at the hospital for decon before they allowed them to get treated. I also work with the fire department. When I was not working on the VoO program, at times we helped with the decon process for affected workers who came into the Venice area before we would help them get medical treatments. Complaints of being sprayed didn't go down until July, two months into the job.

I had a sore throat and hoarseness for about a month, beginning in mid-May 2010, when I was located in Pascagoula, Mississippi where a big batch of oil came in. That was the first time that I had health problems. We do not have staph infections in our line of work. I never had staph infections before the cleanup, but Ochsner Hospital diagnosed me with them after. I have not had my blood tested for chemicals; most workers have not been tested. BP and the hospitals never discussed it as an option. However, it would be good to know if this stuff is in our systems. Some of our guys within the association got very sick and still have big issues to this date, especially our men who were sprayed with the dispersants. Health problems include rashes and boils on

AC

their skin, severe headaches, dizziness, stomach pain and nausea. Numerous times people from throughout the state called about reported the same issues to us – being over-sprayed and not protected.

Then again, I tried to get some of the guys to step up with me and say, "Look, we are not going to go to work until they give us certain protective gear." BP had these guys so scared to the point where if they came out and started saying this stuff themselves, they thought they would get fired. There was a large demand for jobs after the spill, and they knew they could be replaced. The workers that we represented listened to what Louisiana Shrimp was saying, and they would confide in me that they were concerned about their well being on the job. But they didn't want to step up and say it to anyone else, because they were scared that they would be laid off. When I was fighting for better working conditions, I wanted all of us to go on strike until we were given respirators. Some were willing to, but the majority said no because they could not take the risk of being fired. All of the fishing areas were closed, they had nowhere to work and they needed the job to support their families. They knew that if they spoke out or stopped working until provided safety equipment, BP would just replace them because they had so many VoO applications. They were between a rock and a hard place.

5. MEETING WITH OFFICIALS

In early May, after the first time one of our vessels was sprayed by the dispersant Corexit, I met with approximately six OSHA officials in the yard that we were working out of. I expressed deep concern about the Coast Guard approving BP spraying when our vessel was anywhere within range of where they were spraying. We wanted them to move our vessels completely out of the way when they knew that they were going to spray a site. They acted like they were really concerned, but when they left they didn't act on one thing that we discussed. Not one. They said they would look at it, see what they could do, and from that point on I didn't hear anything from them. In wasn't until July that they made an effort to move the vessels when spraying took place. By that point, several of our workers had already been sprayed on multiple occasions in May when the spraying was heaviest, into June.

On top of being out on the water while they were spraying dispersant, our fishermen were inhaling the toxins constantly. During the meeting in May with OSHA, I also raised concerns about our workers not having access to respirators. As many times as we asked them for respirators, and we're on record asking for respirators to give to our fishermen, not once has OSHA or the Coast Guard or the federal government pushed BP to do so.[1]

BP would assign a representative from BP patrol as my contact, since I was a team leader. The patrol would oversee two teams. The team leader may work with the patrol for a week, then BP

[1] *Democracy Now!: Coast Guard Grounds Ships Involved in Spill Cleanup After 7 Fall Ill; BP Reportedly Preventing Fishermen from Wearing Respirators* (democracynow.org broadcast May 27, 2010).

ED_001324_00007754-00117

A.C

would swap him out and another guy may come and take his place and I had to start all over again in explaining my safety concerns. Within BP. there is not one particular person that you can actually point at; BP created a dysfunctional system during the cleanup, which made it difficult to hold one BP representative accountable for the daily safety lapses. Fred Lamont was one of the main guys that I dealt with, but there were several others. That is how they got us; every time I built a relationship with you and you knew my concerns, BP would take you out of the equation and put someone else in and then I had to start over again. To get them to believe in the problems I presented, I had to start from scratch. That made it very stressful and frustrating for us. it was a game they were playing, and they were playing with people's lives.

6. FIRED IF VOCAL

If BP had 150 workers, it could have 300 just by doing a rotation and sharing the duration of work. I testified in front of the President's Commission to advocate for rotation. I told them, put me in two weeks and take me out two weeks, as long as the fishermen can work. If there were 200 vessels working full time, I figured we could triple the number of vessels employed by three, simply through a rotation process. I pushed for rotation about a month after the spill and worked about two more months after that. BP verbally communicated to us that they would go on the rotation, by laying several of us off for two weeks and then take us back. However the rotation wasn't just rotation, it was letting us go; they laid us off and never put us back on. I worked from May 6 until August 3, 2010. I was one of the first they let go because of how vocal I was about the unsafe work conditions. It was hard to fight it, because there was nothing in writing about rotation; it came up after the contracts were signed. When we signed them, we thought that we would get most of the fishermen hired. About 40 percent, if that, of our members in this area did get jobs. I am grateful for the time I got to work, but a lot of fishermen didn't get to go to at all.

The intention of the VoO program was primarily to hire commercial fisherman, a) because we know how to navigate the Gulf best, and b) because our livelihood had been directly impacted by the spill. However, BP did not follow the guidelines to ensure that fishermen were employed. There are laws in this state that allow you to determine who is a fisherman and who is not. According to Louisiana state law, 50% of your income has to come from commercial fishing in order to be a certified commercial fisherman. However, non-fisherman bought commercial fishing licenses in order to increase their chances of behind hired on the VoO program. BP accepted that as sufficient proof, bypassing the 50% income rule. I brought this issue straight to BP numerous times to ensure that the fishermen were getting work. BP had the applications from the fisherman already; all it had to do was check with Wildlife and Fisheries and let them distinguish who is a fishermen and who is not , and pick that group and let them go to work. We had citrus farmers and grass cutters and all walks of life working, and many of our fishermen sat here not working at all.

VoO was created, because we started raising our voices for them to put us to work. We wanted everyone from this area to work on their own waters where they knew them best; in St. Bernard,

A.C

AC

East of the River in Plaquemines Parish, from Barataria Bay all the way to the Mississippi line. We wanted to do the job, because this is our ground and our waterways. We live here, and we make a living off of these waters. If anybody was going to work hard to keep the oil out of it, it was going to be us. We know the waters, we know the currents, and we know where they are going to go. We wanted the VoO program, because we make a living out of these waters and we eat off of them. By us going out there we felt that we were doing something for our community; we were stopping the oil from coming in and messing up estuaries and sanctuaries that our families depend on.

One problem with the rotations was that in the interim when we would not be working, we wanted to know what we could do during that period we were not working, and we didn't get a response. Our contracts stated that we could only use our vessels as part of the VoO program until we received a letter of termination, otherwise we would automatically be terminated. Were we just going to sit there with our vessels? We were between a rock and a hard place, because when we went on rotation we were told that we would be rehired, so we did not want to risk early termination by using our vessels. To this day I still haven't received an official termination. Some guys have. On November 26, 2010 an official termination letter was sent out to a lot of fishermen. By then, most of our fishermen had already been informally laid off. I think they should pay them to that date, because a lot of guys didn't use their vessels since they were under contract. The amount of losses is dependent on the size of the vessel. However, it was substantial and for most of our members, their vessels provided their primary or only source of income.

7. GOVERNMENT IGNORED INDUSTRY ADVICE

We know we need to have fossil fuel around here. We're not against it, because this community thrives on the fishing industry and the oil industry. You take any one of them out of the equation, and this whole community will collapse. We're on the verge of collapsing now, and that's a big issue. I have had a seafood restaurant in Venice for 18 years, in order to make a little more income from our catch. After putting all of our money into the restaurant, we lost everything after Katrina and we had to put all of our money back into the restaurant to reopen it. Recently I had to close the restaurant, because I could not afford to keep it open. It was very difficult, because our workers are like family. The community is struggling at this point to even survive. On top of the post spill oil moratorium, the fishermen were not making money, and those are our main sources of income along the Gulf.

I'm so mad, because if the government handled the cleanup properly and responsibly last year, the threat to our markets would probably be history. I spoke hard and loud about this. We begged them to move forward cautiously and responsibly. We mainly focused our energy at the state level, because the industry has a good rapport with Governor Bobby Jindal. In 2009 the Governor created the Louisiana Shrimp Task Force. Its role is to study and monitor the shrimp industry and to make recommendations to state agencies that will benefit the industry, the state and the citizens. Wildlife and Fisheries has to approve reopening of the fisheries within three

AC

ED_001324_00007754-00119

A.C.

miles of the shoreline, and NOAA had control over the federal waters. Unfortunately, Wildlife and Fisheries was taking NOAA's lead on fishery openings, and we felt they opened the fisheries too early.

Even before the well was plugged, President Obama came to Grand Isle – an area heavily impacted by the spill - on June 4 and ate the seafood. The state and federal government were announcing "Gulf seafood is open for business." During that time I was saying, "Keep it closed for a year, don't even sell anything. We only have one shot at doing this. If we mess it up then we've messed up a whole industry." We wanted them to keep it closed for 2011, pay the fisherman for their losses from that year, and then assess the situation. They could find where the oil was heavily impacted, keep that area closed and go forward with reopened commercial fishing for the rest of it. I was worried that the food chain would be devastated.

Contrary to the federal government's approach to quickly open the fisheries, we wanted to let all of the fish and seafood escape before the oil hit and the dispersant was sprayed, so that they would have a better survival rate. When the areas were secure, they would come back to repopulate. University studies are showing that certain plankton, microscopic plant and animal life, are being adversely affected by the oil and dispersants.[2] This is disturbing, because plankton is an important part of the food chain. We know there will be problems with repopulation in the years to come. Louisiana Shrimp is just one group that's trying to do what's right for all of our fishermen. When we do that, we're protecting the community and also the public.

In late July of 2010, after the well had been capped and they were trying to wind down the cleanup, we started finding oil daily on the bottom of the bays and sanctuaries. The boats were passing through, would kick up the oil and we didn't know the source. We didn't realize that it was sitting on the bottom of the Gulf. My son in law was working on one of the boats that I oversaw, and he found oil on the same day that the VoO program was going to let me go. When he made a circle with his boat it stirred up big chunks of oil that would rise to the surface and there was oil slick all over. That is when we realized it was sitting on our seafloor. I brought it to BP and the Coast Guard, because they wanted to move on and go to the next stage of the cleanup. How do you move on when you haven't even finished cleaning? I invited NBC, MSNBC, ABC, BP representative Fred Lamont, and the commander of the Coast Guard down here, and I showed them where it was at. Within about three weeks after I pointed out the oil, in August Wildlife and Fisheries opened that same area for fishing. I was deeply concerned about that.

After that incident, in late summer of 2010 I attended a seafood safety meeting with OSHA, NOAA and the FDA. They had the nerve to tell me that the oil my son in law found that day wasn't BP's oil. I asked them, "Then where did it come from?" They responded that they tested

---

[2] Christine Dell'Amore, *Toxic Oil Found Deep on Gulf Seafloor? Oil may be harming base of food web, early results suggest*, National Geographic News, August 18, 2010, *available at* http://news.nationalgeographic.com/news/2010/08/100818-gulf-oil-spill-seafloor-toxic-science-environment/

A.C.

it and it was oil, but it wasn't BP oil. That was an irrational statement, because we had seen the oil coming into that location and we cleaned it while we were working on the VoO program; it had been coming into our bays and on the inside of one of the sandbars. Bastion Bay still has oil. If there are 100 boats shrimping and one boat goes into an area that is dirty, brings potentially tainted catch to the seafood dock and runs it through the conveyor that we all use, it could contaminate the whole conveyor and affect the clean catch from the other 99 boats.

At that meeting, the federal government was meeting with seafood industry leaders to tell us that that all of the areas that they opened were safe for commercial fishing. They told us that they tested the seafood before they reopened the fisheries. I am not a scientist; however, common sense will tell you that the federal government's seafood safety studies were flawed. The government was depending on a smell test, but I know from years of experience that you can't smell what is inside the shrimp. In addition, the FDA based it's testing on a 170 pound person eating four shrimp. What about a 120 pound woman or a kid eating shrimp and other seafood? In the Gulf, we don't eat just a few shrimp, we eat pounds of it. At that meeting we said, "Why put us as the industry leaders on the spot like this? Why don't you take the additional precautions that we are advocating and only open areas that we know are clean, after samples have been properly tested?"

As industry leaders, we were looking out for the best interest of everyone, including ourselves, and we could not afford to take risks when it came to the integrity of our product. I sell and eat the seafood, and I didn't want to risk getting anyone sick at any point because we were subject to lower government standards. As industry leaders, we are very careful that our catch is from clean locations. Unlike government officials and politicians, the long term health of our industry guides our actions.

8. CONCLUSION

Most of our members right now who are sick are in litigation. BP didn't want to step up and admit wrongdoing, so it has become a legal battle. If BP starts paying their doctor bills then they're admitting guilt. They aren't going to sufficiently pay our medical bills to demonstrate that they were responsible for the actions they took, just as they didn't give us respirators to demonstrate that our working environment was unsafe. Our members who got sprayed are still paying for their medical bills. BP and our federal government dropped the ball all the way around with us. I'm totally disgusted with what went on, how it went on, and why they didn't want to step up and take responsibility. It would have reflected positively on BP and the government to address the safety concerns; however, I couldn't find anyone with authority to ensure that the spill and cleanup was handled correctly or to follow through on our recommendations.

If something like this ever happens again, the responsible party and the government need to involve the industry leaders and make sure that we are active partners in the response plan. They

A.e

still have plans with boats, boom and equipment ready. If they include us in the planning process ahead of time, I feel we would be able to respond to a future spill much more effectively. However, if they try to exclude us again, we will have a repeat of the turmoil that took place during the BP oil spill.

I have read the foregoing nine page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on May 5, 2012.

Subscribed and sworn to before me
this 5 day of MAY, 2012

ROBERT KRAUTHOF

Notary Public JP 38-05
My Commission expires on: 12-31-14

I am providing this anonymous statement to the Government Accountability Project. I've been fishing all my life, since I was 12 years old. I was hired by BP contractor Danos & Curos to work on the oil spill cleanup. I worked on the Vessels of Opportunity (VoO) program as a captain and then at decontamination ("decon") site from May through October 2010, cleaning up oil in Louisiana. During that time I was directed to break OSHA regulations and safety protocol. After my boat was sprayed with dispersants my crew and I got sick, and I am still sick.

Prior to the oil spill, I had worked offshore for almost a decade. I worked my way up from rigging to foreman for various jobs. When I worked offshore I was required to receive extensive safety training, including a 40-hour HAZMAT training. During the oil spill I had one of the first boats out there involved in the cleanup. At first I rode the boat around and looked for the oil. When we found it we put out boom, a tool used to contain and remove oil after a spill. Then I worked at a decon site to clean the dispersed oil off of the boats that were used during the clean up. I didn't get training, until three weeks before over my work was over. This was after we were spraying the boats down during decon and I had gotten sick.

1. GOING IN BLIND

My employer set it up so that we would do a little training and then they would say that we received the required training. First, a BP contractor had all prospective cleanup workers in my town attend a meeting. At that meeting everyone had to sign a contract. However, they didn't want to tell us what we were cleaning or how we were cleaning the boats for the decontamination job.

After that meeting, the brief oil spill cleanup course that we took didn't inform anyone of anything. I believe BP provided it, but it was just an intermediate course at a school auditorium that basically informed us "this is what could happen" and then they let you walk out the door. They told us a little about heat stress. They told us some about what would happen if we encountered dangerous chemicals such Benzene and Toluene; however, they told us that we would not encounter these chemicals during the cleanup.

The Coast Guard was the only government agency I remember seeing, but according to OSHAs rules, if you were going to clean oil there needed to be a responder on the boat. A strike team is the first team called to respond to an oil spotting. Sometimes there were six responders and 25 boats on a strike team. There were times we were ordered to clean oil and we didn't have a responder on the boat. I was assured I would have a deckhand; however, the first day I cleaned oil I didn't have a deckhand on the boat. I did it alone.

We had a safety lady who rode around every now and then, but she was only worried about our boat being equipped with a fire extinguisher and safety kit. She may have been employed by BP, but it was not clear. They had a group of responders that we worked with. BP was using a lot of different contractors; the responders were not from one company. They were coming out of projects in New Orleans; they had never seen water in their life. We would tell them to grab rope

and they looked at us like we were crazy. They only worked 12 hours, so we would work before we picked them up, or keep working after we dropped them off.

We would get up in morning, ride out, get a responder, and then we would ride until we find oil. We used containment boom. We had them on the boats and had out riggers to put skimmer frames on. We would make a loop around the boat and catch as much oil as we could and have absorbent booms inside of that trying to pick them up. I was the captain on the boat, but I had hands on deck with me. They had rubber boots and Tyvek suits and gloves, but nothing for breathing. For my protection, I only had rubber gloves. When they picked up the oil they reported that they would feel skin irritation. Even if they zipped the Tyvek suit up to their neck, their head was still exposed.

2. DENIED RESPIRATORS, SPRAYED BY COREXIT

From the very beginning we asked our supervisors for respirators, and they said they didn't want us to wear them because there were unsafe and would result in heat stress. A couple of the responders told me that they asked for respirators and were denied them, and if a boat had respirators they weren't allowed to wear them. They started spraying the dispersant Corexit (detailed below), and it was hard to breathe and everyone was asking for respirators. Everyone was getting worried because the boats got sprayed and we were breathing the mist in all day long. In the end we still didn't know anything about the real dangers of the Corexit; they explained that Corexit was like Dawn dishwashing liquid.

Fishermen keep a very clean boat; that is where you live. My boat was painted right before the spill, so we ran out to scrub the Corexit off after it sprayed the boat so that it didn't harm the paint. We got out and they told us we can't clean the boat. They told me that we have to leave stuff on the boat until the whole spill was over and then we could put it through decon. We weren't only worried about the paint; leaving the oil everywhere posed a safety hazard. I tried to tell the guy on the radio who was instructing me not to clean, "You have men jumping off a crew boat onto my boat and you want me to leave boat full of oil, when he has never jumped under these conditions before?"

There was no way to avoid getting oil on the boat. When collecting oil with boom, you grab it with your hands and pull it into bags. As I steered the boat I would catch it into containment boom, move forward and pull down fast. The oil would slosh over and we would get it into bags as fast as we could. Someone on the crew would then throw it into another big boat.

They told us to double bag all of the oil waste we collected, and tape it up. They were big black or clear plastic bags. It is the gummiest stuff. We were filling about 40 to 60 bags a day, but the first day I had over 70 bags. Sometimes the responders complained that we were working them too hard; however, they worked 20 minutes and had enforced breaks. The people most worried about cleaning up the oil were the fishermen; they were the same people who thought about going trolling this year.

#"

"

Another boat was spraying what I believe to be Corexit. They were about 300 ft from my boat when they started spraying, and workers on a nearby oil rig got sick. My boat got sprayed on May 26, 2010, the same day as the workers who were airlifted after they got sprayed with dispersants and got sick. Then two days after that they sprayed offshore and we got misted.

For several days we were told to go to the Mississippi River Gulf Outlet (MRGO) in St. Bernard Parish, Louisiana. Then the St. Bernard Parish president kicked us out of MRGO because all of the boats had oil on them and the wildlife was being affected. When we got up there the oil riggers working offshore were matted with the oil.

We waited two days in between, and when we went back to our original location all of the oil we were cleaning was gone. Boats had come in and sprayed the dispersant and the oil sank. It got to where after they came and sprayed the oil it just sank, but you could go into shallow water around South Pass and when you spun the mud up you would see the oil sheen on top.

We were allowed to go three nautical miles offshore from the landline; however, I was probably 25 miles offshore at one point. They sent me out to Chandeleur Islands, which is at the mouth of the Mississippi River. I had no rope and no life raft. A couple times we went out, but no deckhands or responders were provided.

I was always told by my supervisors that if we didn't do X, Y and Z, they would fire the boats. It was shrimp season, but everything was shut down so we needed the work. We were told, "If you can't go here, we don't need the boat." At times they wanted us to go past the three-mile line. However, I know those waters and we had to have certain equipment and a certain boat to withstand the conditions out there. I didn't have those things so I didn't go; I didn't want to put my crew or myself at risk. That is when we would be denied work.

3. HEALTH PROBLEMS

In the beginning it was hot, but I thought it would be a regular job. Then they started spraying and there was a mist that we were breathing in and I started feeling off; we all had breathing problems immediately. A few times we could see a fog on top of the oil; I don't know if it was dispersant but it was something airborne. One time I was working and I had a shortness of breath. I could tell I had to take a break, and that's not me; I never take breaks, but I started feeling fatigued after a while. With the exception of one incident, I didn't go to the hospital until it was all over.

I went to the hospital once during my time on the job. I got a bad cut when I was on the job, but trying to get me medical attention was a joke. Two guys got on the truck with me and we drove all the way to another parish. When we got to the hospital, they explained that they didn't have a contract with BP so they couldn't touch me. Then I had to get the car of the guy who owned the boat and the two guys who got me told me I didn't follow procedure, and I had to go back to Venice and get them to sign a paper and then come back...Later a BP representative called and

asked me about the incident. The cleanup was over with and they had sent out termination papers to everyone. She asked if I was hurt on the BP job. I said yeah I had a cut and I got the stitches out, and that was all the call consisted of.

At first when I was sick I thought it was a virus. The BP medics told me it had to be heat related. I would get a little better, but I couldn't eat anything. It had to be bland food and it would come back up. My wife got scared because I was losing weight; I lost 15 pounds in three weeks. In November of 2010 I was real sick for three months, so I went to the Emergency Room (ER) at Louisiana State University (LSU). They gave me the anti-nausea medication Finnegan and send me home. I would stop throwing up, but then the medication would wear off and I would get sick again. When I asked for a blood test to see what was wrong, they told me I had to see a primary doctor, but I couldn't do it because I didn't have the money.

I'm feeling so so now. My breathing has been messed up since I started working on the cleanup; l never did get my wind back. I play with my dogs 15 to 20 minutes and I can't breathe. Now I can't smoke a whole cigarette; I smoke half and start to feel it choking me. I can't eat too much anymore either. I can't eat fried food. I mainly eat grilled and baked stuff that I never ate before. I never saw any of this coming, because prior to working on the cleanup I was in good health. I could run 100 yards of football field all day long. I had been working since I was 12 years old.

4. BP CLAIMS PROCESS

We didn't make any money this year, the ship season was bad. Once I went to BP for a payment, because I was unable to work. They told me I didn't have enough paper work, and I didn't know I could go back. When I went in to fill out a claim, two to three times my wife had to drag me out. When I went I brought what trip tickets I had, a letter from the captains I worked with and my license. BP gave me the little $5,000 check.

I had to put a lot of money into my boat for it to be used during the cleanup. I had to take my fish box out and line out. I had to buy the fire extinguisher, the first aid kit. Even though the Coast Guard approved what I had, they wanted brand new equipment. I had to spend two thousand more on my boat, because they told me I had to be mobile to go to Grand Isle, but I was never sent out there. However, when I filed my claim they told me my boat never went to work. I got the number from the guy running the boat and called them, and they said the boat was never on hire.

Before we began working on the cleanup, everyone filled out a contract. Then they sent you a letter in the mail. It included an HOU number, which was the contract number that you're paid under. I was told that boat had to be on standby if it was not on a job. With my contract, they shut my boat down for the whole fishing season. From the day they gave me my HOU number until my termination I was told I would receive $312,000. Then, when I filed my claim they said the piece of paper that I signed wasn't a contract. I don't know anything about lawyers and

lawsuits. I'm a fisherman. The people who understand it better are saying it is a contract. We thought that they thought we were just dumb fisherman.

&"

"

I am providing this anonymous statement to the Government Accountability Project. I've been on the Louisiana waters and shrimping with my grandpa or trolling since I was a kid. I've worked as a deckhand since I was a teenager and I've ran boats all my life. I have a Masters license.

Beginning in May 2010, I spent six months working for BP and BP contractors on the oil spill cleanup. I worked in Venice, Louisiana as a captain for workers collecting boom and then I worked in Grand Isle on the Vessels of Opportunity (VoO) program, transporting high ranking BP and government officials between Command Centers and oil sites. I concluded my time on the cleanup transporting medics to sick workers. Daily I witnessed violations of federal safety regulations. I am providing this statement because BP, its contractors and the government need to be held accountable for what happened during the cleanup. I want what's owed to me; my family and I are sick, I can't get unemployment because I'm self employed, and I have thousands of bills in medical costs and damage done to my boat. I had a great life, two beautiful kids and a great house, and a company that yielded several hundred thousand dollars annually.

1. SAFETY IGNORED

I was watching the news the moment the spill happened, and I knew it would be a bad deal. It was the first blowout at that depth, and every supply boat has thousands of gallons of methanol. After it happened I got a job as a captain with a BP contractor that oversaw the cleanup in five Louisiana parishes. BP hired safety contractor PEC to put on a safety class, but we didn't take it until one month into the job. They were giving everyone the class in four hours. For additional time to get an instructor card you have to get another 18 hours. I was supposed to take an eight hour class, but we finished it in five hours. I have been to a lot of safety training classes in my life and none of them were as uninformative as this class. Some people got up and left during the class, likely because they felt like it was a waste of time. The instructors repeated the same eight points for five hours, and then told us the test answers before we took the exam. During the class we were told the chemicals would be weathered by the time we went out on the water and therefore not dangerous. They didn't discuss Personal Protective Equipment (PPE), just that the oil we would be dealing with was not hazardous. Later we realized it was a lie. Every day I wore tennis shoes and fishing pants shorts. Some of the shrimpers had shorts and tank tops on. At that point we didn't know how toxic the environment was.

BP told me and other workers that if we took additional safety courses during the spill, BP would reimburse us. I received the 40-hour Hazwopper training, but I paid for it and BP did not reimburse me, even though I submitted and invoice. This happened to a lot of workers that I know. Additionally, since the 9/11 attacks, the government put into effect a safety requirement that anyone who works in the maritime industry or air travels has to have a Quick Card issued by the Occupational Safety and Health Administration (OSHA). If you don't have a Quick Card you can't get in the boat. I already had obtained a Quickcard before the spill, but during the cleanup other captains didn't have them.

Everything going on out there during the cleanup was chaos in a structured way. OSHA was invisible on the water because of maritime. Everything was run through the Coast Guard. The Coast Guard had training facilities built by BP training vessels and paid by BP money. When I was the captain for Coast Guard officials, they shared that they were training cadets in these new facilities. BP hired a lot of companies to work on the cleanup; however, BP was always in charge and provided the orders to the contractors.

Throughout the cleanup my supervisors would often say "Oh, we're not going to enforce that rule now, we have to get that mess cleaned up." They hired people from all over who didn't know about the conditions and real safety hazards, but you did what you had to do; you had to take the job and deal with it because you didn't have money to go home.

At first we were operating out of Venice, Louisiana. During the spill I took scientists and divers within ten miles from the site of the Deepwater Horizon explosion. I was also running crews out from setting up boom and picking up boom. There was no clear structure; you didn't know what you would be doing each day. Every morning you would arrive at work and the port captain would assign you a duty for a day.

Everyone who worked on the oil spill cleanup was supposed to have an ID card. You had to scan the card at the beginning and end of each work day. At the end of each day, medical personnel would ask us how we felt. When we did report our symptoms, we were always told it was due to dehydration or sea sickness, we were never told that it could be related to the oil or dispersants. When someone fell ill they could not go directly to the hospital; they had to first go through a through a private medical response center located in a tent. When I was in Venice the medical tent was located at the BP Command Center. It felt like we were going through a triage every day.

The doctors supervised these tents. The Coast Guard were in the first tent. Depending on your symptoms, you would move to the next tent. When I went through it one time, the medic told me "You must have gotten dehydrated." I had three cases of water, three cases of Gatorade and five gallons of ice on my boat; I wasn't dehydrated. Then when I complained about cramps they told me I was seasick. Really? I've been working boats since I was a boy and I never got seasick. A lot of workers I knew had the same experience when they went to the BP medical tents."

After the first few days I knew what their medical protocol was about. It was created to downplay the number of workers getting sick on a daily basis and the severity of their health problems. There was a safety culture of, "hush hush, it didn't happen." I told everyone I worked for when they got on the boat, "If you think you are going to be sick, tell me now." One time I had two guys on my boat doing cleanup and one passed out. I took him back to the medical tent and I asked my supervisors about him the next day. They wouldn't tell me anything. I hope he is ok. When I left Venice and went to Grand Isle, it was more of the same situation.

Some doctors would then try to tell us stuff like this didn't happen. One day I and 15 other sick workers were at a public gathering regarding health problems associated with the spill. We all shared very similar experiences about the medical tents. We all had similar symptoms of at least nose bleeds and watery eyes. It was obvious that they were checking workers for symptoms of chemical exposure, but we were regularly diagnosed with seasickness or dehydration. They tried to tell us we had seasickness on days when the water was real calm. Most of the guys have worked on boats since we were young; we weren't buying into the false diagnoses. One of the medical doctors for BP in Venice was at the event and he wanted to speak with each of us individually. He came off almost aggressively; at first he explained that the tents weren't called a triage, and then he refused to admit that they were checking workers with symptoms of exposure to hazardous chemicals. BP and the Coast Guard knew it was toxic and set these places up to monitor us and make sure no one was dropping dead.

I became the captain for a lot of high ranking officials, including the Coast Guard and BP. I would take the officials from Grand Isle to Bay Jimmy, where there was a lot of oil. We would stop at Port Sulphur and the BP Command Center as well. A few guys from the Coast Guard were frank with me off the record about concerns with the cleanup, but they needed to keep their job and could not be vocal. When the cleanup winded down and BP and the Coast Guard announced that they were not finding more oil, a lot of these guys knew it wasn't right.

At Grand Isle, I befriended a BP safety representative. He has been all over the world, including Iraq, and was a high class safety guy. He would come to be so frustrated and say "Man, I don't understand. They have protocol but they didn't follow it." I witnessed safety violations on a daily basis as well. For instance, one day I saw someone brought in from the beach that had a head and neck injury. He didn't properly mobilize and put directly in an ambulance. Rather, he was put on a boat to be transported to a dock where he would then be taken care of. The paramedics should have cared for him directly at the beach, rather than risk additional injury.

Any damages to boats or medical incidents are reported through the BP safety personnel. A Job Safety Analysis (JSA) was recorded and submitted about the head and neck jury incident. However, when BP shut down the command post and facilities, we discovered that all the file cabinets in the safety trailer disappeared in Grand Isle. The BP safety representative couldn't go back and get the JSAs from medical incidents and the logs for boat damages. All we knew at the time was that BP was moving its Command Post to another location, but he was never able to locate the records. At one point for a month I was the captain for a safety boat with medical workers on board. I would bring the medical staff from the BP Command Center and take them to the sick workers. Worker safety incidents occurred multiple times per day throughout the cleanup.

I have a friend who owns a personnel company. He wanted me to call and get a crew together for the cleanup. I warned my construction guys not to get into it because they don't have a clue what they're getting into. They wanted to because they were all told they would make $25 o $30 an

$"

"

hour, which was not true. In most cases, we didn't get paid for all of our work though BP or BP contractors (detailed below). Around that time a lot of people were being hired to clean the beaches. The beach crew did have to wear Tyvek suits, but that didn't come until after the cleanup began and safety concerns were raised. All of a sudden minimal Personal Protective Equipment (PPE) was required for beach cleanup personnel, such as Tyvek suits and gloves. However, we did not receive PPE on the boat.

2. SPRAYED

I got sprayed with Corexit twice. I was having a casual conversation, and all of a sudden we heard a plane. The Corexit is nasty stuff. It disintegrates so that you can't see it, but it's on the skin. When it is sprayed from an airplane it's sticky and hits you like pellets, but it doesn't stay on the skin for long. I was sprayed off of Port Fourchon. That was the same day that the largest amount of oil entered Tartellon Bay. Fourchon West was one district and Fourchon from Grand Isle was another. That day more oil was coming up from Tartellon Bay and they were setting booms trying to contain it, but it wasn't working. The next day, after they had sprayed, there was no more oil in Tartellon Bay.

3. FAULTY CONTRACTS, NO COMPENSATION

There was an uprising in Venice; the sheriff's department and the National Guard had to be called in, because when the techs found out the Corexit was toxic they wanted to fight. The techs were uneducated about the health hazards of the chemicals, and its toxicity was downplayed by the employer. In response, the BP contractor threw a party the next day and told them "Everyone is going to get a check". Workers were mad because DRCs response did not account for the fact that their health had been compromised. Then DRC wanted us to sign a contract that would cut everyone's pay in half and be retroactive from the day we were hired. They told us on a Friday that if we didn't sign the contract, we would no longer work for DRC[1]. I told my work partner, "Don't sign it." Our wage was supposed to correlate with the government prevailing wage, but DRC was scalping us. On Monday morning BP asked to see DRCs books; however, we still didn't get paid for the program.

In Venice I ran an aluminum boat, and was strictly laying boom, pulling boom, picking up boom. I still see oil on my boat. I took it out in Grand Isle every week and waxed it. We figured they would decontaminate ("decon") them and everything would be fine. That was the biggest joke of all. The chemicals used on fiberglass shouldn't have been used. The chemicals stripped all the wax off the boat, tore paint off of the motors. To make matters worse, the guys hired for decon didn't have a clue what they were doing. However, if you didn't go for decon, you wouldn't get the final check or clearance from the coast guard to use your boat again. I went to decon, and still I never received my final paycheck from the last two weeks of work or for overtime.

[1] &''()**(+,-./012/34,5/''/6780*9(:;!;"

I know how contracts work because I run a company. When I received BPs contract to work on the cleanup, I read it word to word. If you received a contract, the only way you could be terminated was by written notice. My contract states they can't terminate me unless there is a 24-hour written notice. I didn't get my notice until the month after I was let go. They realized they had to get notices out because people were saying "Hey, we're not terminated yet, you owe us money." Then everyone in the VoO program got a termination letter at the same time. BP said it didn't own us money, but during that time our boats couldn't be used for anything else because we were still under contract until we received our termination letter. On that vessel, they owed me $60,000 to $70,000.

I had it bad, but so did my supervisors. The stuff they had to put up with in this job they will never do again. Yeah, they made good money but they said it wasn't worth it. Recently I spoke with four people who worked for Environmental Safety and Health (ES&H), which was one of BPs primary contractors for oil spill cleanup efforts. The four guys are now sick.

4. HEALTH AND FINANCIAL PROBLEMS

I thought I could make decent money working on the clean up. When I was working, my wife and kids were in Grand Isle for two to three months. I was told the beaches were fine and clean. However, I am afraid that my kids were exposed to Corexit when they swam in the ocean and pools. Since then, I have lost my home and we moved into my wife's grandmother's house. My family is sick, and I have a stack of medical bills. I owe $40,000 for the three times I have been in the hospital and I don't know how to pay it. In December 2010 I didn't leave the house because we didn't know if what I had was contagious. Every time I go to the hospital they test me for the flu; I don't have the flu. I took more antibiotics than I have in my whole life. I applied for short term disability and was denied. I can't get unemployment, because I'm self-employed. The church helped me once.

Before I worked on the cleanup, I was in good shape. I didn't have health problems, and my wife was in good health. I was active; I'm not one willing to sit around. I think I have spent more time sitting around last year than my whole life. My health problems are worse than my family's, but everyone has been affected. We all had urinary track problems. My wife and I have severe abdomen pains. It is different things at different times. If I'm overheated, I will suffer - every time you sweat, stress out, get over done. I am blessed to have two very intelligent little girls. But every day my little girl says, "Daddy, my belly hurts, daddy my booty hurts." It breaks my heart; not many kids complain when they are two years old. My four year old is the same way. She has stomach problems and doesn't want to eat. She runs a high fever at random times. But what do we do? No one knows what to do when we've never dealt with this before. Now I have learned to live with it. I don't have any answers.

One of the side effects of exposure to these chemicals is short term memory loss. I have always kept notes and records, because that is how my grandpa taught me – if you don't keep records,

;"

"

something is going to come back and get you. I can't remember everything; my short-term memory is gone now. Sometimes I leave home without a wallet. I have a notebook that I record everything in and I have to go back and review it, as if I'm studying for school. That is the only way that I am able to keep track of my life. Life has changed so much.

5. CONCLUSION

I don't have problem saying what happened because it is what it is. The oil field made Louisiana, along with the fishing industry. I can't get a job offshore now running a boat, because there really are not any jobs. The way this has been handled is what pisses me off. If they handled the cleanup how they normally would, with more skimmers and boom and proper PPE, I wouldn't be talking about it. If it is a cover-up – we all know it is – who do we go to because the government is not listening.

In Gonzales, LA there is a major holding facility where several kinds of Corexit are stored. I drove there is August 2011 and saw it stored. I couldn't believe it; after all the damage that Corexit has caused, it is still being sold. Grand Isle is still covered every day with tar mats. BP and the federal government's whole philosophy has been "out of sight, out of mind"; that's what the Corexit was for.

<"

"

I am submitting this anonymous statement to the Government Accountability Project on July 13, 2012. I have lived in Baton Rouge, Louisiana my whole life. I am married, and have a five year old son. In June 2010 my son spent less than a week at Orange Beach, Alabama. I believe the pool that he swam in had the dispersant Corexit in it. He was three years old at the time and got very sick. He lost one third of his body weight. The doctors didn't know what the cause was, and then we found high levels of the chemicals in Corexit in his blood.

Initially I would not speak publicly about my son's health problems. I was trying to do contract work for a company that conducts extensive background investigations, and I didn't want to be seen as someone who is volatile and stirs up problems. However, I could not remain silent about the impact that Corexit has had on my son's health, because if we don't learn from this tragedy then needless more children will get sick during future oil spills. I have no qualms about the oil industry making a profit, but it needs to do it right and not put the public in harm's way if something goes wrong. The dispersant Corexit that BP used in response to the spill is extremely toxic.

1. DON'T GO IN THE WATER

My son was three in June 2010 when my relatives took him to Orange Beach for 5 days. I have since learned that Orange Beach was one of the most polluted Gulf beaches following the oil spill. I was against him going at the time, but my relatives promised he would not go into the Gulf water. Just from doing my own research, I was concerned about him being exposed to toxins from the spill.

When they went to Orange Beach, they saw oil cleanup workers cleaning up the beach with backhoes and frontend loaders like tractors that they were throwing the oil bags in. They also saw a few large military planes that dropped in elevation when they flew over the beach. When the planes flew over the water they dispersed what my relatives believe was Corexit, since it was still being used heavily in the Gulf during that time. As it was being sprayed, the wind may have carried it into the pool that my son used. I found out later that chlorine acts as a binding agent for the compounds found in Corexit. My son stayed primarily in the pool and walked along the beach, but he did not get in the ocean.

Within one month after my son returned from Orange Beach, he had lost 15 pounds or approximately one third of his body weight, which took him over a year to gain back. He was 47 pounds when he went to Orange Beach, and his weight dropped at one point to 32 pounds. I had him on probiotics and tons of vitamins to try and fight whatever was going on.

2. HOSPITAL VISITS: KIDNEY STONES & ADHD AT AGE 3?

In August 2010 my son had his first pain attack. I heard him scream from the bathroom and then a loud thud. I ran to the bathroom and he was passed out on the floor in a pool of urine. I looked in the toilet and saw a kidney stone that he had passed. My wife and I took him to the Emergency

Room (ER) at Lady of the Lake Children's Hospital in Baton Rouge. He was running a 105 degree fever and they put him in the Intensive Care Unit (ICU). Then we had to have his kidneys examined. At three years old he passed a kidney stone.

The doctors and nurses shared that they had never seen anything like this and could not find a cause as to why he was sick. I began researching health problems associated with the oil spill, and learned about the Volatile Solvent Profile blood test, which tests for many of the same chemicals or Volatile Organic Compounds (VOCs) found in the crude oil and dispersant. I asked if they could give my son a Volatile Solvent Profile to test for different toxins in his blood. They wanted to know why and I explained that he spent time at Orange Beach. I wanted to know if his health problems could be related to toxic exposure from the oil spill. They responded that in their opinion this wasn't the cause. When I asked what the cause was they said they didn't know, but they still refused to do any testing relating to the oil spill.

At age three they put my son on Hydrocodone, which is basically liquid Loratab pain relief for children, to curb the pain attacks. They also gave him tons of antibiotics. He was taking a very strong pain killer and a very strong antibiotic at the same time, which concerned me. Later, his pain attacks started happening two to three times a week. He said it felt like someone was stabbing him on his right side where his kidney is. A couple weeks after we returned from the hospital we had two guests over for dinner, and my son had a pain attack in front of them - as he was walking through the living room he dropped to the floor. We never knew when they would come on, and we needed answers.

After the incident I took my son to a local clinic to see a pediatric urologist. My wife did not attend the appointments that involved medical procedures; since our son's been sick she has been very fragile and doesn't want to see him hurt. I explained to the urologist, "Maybe we should do a blood test for Volatile Organic Compounds." He rejected my suggestion immediately and wanted to know why I brought it up. I told him the same thing I told the other hospital: my son had been on the beach where Corexit was being sprayed, and I wanted to see if there were any chemicals in his blood that could help explain why he was suddenly having these severe health problems. The urologist reacted as if my suggestion was crazy and proceeded to tell me that my son needed to be tested for Attention Deficit Hyperactivity Disorder (ADHD). He made that evaluation after only meeting my son for less than one minute. I have no idea where his ADHD diagnosis came from; I have since talked to other pediatricians who told me that children are not tested for ADHD until a later age.

In the summer of 2010 I also had to take my son to Woman's Hospital in Baton Rouge. The doctor wanted to do a scope on him, and Woman's Hospital was the only hospital in the area with the right equipment. Three nurses and I held him down while the doctor put a catheter in him. It took them about 30 minutes to get it in. They examined him and said they did not know what could cause what he was experiencing. We couldn't get answers from any physicians. A

few weeks after that, his pain started trimming off so we took him off the pain meds and antibiotics; he had been on them for 90 days.

Within a day or two after my son got off the antibiotics he was having trouble breathing. We took him back to the ER at Lady of the Lake. They said he had a massive lung infection. He was admitted again for two to three days, they released him, and two weeks later we were back again with another lung episode. This time they gave him breathing treatments in the ER and that was the extent of the hospital's response.

3. 2nd HIGHEST CHEMICAL LEVELS IN BLOOD

After my son lost a third of his weight, he didn't start gaining any of it back until late fall of 2010. Fortunately during that time I met Marylee Orr and the Louisiana Environmental Action Network (LEAN). They told me they were doing an independent study of people having problems medically after the oil spill, and they would be willing to pay for the Volatile Solvent Profile on my son, which we could not afford. Our insurance would not cover this type of blood test, because – 1) it wasn't ordered from his regular doctor; and 2) they didn't see it as a need. Our insurance didn't cover his other bills when we were in the hospital. We probably paid $4,000 to $7,000 out of pocket – or continue to pay, because we don't make a lot of money. We're being sent to collections now for the medical bills, but that is the least of my worries.

Just before Thanksgiving of 2010 Marylee sent us to Dr. Mike Robichaux ("Dr. Mike") who was drawing blood. We drove about 150 miles south just to get a blood test because he's the only doctor willing to draw blood for the test. More than anything at that time I wanted to have peace of mind and to know from the blood test and other medical tests if his health problems were or weren't related to toxic exposure. I have had so many doctors dismiss this possibility without offering any basis. I got the results back January 2, 2011 and at the time my son had the second highest level of toxicity in his blood of anyone who had been tested by LEAN except for one diver at the scene of the Deepwater Horizon.

How does a three-year-old get that much toxicity in his blood when he lives 150 miles from the coast, except for one time when he was on the coast for five days? None of these symptoms were present prior to his trip to Orange Beach. I tried to contact some attorneys after we found out how contaminated his blood was, but no one was representing anybody with health issues. I'm not looking to get rich or anything; I want to get my son properly examined and treated, and have his medical bills paid for. Just from the research I've done on the toxins in his blood, I'm sure that they've settled in his pancreas or his liver. What are going to be the repercussions 10 to 20 years down the road? Is he going to get cancer? Any money that we would get would be used to pay off his hospital bills and put in a trust fund for him when he is older.

4. GOVERNMENT KNEW BETTER

On August 25, 2011 I went to Washington, DC with over a dozen other people from the Gulf who have been medically and financially affected by the spill. We went to meet with agency representatives about our experiences. During an informal lunch I met with a representative from a government agency with oversight responsibilities pertaining to the oil spill health response. I showed her my son's blood work, and her eyes welled up; she said that he will likely have cancer in 20 to 25 years. She explained, "We can't see the harm being done by these chemicals because they get into the blood and change the DNA on a molecular level." She said there is nothing that can be done. Based on the position of government officials at a meeting later that day, I don't think she was supposed to share that with me; but it was her immediate reaction after seeing my son's test results.

At our final meeting of the day there were representatives from the Center for Disease Control (CDC), Health and Human Services (HHS), the Agency for Toxic Substances and Disease Registry, and admirals in uniform. They told us that cameras and tape recorders were not allowed. They wanted us to fill out a form but they didn't say who it was for. They did tell us they were going to conduct a study on health problems associated with the oil spill. I didn't sign anything.

During the meeting the CDC passed around a loose leaf binder with pockets. The binder was not specific to the Gulf oil spill; it included general information about the CDC and its function in government. However, a pocket sized safety booklet about cleanup work was tucked into the binder pocket and I saw it as it started to slip out. A cleanup supervisor who had fallen severely ill was sitting next to me. He saw the booklet and in a surprised manner he quietly said to me, "That is the book that BP was seizing from us." He told me that when he was on the job he got a copy of the same booklet, made a hundred copies and distributed them to other workers, but his employer realized what he was doing and the copies were seized. The book was titled, "Oil spill Clean-Up Initiative. National Institute of Environmental Health Services. Safety and Health Awareness for Oil Spill Cleanup Workers. OSHA 3388-062010. The cover page also listed HHS, National Institute of Health and OSHA. The booklet detailed toxins used during the spill and associated health effects, including cancer.

Everyone in our group had health concerns, and at the meeting we went around the room sharing them. The government representatives sat there denying our assertions or evading our questions. One woman shared that her daughter had three miscarriages since the oil spill. She asked a CDC representative, "In our area we know miscarriage rates are skyrocketing in our community since the oil spill; we need to account for the number of miscarriages since the spill across the Gulf. Can I find that information anywhere?" Without responding, the CDC representative turned to a member from our group who, in addition to being very ill, had a dog with severe health problems since the spill. She said to him, "We know your pain, tell us more about your dog." I did not have an opportunity to speak about my son. Most of the remaining meeting time was diverted to the health of his dog. We left with more confusion around the health problems we are facing than

when we entered, because the government representatives rejected the notion that our health problems could be associated with the spill.

5. WHAT DOES THE FUTURE HOLD?

I won't let my son go back to the Gulf beaches. After he returned from the coast he was constantly running a fever, coughing and not wanting to do anything and just laying around. It has been over two years since his trip to Orange Beach, and he still has chronic coughing and a constant runny nose. When we put him on antibiotics the symptoms subside, but then when he completes the antibiotic his problems return like clockwork. He can't stay on antibiotics his whole life. We made several attempts to try and move to get away from the general toxicity of Louisiana; we just don't have the money to leave. My son left in the summer of 2011 for Phoenix, San Diego and Houston for almost one month with my parents. He seemed to be doing better when he returned. He's grown taller but it took him over a year to gain all of his weight back. Fortunately he hasn't had any bladder or lung problems recently, but what does the future hold for him?

My parents went into the pool during that trip, with my son. My dad was having a lot of breathing problems last year and my mom was wondering if he should get tested, because it all began after their visit to the Gulf as well. My son's blood test at least offered me some answers, but the doctors we spoke with initially were so negative that we didn't go back and share the blood test results with them. We didn't even go back to the urologist because of the way he talked to us. I don't understand why he would think that a three-year-old needs to be tested for ADHD rather than have blood work done; that's insane to me. The CDC representative was candid enough with me; what more can be done?

My name is Betsey Miller. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. My husband is James Miller, better known as "Catfish." We've lived in D'Iberville, Mississippi our whole lives. My husband is 46. I'm a veterinarian technician and he's a commercial fisherman. We were just trying to make a living, and the spill happened. One of our family boats was hired by BP for the cleanup through the Vessels of Opportunity (VoO) program on May 10, 2010, and James' contract ended August 27, 2010. James has been a commercial fisherman since he was eight years old, with his dad. He's a fifth generation fisherman. When he was on the VoO program he had no access to safety equipment; he asked about it and was essentially told, you ask about it, you lose your job. Then three weeks into the cleanup he started getting really sick; now it's hard for him to hold any work down because he is repeatedly in and out of the hospital. I am providing this statement because he is currently in the hospital and unavailable. I don't even know where to begin.

1. DENIED SAFETY EQUIPMENT

Everyone was in awe when the spill happened; all of the fishermen's livelihoods were being threatened. The opportunity came along to work on the VoO program, and of course the fisherman weren't going to turn it down. BP was offering $2,600 a day for an eight-hour shift. I knew from all of the paperwork I had read that BP was supposed to supply the men with respirators, hazmat suits and other safety gear, since they were working on the oil spill. I was concerned that they were out there touching the chemicals with their bare hands, and I knew my husband didn't have sufficient safety gear. Before he began working, the only training that BP provided was a boom course. He learned how to set up boom and contain the oil. The only safety advice the training provided was that workers should drink a bottle of water every hour. During James' second week on the job, when he began feeling the health symptoms more severely, he asked the safety inspector with BP contractor Danos and Curole about the equipment they were entitled to at the dock before they went out on the water, and it was like "hush hush." He told James that if he ruffled feathers, his contract with the VoO program would likely be terminated. Throughout his time on the job, his supervisors made it clear that if you pushed for better conditions, you could lose your job (detailed below). The jobs were scarce and competitive. Of course no fishermen wanted to lose their jobs.

The fishermen are like a community of their own; they're a different breed. I've grown up with it all my life because my dad was a fisherman. They're tough people but good hearted. My husband is really tough, he doesn't bite his tongue for anyone, he tells you like it is. I think that's why he gets a lot of flak from different people, because he does speak what's on his mind and he doesn't have a problem doing that; where a lot of people would back down, not him. During my husband's third week on the job, he again asked why they didn't have more protective equipment. We had seen workers on other boats with hazmat suits, respirators and other protections. He later discovered that those boats were spraying dispersants. They were in skiff boats, and they had dispersant tanks with nozzles that they sprayed from. James befriended some

of the workers on those boats, and they confirmed that they were spraying dispersants. They told him that it was highly toxic, and they were using it to sink the oil. They were workers just like James, following their instructions.

During James' second and third week on the job, these boats sprayed dispersant less than 100 yards from him. He explained to me that he would have to move his boat on certain days when the wind was blowing in his direction and the dispersant fumes were too strong to withstand. What concerned him most is that he saw these boats spray dispersant inside the sound on the beaches, as close as one mile from the shoreline. He reported this to the safety inspector at his work site and explained that he wanted to videotape them spraying so that BP could be held accountable for spraying so close to the shoreline. However, the safety director told James that he risked getting in trouble if he videotaped it. After James and other workers started asking questions about the dispersant use, the dispersant operation was moved to Bayou Caddy in Bay St. Louis, Mississippi where their staging site was located. From there on out, they began spraying at night.

As it turns out, some of the cleanup workers wouldn't come out on the big rigs during the middle of the day because the sun would heat up the oils, give off a gas, and the smell would make people sick. My husband and his crew were in the thick of it, and they didn't have any protective gear other than rubber boots and gloves that they had to reuse. I often provided my husband with clean gloves.

The first two weeks after he came home I washed his clothes totally separate, because I do that anyway with his shrimp clothes. Then I would wash our clothes and my kids clothes separate. I even went as far as to the laundry mat to do the clothes, but by that time apparently it was already in my washer. When I washed his clothes or we were intimate, I would break out in hives as big as a finger. I would start itching real bad, and I was taking 100 milligrams of Benadryl trying to counteract the itching. This happened even after he would get out of the shower. We would scrub the vinegar all over him to break the smell because he smelled like rotten egg. He would scrub with the Dawn dish soap and Go Jo, which is an orange type substance that gets grease and oil off your hands.

That lasted about six months, even after he stopped working. Now I don't have a problem at all. I don't know if it's because I threw away all of his clothes that he used out there, even down to the socks, and we started over. I went through the boat and threw everything off the boat away, including mattresses and the whole nine yards, because it seemed like every time he went to the boat he got sick. He's working the boat. BP would not decontaminate ("decon") our boat (detailed below), so we tried to decon it on our own with bleach and codivan.

2. HEALTH PROBLEMS

When James was working on the VoO program, our boat was docked at Pass Christian, Mississippi. He had a 45 miles grid to survey for oil. When they found the oil my husband would

report the coordinates where he found oil to his supervisor. During the first few weeks when the skiffs were spraying dispersant during the day, they would often arrive to spray the oil shortly after James reported it. I went out there with him a few times, but I couldn't stand the chemical smell from the dispersed oil.

After three weeks, in early June his chronic vomiting began. He couldn't stop vomiting for 12 hours straight. The first time he got up, got to work, got half way out on the water to find the oil and told his crew that he felt like he was about ready to fall out. He called his team leader and said, "This isn't safe, I'm going back in for my sake as well as my men's sake." When he did go back in, they called me and he was brought to Biloxi Regional Hospital, which is the only hospital he has been to. That time he stayed three days in the hospital, and ever since then his symptoms have progressed and progressed and progressed; vomiting, headaches, bloody diarrhea and bleeding from the rectum. His mind is fuzzy all the time and his eyes look like they are glazed over (detailed below). As he describes, it's like his nose feels like a glazed donut.

Once at the hospital they pumped him full of fluids because he was so dehydrated. However, the Biloxi Regional Hospital did his blood work on November 6, 2010 and said that they couldn't find anything wrong with him. We later discovered that they needed to use a specific blood test in order to identify the chemicals in his body (detailed below); however, they used a more standard test that did not reveal the high levels of chemicals in his blood.

After he went to the hospital he went right back to working; he would come out of the hospital that day and go back to work the next day. He did ok for about a week, and then the vomiting and his other symptoms started all over again. My husband only stopped working when they released the boat. His termination date was August 27, 2010. There were mornings when he would just puke puke puke, but he would get up and go to work because he had to. I mean, that's how we survived.

Shortly after James stopped working on the VoO program, BP gave him the HAZMAT course. They did not offer it while he was working, but enough people were asking about workplace safety and finally the course was made available. Workers had to get on a list and a BP representative called you and said, "They are having a HAZMAT course at this location, be there, and your name would be on the list." July 14, 2010 is when James took the HAZMAT course, but he started the VoO program in May. BP told him that he needed to take the course, and whoever was working for or with him could also take it. I took it with him so that I could read the questions. The reason I go to all of these different meetings with him is that some fishermen don't read or write very well and my husband is one of them, so he doesn't always understand the material they give out.

After he took the course, he explained to me that he never would have accepted the job on the VoO program had he known about the health risks associated with chemical exposure from the beginning. He explained to the HAZMAT instructor that he was experiencing most of the health

symptoms on the list provided for chemical exposure symptoms, including burning eyes, a runny nose, skin tingling, ears that would leak liquid, violent vomiting and rectal bleeding. The instructor asked him if he had been detoxed, and when James explained that he did not even know what it meant to be detoxed, the instructor told him that he needed to see a detox specialist because he believed that James had been chemically poisoned.

3. DENIED DAMAGES

Any time he is around the chemicals from the spill, if we're down around the boat or if the wind blows a certain way, James gets sick. He has not been on the boat for the past several months because it only exacerbates his symptoms. He is sensitive to common scents, such as hairspray or perfumes. He can't use certain deodorants now, and toothpaste irritates his mouth. He cannot use dishes from the dishwasher because the smell of Cascade upsets his system. He can't be around diesel fuel, and when he touches oil his hands break out in hives and rashes. Our boat has never been de-conned at all. BP's contract stated that after the boats were released they would be taken to a decon place and de-conned correctly. We contacted BP after the boats were released from the VoO program; I followed every step that asked me to do and filled out all paperwork required. However, BP sent the paperwork to us stating that the boat was fine and decon wasn't needed. Our boat was right out there in the oil, how much more evidence do you need?

I have a letter from the Coast Guard who gives a document number and states that "Vessel Decontamination verified complete and vessel poses no apparent pollution or risk to the environment due to the oil contamination or damage as a result of the oil spill response efforts or transit through affected waters. Vessel appears in apparent good order and fit for intended routes and services." Do you know how they inspected our boat? They stood on the dock and looked at it. They never got on it, and then they gave us this piece of paper and said it was all ok.

We've even had trouble trying to get BP to pay for the boat damages that occurred when it was used in the VoO program. When James was working for BP he got a big rope caught in the propeller, and it caused the vessel to shimmy when running. We reported it; I have statements from the team leader, four other guys who witnessed and confirmed this, from our deckhand who had to dive overboard to get the rope out. BP told us to submit everything, because we had to put the boat up on dry dock because it bent our shaft. A shaft is $4,000 to $5,000 a boat. Needless to say, $25,000 later after we hauled the boat up on our dime and I submitted all the paperwork, BP sent back a letter that they weren't paying us and it wasn't their fault. They denied us, stating "They were determined to represent an issue that has no direct connection to the oil spill." We were out there as part of the VoO program; how much plainer does it get to have a rope caught in the propeller? I found out all of the dates, I went to all of the locations where the damage occurred, and I got everything in order. Still, I learned it the hard way a long time ago that if you don't have a paper trail, you don't have anything.

We have not been paid in over 20 months for our business losses; no interim payment or anything. In the beginning we got the $5,000 check twice, and BP supposedly did it based on what we made a month. Then it went down to $2,500 and since then we did not receive anything. BP did not indicate why we stopped receiving payments. We were told that we would receive $2,000 and something dollars monthly, which was supposed to be based on lost wages. However, we averaged at least $10,000 each month before the spill. BP then said they said they didn't have enough information to provide the interim payments, so we broke it down for them through past financial records. What part they don't understand and don't get I don't know, but it's black and white for them.

The BP Gulf Coast Claims Fund (GCCF) recently sent my husband a proposal for his profit loss and they want him to take a settlement of $25,000. I said, are you crazy? We make more than that in two months when there is a good season. It doesn't add up. Where these other workers don't have records, they are offered more. We have an accountant that does our taxes every year. I have it all laid out for BP. Regarding James' health problems, we had to file a separate form for something like physical injury or plausible death, and the GCCF sent back another counteroffer of $25,000 for the medical bills. I was like, are you all crazy? We had over $200,000 dollars worth of medical bills. More recently, under the class action suit, James was offered a $60,000 medical settlement. We had to decline it, because we have over $360,000 in medical bills now. It's not about being out there to make a dollar. If we could, we would give every penny we have back to BP to have this man's health back. The money isn't anything if I don't have him. I don't know where to go, where to turn.

4. CHEMICALS IN BLOOD

In early 2011 we went to Louisiana to see another doctor, Dr. Michael Robichaux ("Dr. Mike"). We love Dr. Mike, because he's the only one who is willing to help. He knows what is going on and he is trying to help the people, but he can only do so much too. We found him after a lot of research, and with the fishermen keeping in contact with everyone on websites. He sees a lot of men on the Gulf having the same problems that my husband is having. For some, it's even worse. Dr. Mike drew James' blood for a volatile solvent profile test, to see if the chemicals from the oil and dispersant were in James' blood. Dr. Mike sent the test to the Metametrix lab on February 26, 2011. We got his results back and he tested high positive for six of the compounds that comprise the oil and dispersant. For some of these chemicals, you are not supposed to have more than .1 in your system, and James' test showed that he has 11.1. Dr. Mike explained that we needed to find a specialist to read the test results, because it was not his field of expertise. We sent his test results to a doctor who specializes in chemical exposure. She explained that James is so poisoned that it could take him several years before some of the symptoms even subside. She explained that he vomits everyday because when he sweats he releases the chemicals from the fatty tissues, and it is more than his body can process at one time.

We asked Biloxi Regional Hospital to run the volatile solvent profile test as well. They took his blood and had to send it to the Metametrix Lab; however, the hospital lost his results. James' doctor called and told us that out of his 35 years in practice, this was the first time that his test results had been lost. My husband's doctor had a frank and candid conversation with him at one point, and explained that he couldn't write anything on paper to identify the cause of James' illnesses, because legally he couldn't prove that BP made him sick with the dispersants that they used on the oil spill. He explained, however, that something very similar happened to him 30 years ago when he was a medic in the Vietnam War. He was sprayed with Agent Orange and he and several of the men he was caring for had similar symptoms, including respiratory problems and skin rashes. He explained that James and others were sprayed with a chemical that – like with Agent Orange – the government authorized and there is no process to address it. He explained that BP and the government don't want to diagnose and treat them because then they would in turn be admitting that they got us sick.

5. HEALTH DECLINES

The man who dived in to release the rope when it got stuck on our boat is not as sick as my husband, but he has several similar symptoms - the vomiting, the headaches. Like most fishermen, he doesn't have insurance so he doesn't go to the hospital. When you walk in they want money right off the bat if you don't have insurance. How do you explain to hospital staff why you are there, about the working conditions with BP? They look at you like you're crazy. We want help, but we don't know where to go. I don't know if the hospitals don't know what to look for, if they don't know the right protocol, or know where to begin to address this type of chemical exposure. But I know something has to be done. If not, I won't have my husband much longer.

He's waits until the last minute to go to the hospital because -- 1) we don't have insurance and 2) no one likes being poked and prodded on, especially him, who's scared to death of needles. So when he says, "I've had enough," you know there is something wrong and he is ready to go to the hospital. Since James first went into the hospital in June of 2010, he has been in four to five times and his health has only deteriorated. He vomits every day. It's like a pattern; between 1:00 and 5:00 am, he will hit the floor out of nowhere and he just starts vomiting, and then he starts snotting at the nose real bad. He gets these headaches and the glassy film over his eyes, and a lot of time he has diarrhea with it. Sometimes it lasts maybe four or five hours, sometimes it will last ten hours. He has these nightly sweats; you talk about stink, he smells like rotten fish that has been lying out in the sun. Wake up to that at 4:00 am. Then you have to get up, strip the bed, take showers.

On August 12, 2011 it was a ten hour day of throwing up, and he had just had enough to where he had blacked out. He called me at work crying and said, "I've had enough, I don't know, let's go." I called his sister, she took him and I met him over there. He told them "I'm not leaving until you all figure out what's wrong with me because I don't want to die." They have all of his

records, but all they can try to do is maintain it. He is highly allergic to sulfur, Luritab, Codine, so the hospital gives him Purkestine. Today they are talking about scoping him again, which he has had done, because they don't know what is wrong. He has had every test underneath the sun done. The only way to keep him from vomiting is to keep him knocked out. And that's not him. He's a workaholic.

Before he got sick, his whole life he would hit the floor early in the morning and be at work, always doing something. We just built a new set of doors for our boat. Before all of this, he was as healthy as a horse, as strong as could be, hardly ever ever went to the doctor. He doesn't like to take medicine; I have to make him take Tylenol when he gets a headache. He's not a complainer at all, he was raised really tough. He's a great man, he's a good guy. Now I'm at my wits end because I don't know what to do for him; I don't know how to help him anymore. It's hard, because he's deteriorating in front of me. He looks like he has aged ten years, and I have been married to this man for six years.

Thank goodness we have a nurse this time on his floor who is actually on our side. She doesn't look at us like we're crazy when we make the connection between his health problems and working on the VoO program.

6. SEAFOOD SAFETY CONCERNS

One of the hospital staff spoke with me who totally agrees that BP is a lot of our problem, of our people being sick and our gulf being not bountiful enough to provide. She says, "I won't eat the seafood that's come out of that water." After she saw the baby dolphins washing up and other problems, she stated that she wouldn't eat the seafood or let her grandkids play in that water. We were talking and she said, "Oh yeah, like all of these baby dolphins suddenly died by themselves." I looked at her and I said, "Oh, you know about that?" And she said, "Yes, they're crazy, I wouldn't feed none of that seafood to my family." Honestly, we don't let our grandson go in the water, and even though my husband is an excellent fisherman, we don't eat the seafood right now. Would you eat it? No. Because when you see the animals out there that you're catching, that aren't growing, and they smell funny, something's wrong.

I wish BP and our Marine Resources Department down here would listen to our fishermen, because this is our fishermen's backyard. They know these waters in and out, what belongs there and doesn't belong there. They know what the season looks like, where it changes, what changes, how it's supposed to be, what these animals look at, what time they flush through. Everything is off this year, everything is off. The fish and shrimp are not growing, there are less and less of them and I don't even know if we will have a crop next year. My husband is really adamant that he doesn't think there is going to be anything next year to catch, and he says he definitely wouldn't eat it then either because no one can tell us what the long-term effect is going to be. He is already dealing with severe health problems and we don't know what his life is going to bring.

("

"

There's just something that's not right, when all of our baby dolphins are dying, and crabs are coming up in some of the lab tests with oil. I know personally they have tested for oil because where I work there is someone that works for a local lab. She told me that the little blue crabs who have hatched in their hatchery had oil in them. She told me, "I ain't eating that stuff." We live off of that. My freezer used to stay stocked. Now it's like, "No, don't bring that stuff to me." I'm scared of it; I don't want to feed it to my kids or my grandchildren. Still, it is a lot of these fishermen's staple to feed their families.

The government says it's all ok. If you go down to the end of my street and look up, there is a big billboard that says our Gulf seafood is safe, and I'm like, hmm ok, you all eat it all you want, because I'm not. I really don't understand why you would want to feed the public food that is not 100% safe. These are children and pregnant women who are eating it, come on. I just never realized there could be such evil people in the world until they are put in front of you. Lord knows I've come across some devils right now. We're just trying to fix my husband. I just want my husband well.

7. CONCLUSION

It's a fight, a struggle, it's one that I'm not giving up, because I love my husband dearly and these fisherman don't deserve this. BP and the government are the ones who messed up their playground. They're the ones who are basically contaminating the people. Step up to the plate to fix what you did wrong. Put yourself in our position. If you were just a common fisherman and your livelihood was damaged and you're still struggling and wanting to know, how are you going to feed your family and pay your bills, knowing that your wife is working herself to death, and here you are trying to do what you can, but there is no help, what do you do?

With James in and out of the hospital, I'm so grateful that I have a supportive job that works with me. They are like my family. I have to take off so much with him, and here I am trying to make up hours and work as much as I can, ten to twelve hours a day, but it's what I have to do. That's my responsibility, until we can figure out what's wrong with him. Because this isn't him; this isn't the man that I married six years ago. I know he feels so bad because he has always worked and now with me having to just work and provide, it's killing him because he is a workaholic. Anybody will tell you, that man can run his mouth all he wants and he is a hard-ass, but he knows how to fish and he loves what he does. Anybody that is a true fisher is that man.

I am physically and mentally just drained, but I'm not going to throw my hands up and say I'm done, because I'm not a quitter, none of us are. I'm to the point where ok, he needs help but all the fisherman do and there are some worse than him, so my God something needs to be done. A lot of them are scared to talk because they are wrapped up in litigation and don't want their cases to be compromised. If they do speak out, they rarely receive a response from their local politicians or media. When James' isn't in the hospital he's at every community meeting since the spill took place. Even for the Vietnamese, we go to their meetings, because it isn't about him

)"

"

griping about himself. He's griping, because there are other people out there sick like him and they're not getting help.

*"

"

AFFIDAVIT

My name is Christina Tillman. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I live in Pass Christian, Mississippi, which is located along the Gulf of Mexico. This statement is about my two year old son's illnesses, which began after the BP oil spill in April 2010. I'm a surgical technologist, and I am currently enrolled in nursing school. I have worked in the Operating Room, Emergency Room and Observation unit, providing patient care as a clinical technician or medical technician. I have worked with doctors for three years, and I have never witnessed the treatment that we endured while we trying to better understand my son's health problems. It felt like pulling teeth to get any kind of feedback whatsoever from our doctors. Every doctor completely shut down when we brought up a blood test our son had taken that showed chemicals in his body that were associated with the oil spill.

We need to find doctors who are familiar with these chemicals and how to respond to them. This whole ordeal has been costly. We went to dozens of appointments, and we now have large medical bills. If it is BP's fault, BP should pay for it. I hope that other people who had to go through what we have due to chemical exposure from the BP oil spill get compensated so that they can obtain proper treatment for their children or for themselves. This will also allow the doctors to receive compensation for their services.

1. BACKGROUND

When the explosion happened, we didn't even know anything about the spill. I think three days had already passed before they put anything about it on the news, and it was just a brief 30 second segment of, "an oil rig has exploded but there are no problems." But we smelled burnt oil. We used to live right across the street from my parents in law, which is close to the Louisiana state line and about a mile from Bay St. Louis. The Gulf of Mexico is right outside of the Bay. I remember coming outside one day and wondering, "What is that smell?" It was a distinct disturbing smell of burning oil, but no one knew what to attribute it to. Three days later we finally heard on the news that a rig exploded. It got to the point where we smelled burning oil all the time.

However, when my family began getting sick, I didn't think we had anything to fear as far as coming into contact with any type of BP chemicals. We hadn't been to the beach, and we hadn't eaten any seafood, so why would we have to worry about that kind of thing?

Then my son's health problems got worse, and test results came back that showed he had levels of volatile solvents in his system. So many people were asking questions about what types of illnesses he was experiencing, how long was he sick, where did we go, what did we do? Finally I got together with a friend from Chicago who has a website and asked him to help me put something together. He helped me put together a website, www.truthoutonbpillnesses.com. It

ED_001324_00007754-00149

catalogues the experience we had surrounding my son's health problems from the beginning, and our difficulties getting him treated.

I did research on the four chemicals that were found in my son's body and also found in the crude oil and dispersant, Corexit: Hexane, 2-Methylpentane, 3-Methylpentane and Isooctane. All of the health effects that he was having are caused by inhalation of those four chemicals in his body. On my website I have a tab that includes the chemicals found in his body and then underneath each chemical I have the different links that I used. For example, I have linked to an OSHA (Occupational Safety and Health Administration) webpage that provides information on specific chemical and associated health problems.

In addition to creating a record of what we experienced, I put the website together because if there were someone who had gone to the website and had a sick child, they could catch the symptoms early. At first my son was not experiencing life threatening illnesses, he was not in a fetal position regurgitating, or in a state where he couldn't move and needed to be in the hospital. The symptoms were more subtle, such as cold and sinus symptoms, low energy and loss of appetite that progressed into more severe symptoms later. I wanted any parents to be able to see the range of severe symptoms that could be caused by these chemicals being in your child's body.

2. SICK, HOSPITAL NIGHTMARE

In May of 2010 my son, husband and I were all experiencing a summer cold type deal, including a runny nose and sore throats. It wasn't that severe. However, I've been with my husband for about seven years, and he never gets sick, not even a cold. It was one month before my son's second birthday, in September, 2010 when things really started to get bad, and then they came on fast even for the adults. We suffered severe vomiting and intense sinus pressure literally to the point where it felt like our heads were going to explode, coughing, and rawness in our throats that felt like strep. The symptoms cleared up for my husband and me after a month. However, my son's health problems (detailed below) persisted until April 2011. Recently he was diagnosed with asthma.

As the cold symptoms persisted, on September 16 I took my son to the doctor. The hospital put him on an antibiotic, and he seemed to do ok after that. Toward the end of the antibiotic, not only was he not getting any better, he started to run high fevers again and his symptoms were actually getting worse. Toward the end of September I had to take him to the doctor at Memorial Hospital Children's Clinic for the same thing. They basically did the same thing that they did the last time we had gone, and prescribed another antibiotic. On October 3, 2010 he had his birthday party and seemed to be doing fine; he was playing, and he wasn't really showing any signs that he was not feeling well. But then he woke up that evening from his nap and just felt like a hot burning coal. We checked his temperature. I worked in a hospital and know that rectal temps are the best so that's what we always do with him and it was 103.5, a high temperature for a child.

CT

On October 5, 2010 I called the children's clinic. It was a Sunday, so they had to transfer me to an on-call nurse, and she expressed great concern with him because of the amount of times that we had taken him to the doctor prior to this, and because he already was in the second round of his antibiotics. The nurse said, "I really do think that you need to take him to an emergency room, have a doctor do a thorough exam, run every test that they can, just to give you piece of mind and also because it sounds like something is getting missed, like he's not getting better – he's just getting worse."

After that it was like literally, week to week, appointment after appointment of him being diagnosed with viral infections, ear infections, and severe sinus infections. His white blood cell count was up real high. The most curious part was that the doctor we were seeing at the time when he first started to get sick would just put him on an antibiotic and send us home. He would start to get sick again, I would call back. On October 8, 2010 I did a consultation with the doctors and told them "I just don't understand. He keeps getting sick, and every time he gets sick, it's worse that the last time, and it doesn't seem like you're really doing anything to try and help to find out, ok, what is it that keeps causing him to get sick, why is he not responding to the antibiotics? What is going on with my child? I mean this has been two years and he's never gotten sick, and now he's been sick for two months?" And the doctors and the nurses at this clinic, literally, tried to make my husband and I feel like we were just crazy. Like "oh, he's just sick, he's just sick, you know."

CT

When we went to the Memorial Hospital ER in October of 2010 my mother in law was working with Dr. Rikki Ott, a marine toxicologist with a specialty in oil pollution. Dr. Ott suggested that my son get the Volatile Solvent Profile through Metametrix Labs. So we went to the Memorial Hospital ER in Gulfport. We thought that it really wasn't that big of a deal; we could get that done. And when we went they said "Ok, we will run the test." On October 29 we got the results back and discovered that it wasn't the right test. I called Metametrix Labs myself and described the test results that I was looking at and they explained that it was just a basic urine analysis – that it wasn't their testing and that they didn't even have him on file. Then they said "You can talk to his primary pediatrician, and they can order the test through us and we'll send them the kit and they could do the test in their office and then send the kit back to us, or we can even send the kit to you but we have to have an order sent to us by a physician."

I asked the hospital why they didn't run the correct test and they responded, "We can only use our labs and Metametetrix is not on the approved list." When I told them Metatetrix said the hospital could order the test, they said I had to go through his pediatrician. We tried to get his primary pediatrician at that time at the children's clinic to order the test, but she just would not do it. She also said, "We don't work with Metametrix labs, we don't have them in our system, and we only work with the labs that we have on file." He saw all three pediatricians at the clinic, and they are responded similarly. They did run a blood test and found that he had high white blood cell counts, but they never actually tested him or did a nasal swap to see if he had the flu or strep or the other specific problems that they were diagnosing him with. Most of the clinics here

CT

CT

used to be independently owned, but there was a merger that took place a few years ago and now they do work through Memorial Hospital. Testing, lab work, billing, it's all done through the hospital.

His primary pediatrician would not even write the order to get the test done. And it was a very startling situation, if something was causing him to be sick, why wouldn't you just order the test? I'm paying for it, you're the doctor treating him, he definitely has something going on, what is the problem here? What is the stipulation? Why can't you just order the test? It wasn't just their refusal to run the test that concerned me, but that he kept getting sicker. I even took my son to a doctor who is a friend of the family, to see if he would run the Volatile Solvent Profile test. He seemed like he would be really helpful in beginning, and he said that he would call back about the test, but we never heard back from him about it. We dropped it as well, because he is a friend of the family.

Truthfully, at that time I didn't think that BP could be the cause of anything, because everyone made us think that everything was ok. You know, "the oil's gone, there's nothing." I didn't think we had anything to fear, as far as coming into contact with any type of BP chemicals. We hadn't been to the beach and we hadn't eaten any seafood, so why would we have to worry about that kind of thing? But, my son had been sick for five months, I had been sick, my husband had been sick, so we were like, "If this test could tell us anything, it would just be like testing him for the flu or whatever - we're at our wits end, we want to know what's causing this." CT

By conducting my own research about symptoms associated with chemical exposure, I grew increasingly concerned that there could be a relationship between his health problems and the oil spill. On December 9, 2010 I took him to the New Orleans Children's Hospital. I was working in the Operating Room during that time, and the doctor that I assisted looked at my son's medical records and suggested that I take him there. He told me, "If your son gets another fever, according to his recent past medical history they probably will admit him and not release him until they determine the problem." When we went there and provided our son's medical history, I also shared that we were concerned he was exposed to chemical from the spill through inhalation because we live on the coast. The doctor responded as if he thought we were crazy for driving that far. Within five minutes of seeing my son, he said that he just had a fever and he diagnosed it as a viral infection. I explained, "It took us an hour and 30 minutes to get here and we would not have come this far if we did not think his health problems were serious." It was another dead end.

3. CHEMICALS IN BLOOD

On December 15, 2010 we had to go to Dr. Rodney Soto in Florida to get the Volatile Solvent Profile test done. He is a vascular neurologist and neurologist, and one of the few doctors in the Gulf that would work with this particular test. Before I got the test results, Metametrix Labs called me on December 22 to say "The results are in, we're about to mail them out to you. We

CT

just want to let you know that he does have four types of petroleum derivative chemicals that have been found in his blood."

On December 21, 2010 we switched to a new doctor who has handled things a lot differently. She works at a clinic through Memorial Hospital, but she actually ran various tests. As a parent, you want results; if obviously this isn't working and it's not healthy to continue an antibiotic regimen for a certain length of time anyway, let's run some tests, send him to an Ear Nose and Throat (ENT) doctor or whatever is needed to figure out what's going on. She thought he had strep at one point. She did a strep test and it wasn't strep. They thought he had the flu at one point; they did a nasal swab to see if he had the flu, and it wasn't the flu. He has polyps, a noncancerous growth, all in his sinus cavity, and just a lot of severe chronic problems with his sinus. So she referred him to an ENT specialist, who said that he needed to have his adenoids, which are a type of tonsil, removed, and tubes put in his ears because of the flu that he continued to have. They did a CT scan of his sinuses, and the doctors said that it actually looked like the CT scan of an adult male with severe chronic sinus problems; that he had never seen a CT scan like that on a two year old in his life.

On January 21, 2011 I did a consultation with Dr. Soto. This was all happening around when I got the laboratory results back from the Volatile Solvent Profile. At the time that they took the test he did have pretty low levels of these chemicals in his body, but enough for positive readings. to show up on the test. Dr. Soto said that it is possible when my son first started getting sick he would have had much higher levels. Dr. Soto added that the short term symptoms that my son was already having were consistent with the results, such as the flu systems, sinus and respiratory problems. He didn't go into detail regarding the long term effects, but expressed that there could be long term effects and problems. I was already distraught and trying to digest that my son did have positive levels of these chemicals in his blood.

On January 14, 2011 I ran the results by the new pediatrician I was working with. Initially she was very interested in seeing the results; she wanted me to fax over a copy of the results to her. She even explained to me the concern that she had; when my son came in she had given me her cell phone number and she was talking like, "I want you to text me and let me know how he's doing, what his fevers are, because I have had so many children come in with these exact same symptoms, and I'll test them for the flu and it is not the flu and it just baffles me that it isn't the flu."

Before that I had gotten to the point to where I stopped telling doctors about the test, because every time I would bring it up it was almost like I was talking about a UFO sighting or something. They just did not like the sound of this test. So I got really excited about the fact that she wanted to see the test results, because this is a doctor who was not four hours away. She is a local doctor who was actually interested in this. She sounded concerned about all these children getting sick. I thought that here is somebody who can probably help us or find somebody who

will. This was important, because our concern when we got the results was "ok, well how do we get these chemicals out of his body if this is what's causing him to be sick?"

However, after I faxed the results to her I tried contacting her several times about it, and never heard anything back about the tests. I really didn't get my heart broken over it, though, because it didn't surprise me. I was hoping it wouldn't turn out that way, but that's how it seemed to have been with so many other doctors. I didn't press the issue, because overall she has been his most effective pediatrician to date. My son is doing much better than he was before we switched over to her.

Throughout this time, I kept trying to get my son in to see a doctor at the Blair E. Batson Children's Hospital, through the University Medical Center in Jackson. Because the Volatile Solvent Profile test was the only one to come back positive, I wanted a doctor in this area who could take a look at it. I have family in Jackson, and during the time that my son was getting sick my family kept saying that they will have a team of experts that can figure this out, a toxicologist who can say, "OK, this is what this is." My family was concerned that the doctors that he kept going to were general pediatricians who only see things in a certain spectrum; whereas if I could get him into the hospital they have specialized teams of doctors that would be able to diagnose my son more accurately.

4. CONFLICT OF INTEREST?

On February 25, 2011 we went in and finally got a doctor at the Blair E. Batson Children's Hospital. The doctor did an exam and told me, "I just believe that you have a severely allergic boy who is having respiratory allergic reactions to certain things, and we just need to find out what, with your pediatrician referring him to an allergist. I think that's the best route to go." It was a four hour drive to get there, and we weren't just driving to come to another roadblock, so then we shared with him the Volatile Solvent Profile test and the results from it. When I did that, things came to a standstill.

The doctor said, "I have to tell you that these test results and what you are sharing is a conflict of interest. I cannot discuss any of this with you." Then he asked us if we have a lawyer. I told him that we didn't, and he said that "this is a conflict of interest and anything that I tell you I would not be able to testify in a court of law." He proceeded to share that he already had a lawyer "handling these issues." He told me that I would need to speak with his lawyer about "these types of issues." And I'm sitting there thinking, wait, I am here to tell you about my son being sick, I wasn't aware that we needed to talk about conflicts of interest and lawyers, this is getting away from the subject. As soon as I said that we didn't have a lawyer, he went back to say that he did think it was severe allergies that my son had, and so forth.

Since then, everybody that I talked to has said, "He's a doctor, how would the results of any kind of test that would show things that could be causing any kind of illness, be a conflict of interest for a doctor, because that's what a doctor does? You get results, it should show something that

could be causing severe health effects, and if you can't fix it, you find a doctor that you can refer to who can fix it."

On April 21, 2011 we went to an allergist through Memorial Hospital who works out of the same clinic that my son's current pediatrician is at. On May 12 he gave my son an allergy test. He had a panel of 20 different types of things that could be causing these respiratory and sinus problems that our son was having. It was another bafflement from another doctor because they ran a panel of 20 different things in his back and he did not have a single allergic reaction to a single thing that he had put and the allergist was just sitting there like "I'm sorry, I honestly thought there would be at least five things on this panel that he would have a reaction to because of the types of symptoms that he's been having." And he said, "I'm going to have to take some time to figure out where we need to go from here." He had actually called me back later from there and said, "You know, I'm going to look back over everything from the very beginning when he first started getting sick and try to get my bearing on this situation and figure out where we need to go." I still haven't heard from him, and that's where everything has stopped.

5. CONCLUSION

I've pretty much got to the point where if it's a conventional doctor, I'm almost not going to bring the lab results up to them, because it's like a huge wall comes up. And when it comes down to it, I work in the operating room side by side with doctors and I do have respect for what they do; whatever their specialty is, they are experts in that. They have a medical degree, they are doctors. So I am not going to argue with them about what they do and don't know, because they know things that I don't know.

But at the same time, as a doctor you do have a responsibly to your patients, and if it is a field that you don't know anything about, you do have a responsibility to refer that patient to someone else who has an expertise or may know more about that situation. With this it's not like that. It's like, "OK, you have proof that there are chemicals in his body, we are not messing with you – we're done, we're done, this is over." And besides that, it's almost like going to your gynecologist about an ear, nose and throat problem; they don't know, they have no idea what they're talking about.

Right now I'm going back to nursing school. Especially with all of this going on with my son, there were so many times when I wished I could just do this myself. So I said, I'll just go back to nursing school, I'll go to physician's assistant (PA) school, I'll be a PA and maybe that will put me in a position where I can do more if I need to.

I have a private Facebook page and when we got my son's test results back and I got the website up and running in the spring of 2011. Our friends and family from out of town that didn't know about the situation, all responded "oh my goodness, I cannot believe this, this is crazy, are you all going to sue BP?" Our thing isn't money or a suit; it's "OK, you caused a problem, fix it. Do

CT

what you are responsible for doing and provide health clinics if you have to or doctors who do know what they are doing and just take responsibility for it and fix it."

It almost scares me at the same time, because I did get the website up and I do want people to know about this and I do want people to be informed. But at that same time, it's just like my friend from Chicago who helped me get the website up. He himself expressed great concern. You know, he said "I'm going to tell you this as a friend, this does kind of worry me. Don't be surprised if you have BP knocking on your door, offering you so much amount of money to shut this website down." I don't know, I try not to think about it, I want people to know, but it is at the same time kind of scary to me, wondering, what would they do to keep quiet the fact that these chemicals are being found in these children's bodies and causing health affects, and it is health affects that are caused by these chemicals. I mean these are all facts and things that are happening, it's not that this is just what people are saying. What would they do to cover it up, would they do anything? I don't know.

CT

Dr. Soto's main concern now is my son's immune system, seeing what's been depleted. We just put him back in preschool and are seeing how he can hold up on his own now. He seems to be doing ok for the moment, although his runny nose has started up again. I feel like basically now we're just sitting ducks.

CT

I have read the foregoing eight page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on April 12, 2012

Subscribed and sworn to before me
this 2nd day of November, ~~2010~~ 2012

Notary Public

STATE OF MISSISSIPPI
LESLIE ANN HARVEY
ID No 100696
Comm Expires
Nov. 16, 2015
NOTARY PUBLIC
HARRISON COUNTY

My Commission expires on: _____

cps

AFFIDAVIT

My name is Clint Guidry. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am 64 years old, and a third generation Louisiana (LA) Shrimp Fisherman. I reside in Lafitte, Louisiana. It is fishing village along Bayou Barataria 20 miles South of New Orleans. I am President of the Louisiana Shrimp Association (LSA), and I sit on the Louisiana Shrimp Task Force (LSTF) as the representative for all Louisiana shrimp harvesters.

After the Deepwater Horizon explosion, LSA Vice President A.C. Cooper and I mobilized our shrimp fishermen to work in BP's Vessel of Opportunity (VoO) program; however, we were excluded from the planning for worker safety trainings. A.C. was hired to work on the VoO program, and underwent minimal safety training during that time. Since April 2010 when I realized that they were working in very hazardous work environments without proper training and Personal Protective Equipment (PPE), it became my mission to get BP and the federal government to protect workers and the greater public from chemicals associated with the crude oil and dispersant. Despite constant briefings and meetings on this subject with BP and government officials coordinating the cleanup, they did not heed my warnings to properly protect the workers and public. Scores of people across the Gulf are now sick and it is not being attributed to the oil spill.

I have been shrimping in the Gulf of Mexico and inland waters since I was 14 years old. From 1974 to 1978 I worked as an electronic technician, where I maintained public address, alarm, fire, gas detector systems, including methane and hydrogen-sulfide gas, on offshore oil production platforms and drilling rigs in the Gulf of Mexico and onshore. For 10 years I worked for Brown and Root Industrial Services, a division of Halliburton, as a General Superintendent and Area Superintendent in oil refineries throughout the Gulf and in California and the US Virgin Islands. I oversaw "shut-downs," which is maintenance to refinery equipment and piping, for hundreds of workers in all existing refinery based hazardous conditions. Jobsite conditions included crude oil, benzene, ethylene, hydrofluoric acid, sulfuric acid, confined spaces, and fire and explosion.

In 1994 and 1997 I worked for a BP owned refinery in Plaquemines Parish. During that time BP operated under strict Occupational Safety and Health Administration (OSHA) regulations. As a superintendent, I enforced those standards, and I know what the requirements for chemical work environments are. For instance, if we were working with chemicals at the refinery we were required to take training. As a supervisor, I took a 40-hour HAZWOPER/HAZMAT training course at minimum and all workers wore proper PPE. When I saw it was a BP oil spill, I thought

cps

cpb

that at least they were going to make sure to protect the cleanup workers. When I started to hear what was going on during the cleanup I couldn't believe it.

1. Sounding the Alarm

On April 28, 2010, BP and the government realized that they couldn't shut down the spill. On April 29 I got very involved in the oil spill response. I attended a meeting with Plaquemines Parish President Billy Nungesser at his office to discuss oil disaster planning and updates. BP did not send a representative to the meeting; Mr. Nungesser had to send one of his staff to Houma to find out what actions BP was taking in response to the spill.

On April 30 we had meetings in Venice, LA with Louisiana Senators David Vitter and Mary Landrieu's staff, Representative Charlie Melancon and Dr. Jane Lubchenco, administrator of the National Oceanic and Atmospheric Administration (NOAA). We inquired about getting our members income through jobs on the cleanup. That same day, the first training session was held for VoO at Boothville-Venice School Auditorium. BP had 600 to 800 prospective workers at the school, and provided a four-hour training class. After they took the class and signed a contract, workers were sent to work on the spill response.

The in-situ teams, which were the teams that burned the oil, also only received the four hour safety training before working in the most hazardous conditions of all of the workers. Alan Allen of Oil Spill Consultant, a BP contractor, provided training for in-situ workers on how to conduct the burns; however, it had to do with the process and mechanics of burning oil. It did not address the health hazards associated with the chemicals that the workers would be exposed to. The in-situ teams were within miles of the Deepwater Horizon site; they were sitting directly over the oil and drifting in oil all night. They were also being sprayed with dispersants (detailed below). A photo of an in-situ team next to billowing smoke is included in this affidavit as Exhibit 1.

BP and the government didn't follow-up and provide workers the 40-hour safety training until much later in the cleanup. Only after fishermen were already working in the response effort over the oil and dispersants did BP implement a rotation system to send workers to week-long HAZMAT trainings. However, by that point workers were already exposed to hazardous work environments without the proper warnings and PPE. In mid May 2010 I asked workers from the in-situ team how they located the oil, and they explained, "We look around and when your eyes start burning and you're coughing and your lungs hurt, you're in the thickest part of the oil and you can burn it." That greatly concerned me, because at that point respirator protection won't be sufficient to protect them from the toxic fumes they are inhaling. However, I knew by speaking with workers and government officials that they weren't even provided respirators. That is when I began trying to get them respiratory protection, which did not take effect for the in-situ workers until July 2010, as the controlled burns were ending (detailed below).

cpb

During my early efforts, the workers on the in-situ team were threatened with termination if they wore respirators. In May I bought respirators for a crew leader of an in-situ team and his crew in Venice. Several workers informed me that when they brought the respirators on the job sites, they were threatened with termination by their supervisors if they tried to wear them. The safety man on the job site told them, "If you don't see me wearing a respirator then you don't need to put one on." The safety man worked for Tiger Safety, a BP contractor based out of Houma, LA. Shortly after that incident, he was one of the seven men who got sick on the VoO program and had to be airlifted to a hospital (detailed below). The in-situ team informed me that after the safety man got sick on the job, BP fired him along with the whole company.

In May I sent Senators Vitter and Landrieu and Governor Bobby Jindal on my concerns about chemical poisoning of cleanup workers due to inadequate training and PPE, including respirators. Senator Landrieu's staff responded that, as long as her office was acting unilaterally, there was little the Senator could do to ensure adequate PPE for VoO workers. My email exchanges with Senator Landrieu's office and Governor Jindal's office are included in this affidavit as Exhibit 2.

The first two months before the well was capped, all we did was go from meeting to meeting to meeting with high-level officials from the Coast Guard, Environmental Protection Agency (EPA), NOAA, Occupational Safety and Health Administration (OSHA), Department of Health and Human Services (HHS), Department of Homeland Security (DHS) and BP. At these meetings we warned them about the hazards associated with the dispersant and oil, and the impact that it would have on the workers now and years to come if they were not protected on the job. I created a briefing packet of the known health hazards associated with Corexit and made it available to cabinet members. The briefing packet is included in this affidavit as Exhibit 3. At the time we were trying to get the President and federal government to step in and take control of the situation. This was prior to the federal government stating that everything was ok when it wasn't.

On May 24, 2010 due to my working relationship with Senator Landrieu's office, DHS invited me to attend a meeting in Galliano, LA. They were soliciting our opinion on the cleanup. At that meeting I said that I wanted everyone to understand the danger that the cleanup workers were being put in. I read the statement and warnings from the briefing packet I created, which included dangers associated with Corexit. I had no questions or back and forth from any of the Congressmen. I left 15 to 20 copies of my statement for everyone at the table, including Secretary of the Interior Ken Salazar, DHS Secretary Janet Napolitano, then-BP Chief Operating Officer Doug Suttles, Senator Landrieu, Senator Vitter, Senator Barbara Murkowski, Senator Dick Durbin, then-Coast Guard Rear Admiral Mary Landry, Governor Jindal, Mayor Mitch Landrieu, Mayor David Carmadele, Representative Joe Cao, Coastal Parish Presidents and

cpb

Councilmen. After the meeting Senator Durbin approached me and said, "They needed to hear that." I was trying to prevent them from killing people and making people sick, but they didn't heed my warnings. There was no substantive follow up with any of the individuals present at that meeting. Two days later on May 26, seven VoO workers were airlifted to the hospital.

2. Workers Airlifted, HHE Whitewash

On May 26, seven shrimpers working on the VoO program were airlifted from their vessel and admitted to West Jefferson Hospital with symptoms of chemical exposure. In early June 2010 NIOSH representatives contacted me by phone. They informed me that after that incident, on May 28 NIOSH received a request for a health hazard evaluation (HHE) from BP management, to assess the exposures and health effects among workers responding to the oil spill. There are two ways to request a health and safety inspection on a job site: Three anonymous workers can make the request, or the company can request an inspection.

BP had requested the inspection and in effect that meant BP had greater control over it. When NIOSH inspectors came down and inspected the job site for the HHE, BP provided them with boats, told them when and where they could go, and how they could get there. When a company has advance notice and is in control, it can make sure everything is in order for that inspection even though it may not be representative of the day to day conditions. In most cases Everything NIOSH tested for the HHE concerning the response was deemed safe, as reflected by their final report.

The cover up surrounding health problems extends to hospitals. West Jefferson Hospital didn't provide documentation to show that seven workers airlifted from the vessels stayed overnight at the hospital and were chemically exposed from the oil or dispersants. Instead, West Jefferson Hospital documented it as heat stress, existing medical conditions and exposure to de-tox solutions. I stood in the hospital room with one of the men who had been airlifted. He asked the doctor what was wrong, and she looked at him and said "chemical exposure." However, it didn't show up in any of his medical records.[1] In August 2011 NIOSH released its final report based on the HHE that BP requested, which is not unlike the 1989 report they did after Exxon Valdez. Both reports disregard all chemical related health effects. The final NIOSH HHE reports for the Exxon Valdez oil spill and BP Gulf oil spill are included in this affidavit as Exhibit 4 and Exhibit 5.

3. BP and Government Continue to Ignore Health Risks

I had meetings with NIOSH, OSHA and the Coast Guard in Venice on separate occasions, which resulted in a meeting at the BP Unified Command Center on July 3, 2010 to discuss respiratory

[1] See Exhibit 3.B

cpb

cps

safety protection issues for VoO workers. As demonstrated by the sign-in sheet, at that meeting there were four in-situ captains, and government and BP representatives. When I walked into the meeting, a Coast Guard representative dropped an Incident Report right in front of me that documented Corexit use close to VoO vessels in May 2010. The sign-in sheet and Incident Report are included in this affidavit as Exhibit 6. On May 5, 2010 there were four different incidences where the planes sprayed inside of procedural distances. They were supposed to maintain a safe distance of one mile from any vessels or platforms and three miles from the source (well location), but according to the Incident Report, on two occasions a plane, reported as a "Coast Guard" plane, passed directly over a platform while spraying dispersants. VoO workers also shared with me that Corexit was sprayed right next to the VoO boats early in the cleanup. In the early stages of the oil spill BP used Corexit 9527A, which contains 2-butoxy ethanol. The Hazardous Substance Fact Sheet for 2-butoxy ethanol lists the same health effects that people are now having, including problems with the lung, heart and liver.[2]

At the July 3 meeting I went head to head with several people on the issue of respiratory protection. I spoke with Dr. Robert Bourgeois of the Bourgeois Medical Clinic. He was hired by HHS to work on the oil spill response, and he was board certified in occupational medicine. However, when I spoke with him about the need for workers to have respirators, he argued against it because the workers would have to have a complete physical and shave in order to wear the respirators. Further, he thought that some workers would not be eligible to work on the job if they could not pass the physical. I responded, "You're going to risk a man's life because you don't want him to have a physical or shave his beard?" I was shocked.

At that same meeting I explained to Alan Allen, the BP technical advisor who ran the in-situ team, "My training has taught me that when you burn dangerous chemicals, you form oxides that are even more dangerous than the chemical that you started out with; if you burn H2S gas, which is hydrogen sulfide, then the hydrogen burns off and you end up with sulfur dioxide, which can kill you. That applies to almost all dangerous chemicals." Then I asked him, "Do you have any data on what is in the smoke?" He replied that he did not. I asked him, "Do you have any tests or a way to determine what is in the smoke?" He responded that they did not, but that it was not hazardous because they stay upwind of the burn.

That was not the reality, however. I know through photos and firsthand accounts that the in-situ teams were often exposed to the smoke from the burns. These workers had not yet been to HAZMAT training, never had a physical, never took a pulmonary lung test or had blood work. But they were sent out there to conduct the burn with no respiratory protection and no supplied air. They didn't even have an escape pack.

[2] See Exhibit 3.E

cps

ED_001324_00007754-00162

cPS

From 1974 to 1978 I worked in the Gulf of Mexico as an electronic technician. We worked with H2S gas, which can be one of the toxic compounds from the crude oil. When it is burns it becomes sulfur dioxide. We were required to have training, a physical, a pulmonary and a lung test. Every man on the job had to have access to supplied air, especially in the event of an accident, in case someone needed to escape by boat from the rig worksite. With the exception of the four-hour training, none of that was done preceding the response, when it could have had an impact.

I went back and forth with David Bates, OSHA area director, on this matter. Later in the cleanup they actually trained and fit tested the in-situ team for respiratory protection. Email correspondence between myself and David Bates is included in this affidavit as Exhibit 7.A and Exhibit 7.B. They never admitted that it was a hazardous environment, but they eventually put escape packs and air packs on the in-situ team boats. However, by the time they responded to our requests for respirators and escape packs, all of the controlled burns already had been completed. It was too late. The damage to the workers' health already had been done. BP sent them out there in the blind. These are fishermen who before the BP oil spill had never worked in those conditions a day in their life, and they were not informed about the dangers of the chemicals that they would be exposed to until after they were exposed. They were out there on top of the oil with basic hardhats and steel toed boots until July. BP didn't provide the HAZWOPER training until after the fact, after we were vocal about the need to protect the workers.

There were millions of gallons of oil spewing into the Gulf. Louisiana Sweet Crude is 40% by volume light ends, such as xylene, toluene and benzene. Along Venice they were spraying the more toxic dispersant Corexit 9527A where VoO cleanup workers were working. It was only a matter of time before the workers and then public became sick. As part of an impromptu meeting to provide feedback from the shrimping industry to EPA and NOAA, I met with EPA Administrator Lisa Jackson in Venice on June 1, 2010. By that point, already 800,000 to 900,000 gallons of Corexit 9527A had been sprayed. I was sitting across the table from Ms. Jackson and I asked her, "Why is it that when you have all of this going on and three air monitors from Venice, Louisiana, EPA's reports are not showing any high levels of chemicals?" Ms. Jackson responded, "Well the levels were a little high, but we didn't want to create a public panic." I responded, "You are scaring the hell out of me."

After we complained to our Louisiana Senators and Congressmen, HHS did send a mobile medical unit to Venice. Parents also were contacting their elected leaders, because all of their kids were getting sick. The medical unit addressed people on the VoO program, in addition to community members. It was advertised as an independent US government mobile medical unit

cPS

where workers and residents could access freely and anonymously.[3] However, that was not the case.

When I went to Venice to survey the medical unit, it was located at a BP compound. If I had not been so persuasive, I would not have been able to enter the compound, much less one of the community members who really needed medical help. It took me 30 minutes to get in. I had to indicate who I was and where I was going, wade through Louisiana state police, Plaquemines Parish police and BP security. Then two BP representatives escorted me to the US government mobile medical unit.

When I arrived at the medical unit, HHS representative Susan Simmons was present, and an old country doctor. The doctor was a fine gentleman, but he would not know what chemical exposure looked like if it jumped up and hit him in his face. He admitted to me that he was only a "General Practitioner". The on-site medical response was run by Acadian, a private company hired by BP. Acadian screened the whole process and took your contact information. If a cleanup worker got off a VoO boat and wanted to obtain support through this HHS medical unit, he would first have to report to Acadian and I believe he would have had a very difficult time remaining anonymous. Further, based on the clear lack of medical expertise for chemical exposure, this medical clinic could only band-aid the reported health problems. Before I left I asked Ms. Simmons to send me a report of the people that used the clinic. However, she did not contact me or return my calls.

4. Conclusion

The Coast Guard, the Obama administration and all of the agency representatives helped cover-up the harm that BP has caused in the Gulf. If I have to die tomorrow or 100 years from now, I will go to my grave saying that. I have never heard such intelligent people make such ridiculous statements, especially in high levels of government, until the oil spill cleanup took place. You look at these people of power in the eye, and you both know what they are doing will cause harm. However, they continue to do it, and you can't do anything about it. It is a very bad feeling.

History is repeating itself. We witnessed the same government response to Agent Orange during the Vietnam war, and to the health problems of Exxon Valdez cleanup workers and 9/11 first responders: After the damage is done, the federal government comes back with programs to examine what went wrong. They were warned before the cleanup began: You are the head of this

[3] Press Release, Department of Health and Human Services, Federal Mobile Medical Unit Arrives in Louisiana (May 31, 2010), *available at* http://www.hhs.gov/news/press/2010pres/05/20100531a.html.

cps

agency and I am telling you that if you don't change your approach to the cleanup, people are going to get hurt. However, the government continued to use Corexit and not provide the workers proper safety equipment.

Five to ten years down the road these studies may determine that the federal government and BP put workers and the public in harm's way through inadequate PPE and the use of Corexit. That is too late and unacceptable; we need people treated as well. What about the sick people currently, and those who already have died? I am concerned that the people who are the sickest will be given an unreasonable burden in trying to prove the connection between their health problems and their chemical exposure. This is a longstanding problem in the petrochemical industry. The doctors do not readily diagnose chemical exposure and in turn they tend to diagnose the individual symptoms. It is a common practice in oil producing states. We need trained medical physicians down here that are willing to diagnose and treat chemical exposure.

Every time you come to a dead end or stop-sign on responsible cleanup practices and can't figure out what was going on, it likely involved efforts to protect BPs liability. That includes not protecting the now-sick workers by denying them respiratory protection during the cleanup. Had BP let it be recorded that there were unsafe chemical levels on the Gulf Coast or any one of these job sites that required respiratory protection, they would have had to face in court respiratory illness claims from Key West, Florida to Brownsville, Texas. Exxon got away with compensating workers for medical claims 20 years ago during the Exxon Valdez spill, and now BP is trying to skirt its responsibility to adequately compensate sick workers and residents.

We tried everything that we knew to preempt the need for medical care, by advocating for safe and responsible practices during the cleanup. We relentlessly briefed and warned government officials and BP representatives about the human health dangers created by their response to the spill. When I hit a brick wall, I resorted to trying to hold officials publicly accountable. You name it, I did it. It happened during a Democratic administration, but if it had been a Republican administration we would have witnessed a government cover-up as well. Why is the most powerful country in the world being pushed around by an oil company? I used to stay up in the middle of the night crying, trying to answer that question and what I could do to affect the situation.

cps

ED_001324_00007754-00165

I have read the foregoing eight page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on January 24, 2013.

Clint Brady

Subscribed and sworn to before me
this 13 day of February 2013

Notary Public

My Commission expires on: at death

AFFIDAVIT

My name is Jamie Griffin Simon. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am 33 years old. When the spill happened, BP signed a contract with the company I worked for, GIS Logistics Center ("GIS"), to supply a barge for the workers at a decontamination ("decon") site. I would provide the cooking and cleaning on the bunkhouse at the Grand Isle Shipyard dock. From May through October 2010 I worked 18 hours a day. My company rented me out to BP. After the first month of working there I began getting sick, and problems with my nervous system continue to get worse. I am submitting this statement because I feel that, as a company that has employees who have to deal with harmful chemicals and situations, it is their responsibility to make sure that their employees are aware of what they are handling and that they provide them with proper safety equipment. I am a cook. They sent me in the middle of the cleanup to do what I do, and put me in harm's way, and it could have been prevented by informing me of the hazards before I was exposed.

I graduated from a high school for Talented and Gifted Children, the Louisiana School for Math, Science and the Arts. You have to apply, and they only accept 200 in Louisiana each year. There are only 10 of these schools in the country, and 5,000 can attend nationwide each year. I double majored in child psychology and vocal/music education at the University of New Orleans, but I did not finish. I got in a car accident at age 19 and withdrew due to medical problems. Then I got married. In August 2004 through early 2005 I was a corrections officer at Lafourche Parish Detention Center, and in the kitchen I also supervised trustees, who are people in jail with extra privileges.

My mom died in 2003, so I took time off to help raise my little brother. When I went back to work I was cooking as a part time job so that I could be available for my brother. In 2005 I obtained my Board of Health certification, and that license is my license everywhere I go. Also part-time I taught singing and piano until the oil spill happened, from age 22 to 32. I worked for GIS from August 2006 until August 2011. GIS is located in Galliano, Louisiana, but the houseboat that it provided for the decon facility was located in Grand Isle, Louisiana at the Grand Isle Shipyard. When I worked on the barge there I was the head cook supervisor. However, I did many tasks not in my job description in order to help get everything done. I'm not the kind of person who would tell my employees to do something that I'm not willing to do myself.

1. DECON SITE OVERNIGHT

My coworker, hereinafter referred to as "Susie" for purposes of this statement, and I were the first two to arrive on the site in early May 2010 where we would live, clean, cook, sleep and eat for almost six months. The yard was empty when we arrived. The first few days we bought the sheets for people to sleep, and other items to supply the barge. The ventilation system of the

whole barge had mold growing in it, across our bedroom wall. Every day we would tackle a new area to try to get the mold off. So the few days before it was opened we did the best we could to make it livable. They built it into a decon location in three days. Workers began coming through the galley in mid May. It was a small galley and only equipped to feed 40 people and seat 12 people; however, we were serving hundreds of people, so there was a constant line of people going in and out. In the first week it was 100 workers. It grew to 380 at its peak, and generally was over 250 people.

There were so many decon companies contracted to BP that were located at the site; I couldn't distinguish who worked for whom. New Horizon, Miller, Triangle, and a separate contracted company would sit at their vacuum truck until they were needed; it looked like an assembly line of trucks. They only worked 20 minutes of the hour and would break for 40 minutes. A lot of what I know is because on their breaks the workers would come in the barge and make conversation with me.

They were saving the oil in drones so that they could refine it; 18-wheelers would pick the drones up and drop off empty ones. I asked one of the Grand Isle Shipyard foremen, "What are you doing with this?" He said it is filled with oil so that that BP can send it to get refined and separated. That way they will not lose all of the money, and they can resell it. He took me for a ride to see it. I was within feet of it, and he explained how it worked and what they did. The barge we lived on was docked up to the ramp. The shipyard workers would bring boats in, lift them up on risers, clean the bottoms, unload the booms, and get their ships decontaminated. All the workers there would handle boom, ships, oil and the drones of the handled oil. Everything they could clean from the boat would fall into a black tray that they stood in. Then the vacuum truck would suck up the stuff in the tray, and they would send it somewhere to be refined.

However, the stuff that they wanted to resell had Corexit in it, so God knows how many people in the world got contaminated oil. The dispersant was mixed in with the oil that they removed during decon. I could smell it when I went to the decon centers. I knew the smell from when the dispersant was sprayed. It smelled strongly of chemicals, like burning hair perm solution but worse. When they were spraying it, the smell was strongest, because it was in the air. They sprayed dispersant during the time I was working on the barge from May 2010 through October 2010. However, after I stopped working I would still go to Grand Isle, because I have family and friends out there. The last time I was out there in January 2011, and I saw what I believed to be spraying. The C130 plane that sprayed the Corexit looked like a bomber plane, and was gray. When they sprayed what looked like a white substance leaving both wings, the planes would go back and forth like a grid and cover the whole area, and then they would move to a different location.

In late 2011 at Walmart I saw the foreman who first showed me the decon process. He had lost a lot of weight and was pale. I told him about my situation, and he said he has been really sick too but never thought that there could be a connection to his work conditions.

JYS

2. DANGEROUS WORKING CONDITIONS

Susie and I would wash the clothes for the Grand Isle shipyard folks who were doing the decontamination and stayed on the barge. There were 30 to 40 of them at any given time. The burnt perm smell from the spraying is the same smell that was on the workers' clothes. Sometimes we would have to wash the clothes multiple times, because I didn't want to give the workers something that smelled like chemicals and felt soiled by chemicals. Sometimes we would have to first soak the oiled clothes in buckets. They were never completely clean. I tried everything, including OxyClean and Tide. I also used bleach for the white clothes, but we could never get them completely clean. When we put the clothes in the dryer I had to leave the room, because the fumes were so strong that it made me want to pass out. The clothes were abnormally hot when I took them out from the dryer as well. It smelled distinct from the oil. The workers were provided with Tyvek protective suits, but it was so hot that they pulled them down at times. The hotter it got, the worse the smell was. For me now, the hotter it is in my environment, the worse I feel.

The oil sludge that they and other workers brought in on their boots became a problem and was dangerous, because it was very slippery. We only had one oven and one stove to cook for hundreds of people. We would start serving around 10:30 am and wouldn't stop until 2:00 pm. For dinner we started serving at 4:30 pm and wouldn't finish until 8:00 pm. They would then walk through the galley with what they were using to decontaminate the boats and the Corexit on their boots, and the floor would be soaked with this oily concoction by the end of the day.

Early on I asked a BP staff member how I could clean the dispersed oil sludge, and what was in it. The reason I was asking wasn't for my health. I didn't want to create combustion and start a fire, so I asked what I could use that wouldn't make a chemical reaction. For example, if you mix ammonia and bleach together and stand in that room you can die, because it puts off a vapor and gas. He said that the stuff on the floor that I was cleaning, which was a dispersed oil sludge – the texture of really old thick coffee but slippery to the touch – was "as safe as Dawn dishwashing detergent," and I could mop it like I mopped any other floor; no special treatment was needed. The decon facility was cleaning the oiled boats with Citra Clean as well, which is a type of industrial degreaser, so it was a mixture of chemicals from the dispersant, crude oil and Citra Clean. I mopped it, touched it and would wring out the mop, and walked on the floors because I slept there. It would leave a residue on the floor no matter how much we mopped it.

Every time I would tell my bosses there are certain things that we could not reasonably do, they weren't having it. Examples are summarized below. James Craig, the head honcho at GIS, would keep an eye over the Grand Isle Shipyard operation, because he was the boss of my normal GIS supervisor, hereinafter referred to as "Ms. Carol" for purposes of this statement. Ms. Carol worked out of Galliano, but she supervised me and the other GIS employees on the barge. Mr. Craig didn't want to spend the money on the additional equipment to help the barge run safely

JYS

JJS

(detailed below). When I reported problems to Ms. Carol, her supervision would tell her, "We don't want to spend the money, make it work." Curry Matherne ("Mr. Curry") was the supervisor I had to report to on the barge. I really don't know who he worked for, because there were so many companies.

The floor problem got so bad that I requested to Mr. Curry that they buy the hospital booties for the workers, so that they could slip them over their dirty boots at least. He never got back to me when I said that we needed relief from the disaster on the floor, so I stopped complaining. Instead their solution was to bring in long running rugs, from where the workers would enter to exit the galley. Then at the end of every meal we had to take these rugs outside and hose them down because they were only changed once a week. When we cleaned them it would splash onto us. The rugs started red, and by the end of each week they were a dried mud grayish hue.

I reported to Mr. Curry that we still had to handle these soiled rugs, and he shrugged. I told him all the time, "You need to sit in here and see what happens in this galley. I can handle my job, this is not a job, this is an impossible task that you gave me to do." After three weeks they sent one other employee who is mentally handicapped, and was not helpful. He wanted to be helpful, but he didn't have the mental capacity to do the job so we had to watch over him and tell him what to do. I believe that mentally handicapped people have a right to work, but not under these conditions. Then in July 2010 Ms. Carol received all of my paperwork and would come once a week too to observe the conditions, but she didn't have enough pull to change things.

The conditions were very bad on the barge. Groceries stayed in a refrigerator truck outside, and we had to climb over the edge and jump back and forth from the truck. The refrigerator was the size of a dresser, and food was not kept in the proper temperatures. Rather, all boxes were thrown on top of one another and half defrosted. The company would let the truck run out of fuel before the groceries cooled. I would call supervisors and warn them to change these conditions, before all of the workers died of food poisoning. Then the workers complained they had diarrhea, because of the temperature problem. I understand my supervisor thought the food wasn't that big a deal, but it was that big of a deal when you have that many people consuming something hazardous.

I complained repeatedly that I had my public health license on the line. Every major violation that I get is on my record and affects me. I wasn't there for the state board of health inspection, but the Coast Guard inspector would come at least once a week and kept writing violations. I was hoping he would indicate that there were major violations to help me make my case that the conditions were so bad. Within a month on the job they fixed the fridge problem. Another safety concern was that I would have to go down the gang plank, which was very dangerous, and carry 50 cases of groceries. Later, after someone got hurt walking on the plank, they made a permanent ramp.

JJS

We are taught in this business that it isn't any of our business what type of misconduct is taking place. I used to cater big executive parties and was told, "You ignore what you see, do your job and go home." However, I want to follow the book and go by the rules when other people's safety is at risk. My supervisor probably got sick of me for constantly reporting safety concerns, but the whole operation was a disaster from the get-go.

Every morning I would write a work planning safety environmental analysis (WPSEA). It would include all of the hazards on the job. Now all the WPSEAs are gone, and we had to write one every morning. I was told to throw them away when I still worked there, but I didn't. We saved them in my room in milk crates, faced down so that they would be in dated order. Then Susie told me that when they packed everything up to come home, she was told by one of the supervisors to throw the paperwork in the dumpster, because it wasn't needed. However, legally they are required to leave the paperwork for a certain amount of time after we left the barge. The GIS secretary that inputs company paperwork told me that they are legally required to keep them for a certain amount of time. When I worked on the barge I inquired what will happen to them and was told, "Don't worry about them, no one looks at them, there is no one to hand them into, just keep them in the box," and then after I left the job they tossed them in the trash. Now there is no record or documentation that they told me it was safe to mop the floor. However, my whole crew knows that we wrote them because they had to sign them every day.

3. HEALTH PROBLEMS

At first I didn't realize how unsafe the chemicals in my environment were when I worked on the barge. However, I started having health problems that went on for months and months after, and I couldn't shake the symptoms. My health problems started with bad headaches and nose bleeds from the first week on the job, once they started using the chemicals. It was a flu like symptom that didn't go away. I had diarrhea for seven months. I thought it was a food problem, but they already had fixed the fridge.

When we washed the clothes and cleaned the floors I wore kitchen gloves, but they did not cover my full arms, so all the time my arms would itch. It was an 18-hour day, from 2:00 am to 8:00 pm. The hours weren't abnormal for me, but this was strenuous; I had to carry 50 cases of groceries to cook one meal. I can bench press 285 pounds; I could beat a grown man down to the ground. For me to tell you it was hard meant it was hard. I would cry at night and tell Susie, I just want to go home. She would ask me, "Please don't leave me by myself," and we would cry because we were so tired we couldn't move.

The first time I got really sick was in June 2010. It was a month into the job, and I got up and was feeling very heavy. I took heartburn pill. We did make breakfast, but I explained to Susie, "I don't feel right, I am lightheaded and dizzy." The medic on site put an oxygen mask on me and when the ambulance showed up they told him to take it off me, because it was unclear what was wrong. The Grand Isle ambulance took me from the job site to the ER at Lady of the Sea

ED_001324_00007754-00171

JGS

Hospital. When I arrived, a GIS representative was present and the first thing he made me do was take a drug test. He also had me fill out a safety report and sign it. However, I didn't know that it was due to chemical exposure at that time; they told me I had a panic attach. The ER did an electrocardiogram (EKG) to test the electrical activity of my heart, and it gave a normal reading. Then the ER doctor, Dr. Krenshaw, asked if I was under a lot of stress and I told him yes, I have a stressful job, and he concluded that I had a panic attack. I guess it is possible, but I never had a panic attack before then, and I don't normally crack under pressure. The GIS representative then told me to take two days off and follow up with the company doctor, Dr. Blanchard, on Monday. Dr. Blanchard asked if I had chest pains, and told me to return back to work.

At first I was working straight with no days off. Then after I returned from the hospital in mid June the other head cook, hereinafter referred to as "Ms. Betsy" for purposes of this statement, was hired. I was recently informed by a co-worker that Ms. Betsy is now having severe health issues. In addition to Ms. Betsy, eventually I had ten additional employees to help run the barge after I returned from the ER. Despite the additional help, my health problems progressed. I had dizziness and confusion. The week before I went to the ER, I forgot to make a grocery order. I thought I was just forgetting because of stress. In June 2010 I began experiencing the initial symptoms, such as memory losses, cramps, nose bleeds, cramps and eye problems. The symptoms were so bizarre and such a broad range that I never thought one thing could be causing all of it. Then I started forgetting really important stuff like paying my light bill, which is not like me because I had money and am conscientious about my finances. So I asked my aunt to take my checkbook and pay the bills. I was having muscles spasms so bad that I couldn't get out of bed. I was having charley horses but even the muscle in my lip cramped up, which is odd, and continues to this day.

Shortly after I went to the ER, in June 2010 the medic on the job site, Katie, told me I ate too many pickles and had digested too much potassium. I am guessing Katie worked for BP, because she was located at the front of the barge where BP staff was stationed. I quit eating pickles, but my muscle spasms didn't stop. Last weekend I had them so bad that I had to lie in bed for two hours and not move. I couldn't unbend all of my fingers, and I looked like an 80 year old woman with arthritis. On the side of my calf, you could see the indent where it was happening. And I had cold sweats, so I had to walk around the room to try to get it to stop. My ribs hurt from it. Sometimes days and days after I get these spasms I'm tender and it feels like someone beat me up. On the barge it happened frequently, then when I got home I would get it about once weekly, and now I get it once month.

I believe in early August 2010 Ms. Carol sent one of her girls to work with us for a day to witness the conditions. She nearly had a break down by the time she left. She said "That is the most insane job that Jamie and Susie have to do, they are crazy. I would have left." I let her go home early; she had tears running down her cheeks and said she couldn't do it. She was stuttering, beside herself by how hard it was. I found out that she had to take three days to calm

JGS

JGS

herself down and lay on a heating and ice pad. I said, "See, I'm not being unreasonable." Ms. Carol told her boss Mr. Craig that the working conditions weren't realistic, and he said, "Well, if they don't want their job they can leave." That whole episode was after I went to the ER, and they had hired additional workers.

In late May 2010 and early June 2010, a woman who worked for Miller was placed in our barge, because they thought it would be better to put her with us since there were females. She kept complaining about the living conditions and nose bleeds, and Mr. Curry said, "What do you think this is, a Holiday Inn? You're out here to work, and in a man's world." Instead of fixing the conditions, they made her move out and made a rule that only GIS personnel could live on the barge, because it was GIS property. As GIS employees, we were told we couldn't complain.

My symptoms continue to this day. Sometimes I feel like I ate razorblades, as if I would have swallowed something with a lot of sharp edges. My throat is severely irritated and burns with fire if I try to drink something with too much acid, such as coke or anything spicy. Then two days later I am completely hoarse. Then it goes away and I am back to this cough. It is like a constant vicious cycle. It got progressively worse and worse and worse. Before I went to sleep I would be in socks, and now I have a foot that looks like fish scales. I began getting these rashes on my feet around December 2010. I've been to two podiatrists. One tried to tell me it was athletes' foot, another said it was swelling (detailed below). The podiatrists have done all of the tests and said that there is no explanation. My foot's exposure to these chemicals is that I walked on the galley floors that still had dispersed oil remnants regardless of how much I mopped.

I am the kind of employee who will do the job I need to do until I die. I have never been late and never failed to have a meal ready on time. I will get a job done under any circumstance you have. Susie is the same way, a very dedicated employee. But I could no longer function, so in October 2010 I called Ms. Carol and said, "I need to come home." I explained that I didn't feel well enough to work. I kept missing more work, and I was the person who never missed work. She said I could go back to my normal location in Galliano, Louisiana. At that point they had called in a catering company for the site I had been working at, because the numbers got so big that two of us couldn't feed all of them.

4. DOCTOR VISITS

I went back to a normal location in Galliano at the Logistics Center. We house 80 to 250 people there. It is less stressful, less work. I thought my health problems would settle down, but they stayed bad. The galleyhand asked me what was wrong, and I told her I didn't know but I hadn't been myself. She said I was always sick and look like I'm going to die, but I kept pushing off going to the doctor. I got through Christmas and then in January 2011 I couldn't do it anymore. I started going to doctors.

The problems with my eye became more severe in October 2010. It was more aggravating than painful. Then I woke up one morning in November 2010 and my eye was swollen shut from

JGS

JMS

puss. I stayed almost blind from one eye for almost a year. I went to work then I left to see the eye doctor employed by GIS told me I had conjunctivitis, which is pink eye. I could see people but not make out details. I did not gain sight back fully, but the eye doctor gave me an antibiotic drop that helped some. He never said, "Jamie, you need to see anther eye doctor or run a test." The extent of his concern was, "Huh, I'll be damned."

I went back to work the following day. I put in my eye drops faithfully, but it didn't clear up. A few weeks later, I saw Dr. DeBellevue, an eye doctor at Walmart. He referred me to a retinal specialist. I was in the process of a treatment with Dr. Michael Robichaux ("Dr. Mike"), an ear nose and throat doctor whom I have been going to since I was a baby, and he cleared it up within days. However, the sauna was a component of the treatment, and it made me feel sick so I stopped doing the treatment and slowly the eyesight problems returned. Then I went to the retinal specialist in December 2010, who said there was good news and bad news. The good is that there was no damage to the eye itself. The bad is that because I couldn't see out of it, it means it's neurological. Odd that when I went through Dr. Mike's treatment, the two things that cleared up were my eye sight and memory at the same time, and this was further confirmed by the retinal doctor's analysis.

When I first got sick, before I knew the cause of my problems, I called and asked to see Dr. Hutchinson at Lady of the Sea, in the fall of 2010. I asked if they were taking new patients. She said yes and took my personal information. Then she asked me what the reason for the visit was and I said, I'm not positive but I think it could be related to my time on the BP job." She said to wait, put me on hold for about two minutes, then came back and said "We are not taking new patients" and she hung up.

I then saw the neurologist. Most problems are on my right side; if the left part of the brain is damaged, it would be the right side of your body that is damaged. Since April 2011 Dr. Mike, another doctor, my lawyer and the social security office have called and faxed the GIS company eye doctor who treated me for conjunctivitis and told him they need the medical records. However, to this day he won't release them. I personally called and asked how to get them and did what they instructed, and they still wouldn't hand the records over. When my lawyer and I called around November 2011 the receptionist said, "Jamie's medical file is in a lawyer's office, because the doctor is getting a divorce and we need to figure out how much money he made." My medical file should have nothing to do with his divorce. Regardless, since then nothing been handed over. GIS operates this way; they are very quick to pass the buck onto someone else.

On July 1, 2011 a podiatrist out of Ochsner Hospital New Orleans also told me she didn't think my foot swelling could be due to my exposure. She told me that there were only two things that could cause it; a blood clot in my leg, or a mass or tumor that could be putting pressure on the nerve. However, the podiatrist's office called to tell me that both tests came back negative. I asked, "What do I do if both of the tests came back negative, and my foot is still swelling?" The

JMS

JSS

receptionist said they would call me back, but they never did. To this day my foot continues to swell.

The things I remember and don't are weird. Right around the time I got sick on the barge in June 2010 is when I started noticing my memory loss. I didn't really notice it was a memory problem until I started writing things down on calendars and making lists. Then I realized this was more than me being too busy. It gradually progressed into severe problems. People I knew I would forget. And then some days I could remember everything. In December 2010 I left my house with no pants on; I was going to work with a shirt, drawers, and no pants, until I got half way down the road in my car and realized. I laugh because it is funny, but it's not funny. I have lived in Houma for six years. In the summer of 2011 I went to Houma and got lost, for four and a half hours. I couldn't remember why I went to Houma, or where I was. I had to call my little brother and ask. Then my aunt asked me why I didn't use my OnStar GPS, and it didn't even occur to me.

We make a lot of jokes to try to keep on the upbeat side, but it gets really frustrating. I call my aunt and tell her I'm losing it, because I'm not used to this. I used to be able to tell you the vehicle identification number of the first car I ever owned. Numbers are how my brain works, and now I can't tell my eyes from my head sometimes. I went to school for music, and part-time I taught singing and piano until the oil spill happened, from age 22 to 32. Now I can't remember how to play the piano. I sit at the piano and I cry, because I know that I should know how to play it but I can't remember.

5. CHEMICALS IN BLOOD

I didn't report my memory lapses when I was working on the barge. I never put it together that this was related to the BP job, until the summer of 2011. I had gone to Ms. Carol's office privately, because we were close and friends. I told her I needed time off to see a doctor to figure out what was wrong with me. She told me to take the time to figure out what is wrong, and that she would cover for me and find someone to fill in if I needed more time. All of my problems were so far off from each other, who would have thought that my foot, eye and memory problems could all be related?

I contacted my aunt and she saw an article that said Dr. Mike thinks there is a connection to the spill. Before I saw Dr. Mike for treatment, I had consumed almost nothing for two weeks. I went from 320 to 280 lbs, and eventually I lost 70 pounds. I couldn't hold down food, I puked vile. A photo of my bloody vomit is included in this affidavit as Exhibit 1. My blood sugar was so low I was about to pass out. Dr. Mike had not made that connection when I was first seeing him. However, he began finding high levels of chemicals from the oil and dispersant in people's blood, and they were having the same health problems. I went back to Dr. Mike, and he reminded me I was constantly exposed to the oil and dispersant chemicals when working on the

JSS

barge. At first I said no, even though I touched their clothes and mopped the floors. I kept telling him that at age 32 I'm just getting old, until I saw my blood test results.

They tested me for a Volatile Solvent Profile test, which identified the chemicals used in the oil spill in my blood. An copy of my test results is included in this affidavit as Exhibit 2. Out of the 10 chemicals they tested me for, I was positive for seven. The other three were in me, but below the detection level which meant that, while exposed, they would not harm me. My benzene level was in the 90th percentile and toluene was in 95th percentile, which are harmful levels. When I looked up how they affect health it looked like reading my medical records. Almost all of the health symptoms associated with exposure to the chemicals in my blood test has happened to me. Most prominent, with toluene, it listed blindness, seizures, nausea, vomiting, skin rashes and neurological problems.

The Material Safety Data Sheets (MSDS) for Corexit list several of the health problems I am now having, and they still used over two million gallons of it throughout the Gulf. However, when I saw doctors they denied that I was exposed. I am a music teacher and a chef. I didn't work in conditions that would expose me to these levels of toxicity, until working on the barge. When I lived on the barge, for 24-hours a day I was exposed. I would be outside too, breathing in what they were burning, without a respirator or a Tyvek suit. I had an apron, a hairnet, a spatula and some rubber gloves, and they told me to go in the midst of this dangerous chemical environment. Yet they were willing to tell me that the dispersant mixed in with the oil I was cleaning was as safe as touching Dawn dishwashing soap? Then a year later I have health problems that I have never had before working on the barge, and my employer had the nerve to tell me that my work environment didn't do that to me.

After Dr. Mike helped me make the connection between my exposure and my health problems, I called Ms. Carol and told her, "I just saw the doctor, and he thinks that the reason I'm sick is from the chemicals from the oil spill." We hung up and I went to see my first lawyer, Theo Nuggent. I didn't know at the time but he owned a company that was contracted out by BP, so I ended up leaving him. I took a week off and got by blood tested.

6. RETALIATION

From May 2011 until November 2011, after my boyfriend moved in with me, I had weird things happen at my house. Someone had been there several times. After I met with Dr. Mike, he told me to start keeping a journal to catalogue my health problems. Nothing was stolen but someone ripped out the beginning pages from my journal and rearranged things in my house. One time I came home and my trash was folded neatly in my garbage bag. Someone dug through my filing cabinet and went through my night table drawer, because papers were scatter and items and rearranged. They glued down the lose tiles on my floor. I think someone was trying to mess with my head, because how are you going to call the cops and report these instances? One time I came

JJS

home and my tea candles were lit. However, tea candles only burn for four hours, and I had not been home for 20 hours.

The first week of April 2011 I was at Dr. Mike's, and I spoke with a reporter. She wrote an article that quoted me and was later posted on Yahoo News. I didn't even know at that point I was on the Yahoo News. However, Ms. Carol called me on April 12 and said, "Mr. Craig questioned me and I wouldn't tell him anything." He kept asking where I was and why I was out and what kind of medications I was on. He was harassing her about me and she said, "You will have to ask Jamie." She felt it wasn't right for him to be harassing me, because I was sick. She warned me, "Jamie, if he finds out that you are raising concerns, you will be fired." She told me, and it was later confirmed by several of my girls, that Mr. Craig had held a morning meeting, and said that if anyone who worked on the oil spill felt that they needed to see a doctor, they first have to see the GIS doctor or else they will be terminated. He also said that if anyone went into litigation with BP, they would lose their jobs. Then he asked if anyone felt they needed medical attention, and no one said anything because of course they were scared. I said to Ms. Carol, "Well, I guess he will have to fire me, because it's too late, I can't go back to the doctor and say 'Can you unsee me?'" I was sick and missed two weeks of work, but I had doctor's notes.

I can't imagine having to go through this without medicine or rest. I don't know how the others do it. Susie and another former coworker who worked on the barge, "Ms. Cindy," refuse to go to the doctor, because they are both scared of losing their jobs. They both worked in Grand Isle when I did. Susie, who was my assistant and did almost everything I did, constantly has respiratory problems and is always with flu like symptoms, but she doesn't have the flu. Her ankles were swollen to the size of melons when we were running the barge. She would put pillows at end of the bed to prop her foot up, and we thought it was due to her being on her feet for so long and they continue to swell, just like mine. I am beginning to think it's something else, because I'm not working currently and my ankle still swells. It can't be fluid, because the rest of my body is not swollen. It puffs up and hurts so bad, because the pressure is on it and I limp. If I stay off it for days I am ok, but I can't live the rest of my life in bed because of my foot.

One of my high school friends contacted me in September, 2011 because her mom works for a motel, which is located on Grand Isle and housed the BP cleanup workers. She was changing their beds and washing their clothes, which is part of her job at the hotel, and she ended up with the same list of symptoms as me; blind in one eye, one swollen foot, and memory loss. When people that she knows started getting sick and coming forward, she wondered if it could be related and if she should try to get the blood test that I took. I arranged for her to get the blood test and it came back highly positive. She is in the 95th percentile for ethylbenzene, hexane, 2-methylpentane, 3-methylpentane and isooctane. Her benzene is in the 90th percentile.

Ms. Cindy also felt sick around the time I did, and is still in bad shape. She didn't start working in Grand Isle until late summer. She cleaned the office buildings and trailers that the clean-up workers stayed in. She has a rash all over her body that comes and goes. After she washes a

JJS

JJS

batch of dishes her arms will flare up in red patches. When we were working back at the barge together, one day she showed me her back and it was covered in these small red rashes of pumps. But after Mr. Craig held the meeting that all employees had to see a company doctor, Ms. Cindy grew scared. She is in her late 50's and so gullible it's not funny. She is mild tempered, meek, trusting and would never do anything to hurt anyone, and he scared the heck out of her. She was crying, she said she knew she was sick and could not pay the bills without a job. I understand that, I need my job too, but someone needs to hold them accountable. I'm not going to compromise the life of myself or others. Just as I'm not going to watch a lady get mugged, and not chase down the mugger. I always stand up for what I believe.

When I returned to work on April 30, 2011 it was a hostile environment and everyone was walking on eggshells. There were more cameras, and they started timing our breaks. Two days later Ms. Carol was fired. Mr. Craig and Eric Callais from Human Resources went straight to Ms. Carol's office. No one knew what was going on, but she started to box stuff up. Then she came into the galley and was crying. She said "Bye all, they are letting me go." Mr. Craig and Mr. Callais had her by her elbow and escorted her out of the building; they wouldn't let her stay to say goodbye.

Then Mr. Craig told me, "I want a meeting with all of the employees now." I rounded up the crew of 13 that I supervised. I got everyone in the galley and we were all crying because we loved Ms. Carol. "It is nothing personal; we are eliminating her position due to cutbacks and unfortunately sometimes it starts at the top." Then he looked at me, because she was my immediate supervisor, and I was second in command. Ms. Carol ran the bunkhouse and I ran the galley. After her firing her he was in charge, so if I called in sick I had to report to him. I always had a doctor's excuse by Dr. Mike. Mr. Craig started making more new rules. He told us if we left work and arrived in the middle of the day we had to fill out an accident report, because GIS was tracking employee illnesses. Before if you were sick and got a replacement, they didn't care. As long as the position was covered and the jobs got done they were lenient. I asked him why and he said, "We're tracking the wellness of our employees." Then he gave a drawn out lecture about loyalty.

The day after Ms. Carol was fired I confronted Mr. Craig about the article I was quoted in. He said he didn't know what I was talking about. But I said, "If you read it, I want you to know I am the one who got sick." I said "I didn't look for this. I am a faithful employee, for six years I've done it all until the point of impossibility. I work until I bleed. If you feel I hurt GIS by my making statement to the press, I'm sorry. I never said anything about GIS, I said something about BP." We're in a small town and everyone knows who I work with, but I didn't say anything about my employer in the article. I asked him to be patient with me about my doctor's appointments until I figured out what was wrong. I said, "If you need to fire me, do it. It's not my fault I'm sick, I didn't ask you for this. I had no idea I was sick from the oil spill, and that is what the doctor found. If it was you sick or someone in your family you would have a different attitude."He didn't look at me while I was telling him this.

JJS

He went on a mission to drug test me, and I told him he could. I told him "I'm not a drug addict, I've been with the company for years and I have never failed a drug test." When you get hurt on the job they test you right then and there. He also made a rule that we had to have doctor notes if we were sick. He knew I couldn't afford to always go to the doctor, but that I needed to stay in my bed. Still, I was fine with this rule until I found out it only applied to me. I came back and the dispatcher, the bunkhouse's secretary, asked me if I had a doctor's excuse because she didn't want to be questioned. So I gave it to her. Two days later the night cook needed time off and couldn't come in. When she later came in I asked if she had a doctor's excuse, and she said she didn't and I asked if she was asked for a doctor's excuse and she said no, they never do ask her. It upset me that it only applied to me. So the next time they asked me for a note, I said, "Why don't you ask the night cook for hers?" I think they caught on that I had caught on, because they stopped asking me for doctor notes.

Then Mr. Craig started requiring the accident reports. When I got sick they wouldn't let me leave and go home until I got an accident report filed out. It's ridiculous, because the flu or other symptoms are not accident related. When I questioned it he said GIS is starting a new thing and tracking the wellness of their employees. A few weeks after they put the policy in place I wanted to know if they were only tracking our wellness, since we were the department that went to Grand Isle, or if there were tracking other departments as well. I have a friend who works in the main office. I asked if they have new rules put in place and have to fill out an accident report when they get sick and have to leave. She said "No, I've never heard of that. Who told you that?" I said no one and left it alone. They really wanted me to quit.

Mr. Craig tried everything he could to find a reason to fire me but he couldn't, because I do my job. I was with the company for six years, I know the boss personally, I helped organize his kid's baby showers and weddings, yet he stopped talking to me and ignored the fact that anything was going on. I'm the only one treated this way, because I was the only one who came forward that I was sick. "

In November 2010 I was at work and I wasn't feeling well and went to the bathroom. I didn't come back after several minutes. My galleyhand came knocking on the door and found me and I woke up, confused. She asked if I was ok and I asked why and she told me I had been in there for 45 minutes. They last thing I remember was sitting down to pee. Dr. Mike explained that I must have had a seizure. After that, Dr. Mike felt strongly that I needed to stop working. I refused for a long time. As my symptoms progressed and I realized that I couldn't continue to work, in June 2011 Dr. Mike put me on medical leave, and I provided GIS the doctor's note. However, in the beginning of August 2011 I got a termination letter that stated I did not have a doctor's note.

7. THE CHASE

Shortly before I was terminated, in late July 2011 I was driving to New Orleans to visit my aunt and noticed a truck driving through traffic like a maniac. It was weaving through traffic for about

10 minutes, and was approaching me. When it closed in the driver stopped weaving and followed me really close for 15 to 20 miles. Then he sped up next to me. I didn't recognize the guy driving the truck, until I saw the logo. It said GIS, and I recognized it as one of our four company trucks. I tried to speed up ahead to pass him but he sped up too, and wouldn't let me get around him. He made me nervous so I called my aunt and said, in case something were to happen to me, truck number 162 has been following me and is driving like an idiot. When I hung up the phone with my aunt he drove into my lane and actually tried to run me off the road. I called my friend and made it obvious that I was writing his license plate down and showed him I was reporting him. Then he finally left me alone.

All of our vehicles have GPS locators, and this was after I was publicly sick. I think he followed me from home. I live only a few miles from the GIS office. It's a small town and everyone knows what everyone does and drives. I wasn't watching to see if anyone was following. At first I felt threatened when he tried to push me off the road. Then I felt like "Really, after everything you tried to do to me GIS, now you are going to try to run me off the road?" Then I was angry. After the incident I called my lawyer and asked if he thought the incident on the road was a coincidence. Lately I have been paranoid, because I have so much going on. He said if I feel like I'm being threatened, I need to report it. That same day, after the chase stopped, I called the company and repeated the truck number, time and place and told them my name. If they sent him after me, they will know that I reported him. If not and it happened to be a coincidence, then he is reported for bad driving and I am hoping he got reprimanded.

8. WILL NOT BE SILENCED

I don't know what they think they are going to get by watching me, because I am not doing anything that I'm not supposed to. I am a single parent of a child that is not even mine; he is my nephew. My parents adopted him, but my mom was too sick to watch him so I raised him since he was 10 weeks old and took care of her too. My mom died when he was 11, so I finished raising him on my own. His name is Daniel. I am doing the best I can. They can try to run me off the road, but they aren't going to stop me from talking about the dangerous environment that my coworkers and I were forced to work in. All they are going to do is make me fight harder if they try to keep scaring me. When we stand together, we're not as weak as they think we are. Alone I am weak, but against a united voice they are in trouble.

It's not about the money. I don't want one penny, because it is dirty money. If I win my lawsuit, the money can go to charity. All I want is to go back to work so that I can take care of my life and Daniel like I used to. I can sing in six languages, I got a scholarship in music, but now just to be able to sing along with a choir in church is painful. What BP and its contractors took from me is more than they can give me back in any amount of money. My culture, my talent, is God-given. God gave me that voice and they stole it from me.

JSS

Sometimes it gets really frustrating to think that they had total control to stop this. I understand what happened. If what happened after the spill were an accident, I would be the first to say it happened, and it is God's will to take life as it comes. But they did know that these chemicals were unsafe and still allowed people to handle them and breathe them. BP can't use Corexit in its own country, but our government allowed BP to come into our country and harm so many of us. That is why they need to pay for what they did, or else they will do it again knowingly. They have blatant disregard for human life. I am Native American, and we are taught to respect all of God's life. To subject kids to this is unbelievable, and generations of these children will suffer from this. The satisfaction of them having to get up and admit they are wrong, to say, "We're sorry, this is our fault and we have taken responsibility for our actions," will be good enough for me.

There is nothing I have said that I would take back. I am not the type to regret things. I do what I do because I feel it is right. I'm faithful and I will stand up until the day I die. I wrote a letter to BP that I plan on reading in court, because they should know what I went through. A copy of the letter is included in this affidavit as Exhibit 3. I am not just a number, I am a person. What they did was wrong. If they didn't want people to know, they shouldn't have done it.

JSS

I have read the foregoing 15 page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on February 28, 2012.

Subscribed and sworn to before me
this 10th day of April, 2012

Notary Public

My Commission expires on: w/ life

KERRY P. PAPA
NOTARY PUBLIC
PARISH OF LAFOURCHE, LA
COMMISSION IS FOR LIFE

NOTARY ID NUMBER
026361

KERRY P. PAPA
NOTARY
PUBLIC
PARISH OF LAFOURCHE, LA

AFFIDAVIT

My name is John Gooding. I am submitting this statement without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am 48 years old. My wife and I lived in Mississippi from 1989 until 2005. We almost lost our home in Bay St. Louis, Mississippi during Hurricane Katrina, and I did extensive repairs to make it livable again. I was near finished renovating our home when the Deepwater Horizon exploded. I have a history of lung disease. However, the symptoms were dormant over the last decade. After the spill my respiratory problems came back and I began to experience new symptoms, such as seizures and sensitivity to seafood. I live near the coast and a landfill where the oil waste is being dumped. I periodically took my boat into the bay after the spill, when waters were reopened for public use.

Due to my health, we could not live at our home on the bay after the explosion. I have run my own cabinet business since 1991 in Pass Christian, Mississippi, and that is where we now live. It is approximately 86 miles from where the Deepwater Horizon explosion occurred, and six miles from the coast. However, my business and capacity to work has declined sharply since the spill. It has been a nightmare trying to receive compensation from BP for my health and business losses. I am not afraid to speak out about the problems with BP's Gulf Coast Claims Fund (GCCF), or about how the process discriminates against the poor, handicapped and sick.

1. BACKGROUND

I grew up in Hagerstown, Maryland. I was 12 years old when I moved to Mississippi.
I went to college for music education at the Houston Community College. It is a music conservatory branch of Rice University. I had seven years of architectural drawing and design from general schooling. After the storm, I spent August 30, 2005 through thanksgiving in my truck helping my neighbors recover. My wife asked me to help a few neighbors, and within four days I was helping 42 families. I provided all of our local hospitals, church groups and all the military camps ice with my truck.

My home is two football fields off of the coast, in Bay St. Louis. In 1980 I developed lung disease, which is why I am multi-chemical sensitive. I had over 20 lung surgeries, with over 100 metal staples inserted from 1980 to 1987. During that time I spent over one years in the hospital. They eliminated my pleuritis, which would cause my lungs to inflame. Now my lungs are glued to my ribcage. I don't have any pleura, which is the membrane of tissue that envelops lungs. The staples are supposed to hold my lungs in place. I was still able to build and run my cabinet business, but I was always cautious as to what I was exposed to. I didn't know there was a name to my chemical sensitivities until recently, after the spill. I could never be around strong smells, such as women with perfume or laundry detergent. Since the spill my sensitivity is drastically

ED_001324_00007754-00183

JG.

greater.

I built another house in Pass Christian to run my business out of. In 1991 I began my cabinet shop at that location. After the spill I had a financial advantage over my friends, because everything I own is paid for, whereas others were losing their possessions. Right before the oil spill I was down to the finishing touches on my home that had been damaged by Katrina. My wife and I were living there again. It was approximately two football fields from the coast. Since the spill I have not stayed in my house on the Gulf due to fear of exposure.

On April 26, 2010 I was working on my shop in Pass Christian. It is about six miles from the coast. I was working 26 feet off the ground on a ladder, and I got a whiff of the chemicals from the oil spill. After April 26 I started to smell burnt oil anytime the wind was coming from the south; however, I didn't learn until later that it was due to the burning from the oil spill. My whole body started shaking from the smell, and my eyes began to hurt. My throat swelled up and I could barely breathe. I did a few jobs since then in an effort to accomplish something, but my health problems escalated until it got to the point where I would pass out in the shop when I was around chemicals.

2. SURROUNDED BY CHEMICALS

When the oil landed on the Mississippi shores on July 1, 2010 BP and BP contractors started dumping the oil waste four miles north of the shop, at Pecan Grove Landfill.[1]
The county supervisors eventually made them stop doing that. But after the initial dumping I was sandwiched. It didn't matter which way the wind was blowing, because I would either get chemical exposure from the land grove or the beach. From July 1 through July 19, 2010 when I tried to work from my shop, I would go in at 6:00 am and work until Noon, at which point it would be 120 degrees inside. I did it for 19 days, and I finally realized that I didn't know I was breathing in the chemicals because I had become acclimated to the odor. The burning was continuous but once the oil approached, I had constant exposure to the smell. Before then I would notice the smell, because it would come in waves; you could only smell it if the wind was blowing toward us. By July it became a consistent smell that permeated everything, from the air to the upholstery of my furniture.

I would work 10 to 15 hour days. Sometimes I would take a break and go fishing at the end of the day. I had a truck permanently hooked up to one of my boats, so it would only take me 15 minutes to go fishing. I had a boat launch at the end of my street. Life was great before the spill. As a tradition, on June 13 a few friends and I went fishing. We were sitting under the Bay Bridge and I smelled a chemical scent, which was the oil closing in. We were trying to get a fishing trip

[1] Molly Hennessy-Fiske, *Oil Spill Waste Raises Concerns in the Gulf*, Los Angeles Times, Jul. 30, 2010, *available at* http://articles.latimes.com/2010/jul/30/nation/la-na-oil-spill-waste-20100730.

JG

ED_001324_00007754-00184

in before the oil came in. I smelled it the whole time and after that my throat felt raw; it was real sore and sensitive and had a constant burning feeling. It stayed that way and has not gotten better. My lungs started hurting as well, and several health problems followed such as seizures, mouth sores and Multiple Chemical Sensitivity (MCS) (detailed below). At the time, I thought that I had a chemical burn.

Everyone who goes to my house on the beach in the bay then has problems with their eyes or sinus. I took Al Jazeera reporters to the bay, and they got sick.[2] They told me they felt irritation in their eyes and sinuses, flu-like symptoms. It is toxic down there, but there is widespread denial by media and local politicians from the Gulf that there are health problems associated with exposure from the oil spill.

3. "VICTIMS OF OBSERVATION"

On June 13, 2010 when my friends and I went fishing we were out there for eight hours. My friends had traveled a long distance to fish, and we stayed because there was no oil yet, but the Vessels of Opportunity (VoO) workers – vessel owners and fishers hired by BP to clean up the oil - were already in the Gulf. We were fishing around the booms that the VoO workers had placed in the water to clean the anticipated oil. They were riding around in riverboats, which didn't belong in the Gulf, because the boats would split or capsize if the weather got bad and there was a large wave, for instance. I have two boats called "unsinkable boats," because they can handle big waves.

I have claimed the phrase, "Victims of Observation" for the VoO workers, because all they did was ride in their vessels. I was personally familiar with seven boats in a row riding back and forth for a few months, from June through August 2010, rarely collecting oil. I had a few friends who are older fisherman. They worked on VoO and were told a lot of troubling things. For example, they would be fined $150,000 if they rescued an animal. If they saw oil, they were instructed to tell their supervisor, but not report it over the radio. If they wanted to wear a respirator, they would be fired. One of my good friends who worked on the VoO program had to have his ears operated on afterward, and another had to have his gallbladder taken out. They did not have these health problems prior to working on the cleanup.

4. DISPERSED OIL ENCOUNTERS

I went in my boat on August 13, 2010. By that point the local news, government and Coast Guard said it was safe. However, when I went in the bay I saw oil. I noticed my boat made its own scrum line when I put it in idle and turned it in a circular motion. My prop was stirring up

[2] Dahr Jamail, *Sick Gulf Residents Continue to Blame BP*, Al Jazeera, Sept. 11, 2011, http://www.aljazeera.com/indepth/features/2011/09/201191716821664814.html.

whatever was in the water and creating an orange foam substance that looked like the soap from a dishwasher. I believe it was a mixture of Corexit and oil, because I had never seen anything like it before. When I looked in the water there were countless little white specks which would coagulate and make the foam. There were BP workers at Henderson Point, MS, so I went to them and pointed out the oil. They gave me a zip lock bag and asked me to get samples and bring it back to them. I tried to get a sample, which was near impossible; I scooped up what I could of the foamy oil with the bag. I always have a container of fresh water in my boat to wash my hands, so I washed my hands and took the sample to them. From there on out I noticed that when I or other boat owners drove our boats in the shiny spots of the oil, that foam substance would develop.

By the summer of 2012 I had been in my boat several times to take reporters to Cat Island, Mississippi, which was affected heavily by the oil spill. I took reporter David Clow out on June 23, 2012 and while we were out there collecting tar logs, I saw this same foam substance and a C 130 plane fly over us. I also witnessed this foam in the mouth of the bay when I took two people from Washington state to Cat Island on July 11, 2012. During that trip, I collected a 5 gallon bucket of tar logs.[3]

According to the Mississippi Department of Environmental Quality (MDEQ), Corexit is no more dangerous than Dawn dishwasher soap, and it was supposed to dissipate and be environmentally safe within seven days. On October 23, 2010 my wife and I went out on our boat. We saw a dolphin cough seven times, and it sounded like an old man with a smokers cough. We went to a nearby fishing pier and saw a large crab floating on the water. Normally a crab will see you and go away. This crab was alive and just floating around in a circle. We went further past the Pass Christian side of the bay and saw a white foam substance. A large Albatross was in the middle of the foam, barely moving.

We stayed in that location for 45 minutes waiting to find out what to do with the bird. My wife called WLOX, the local news station for south Mississippi, to report the bird for rescue. They gave her a BP phone number, and when she called it BP gave her a phone number to an animal rescue service, which instructed us to retrieve the bird and cover it up. We were informed that someone would contact us to retrieve the bird. My wife used fishing net to retrieve the bird and covered it up with her jacket. She washed her hands right away. However, after that incident her hands stayed red for two days. We took the bird home and put it in the bike shed until the next day. No one contacted us; we had to find someone to take the bird for us. It was a long process and then a big joke. I thought, "Gee, they are saying it is safe to be in the Gulf, but we are finding this oiled bird and we can't even get it help." You would think that our local media

[3]Joshua Guerci. "Storm Surge: Cat Island." YouTube. Sept. 5, 2012. http://www.youtube.com/watch?v=0m5eZHxM2JA&list=UU02CdzXBFSQqEkPdqW4QJZA&index=1&feature=plcp.

JG.

would want to cover the incident, but no one seemed to care when my wife contacted WLOX about the situation.

On November 10, 2010 I put my boat in the water again. I saw oil in the water and I called BP to report it. I was in front of a children's catholic school in Bay St. Louis. I went to the pier with some glass jars and took samples of the water. They are currently in the fridge of my house on the bay. While I was there the Department of Marine Resources came up in a boat and asked what I was doing. I told them I was taking samples of the water. I showed them what I collected, which included the white foam dots in the water. I contacted the MDEQ when I got home and a representative came to my house. He took samples from the water I collected that day in order to test it. He asked me if I could take him out on my boat the next day, November 11.

I took him out for approximately four hours, and we collected water samples. I showed him how I could find the oil just by seeing the shiny spots. The first time he took a sample he had gloves on and put a GPS log in his book and wrote it down the chain of custody. He did this twice. Each time he took a sample I took one as well; however, I observed that I had twice as many particulates in my jar as he did. He told me that he would share the test results from those samples and from the samples he collected from me on the previous day, but he never did.

5. HOSPITAL VISITS, CHEMICALS IN BLOOD

On November 11, 2010 I went to the Bethel Free Health Clinic, located in Biloxi, MS. While I was in the waiting room a staff member from the clinic came in and announced that the clinic had received a check from BP for $15,000. She proceeded to show us a giant sized check. The clinic is receiving money from the National Institute of Environmental Health and Sciences (NIEHS) as well, in order to treat people who are sick from the spill. When I saw the doctor at the clinic he wanted me to take anti-depressant pills. He did tell me that I have hundreds of lumps called muscle tumors, however, the clinic only prescribed me anti-depressants for treatment. When I asked for throat spray and antibiotics the clinic gave me a referral for a pulmonologist and told me to apply for social security. I never went back to the clinic, because it felt like a scam.

More than six months later I was still experiencing severe health problems, and I was not receiving proper treatment because I did not have a reliable doctor. On August 23, 2011 I attended a public meeting that Kenneth Feinberg, administrator of the Gulf Coast Claims Fund (GCCF), was speaking at. I asked Mr. Feinberg about the process to file a medical claim. He said I needed a note from the doctor to be eligible. My wife encouraged me to go to the hospital that night, because my insurance was going to run out.

I went to Gulfport Hospital at 8:00 pm, and I saw a doctor at 1:00 am. He didn't have my

JG.

ED_001324_00007754-00187

JG.

medical files in his hand when he saw me, and he didn't seem interested in my health. He only looked once at my throat very briefly and said he couldn't see anything that was wrong. Once he said that, my wife was stunned. She told the doctor that I had agreed to see him, because she was so concerned about my throat. My throat was continuously sore, and I would wake up in the middle of the night from pain. However, the doctor continued to assert that he didn't see anything and asked if I had a history of mental illness, as if implying that I was imagining the problem. At that point, I looked at my wife and suggested we leave. However, before leaving I asked for a note saying I had an existing lung disease. I further explained that my throat has been raw since I went fishing on June 13, and I believe it is related to the BP oil spill. He responded that he would not write a note or get dragged into a BP lawsuit. He told me to see a pulmonologist and get a biopsy for a tumor that I had on my tongue.

I am not fond of hospitals and I avoid going. However, since the spill my wife has had to call the ambulance several times when I am on the floor from a seizure (detailed below). If I am able to communicate, I refuse to go. I have learned that it is a waste of time as soon as I mention that my health problems are related to exposure from the oil spill. My whole way of life has been affected since the spill. I am supposed to eat small portions several times a day to keep my blood level under control. I cannot eat after 3:00 pm because of the acid reflux problems that I have been having since the spill. That is supposedly what is wrong with my throat; repeated acid reflux – which consists of heartburn, regurgitation and stomach discomfort - causes a chemical burn. I understand that it is a common symptom for people with exposure from the oil spill to have acid reflux, because as my doctor explained to me, the endocrine system is affected by the chemicals and burned. The toxins store in your fat cells and the brain is 70% fat. That is why I am now having the seizures. I took a Metametrix blood test for the chemicals found in the dispersant and oil, and I tested for one of the highest levels of contaminated blood at that time. My blood test is included in this affidavit as Exhibit 1.

My friend told me that the Louisiana Environmental Action Network (LEAN) was paying for people to take the Metametrix blood test. I called LEAN on February 1, 2011 and I had my blood tested two days later on February 3, 2011. LEAN paid for the test and Dr. Michael Robichaux ("Dr. Mike") drew the blood. Dr. Mike is one of the few physicians to my knowledge who was willing to draw blood for the test. He is the nicest man; he opened his doors an hour early so my friend and I could meet him. He took us to the hospital to have our blood drawn. Out of everyone we passed, all the nurses would hug him, and the men would shake his hand. He is a former Louisiana state senator. He walked us back and drew our blood. I was shocked by how easy it was. Prior to that experience, I often called doctors who would put me off for three months before I could see them. That is what the power of LEAN is doing for us here in Mississippi. Now LEAN and Dr. Mike are providing a detoxification program for people impacted from the spill. I don't have any faith in the doctors around here, but I do have faith in Dr. Mike.

JG.

ED_001324_00007754-00188

In June, 2011 I tried to see lung doctors, but they would not see me unless I went through the Emergency Room (ER) proxy. It is about a $2,000 per hospital visit, because you have to get several tests done before they will even see you. However, these lung doctors were the only options in Mississippi. In September 2010 my health insurance ran out, because my income basically ended in April, 2010 and we couldn't afford to keep paying the premiums.

6. HEALTH SYMPTOMS

In late February 2011 I blacked out on my floor for an hour. At noon I was cooking something, then I lost consciousness and woke up an hour later on the floor and my food had burned. A couple days later I was talking to my friend on the phone. We were discussing the results of my blood test for the first time. During our conversation I went into a seizure. I blacked out and my friend told me he could hear me flopping on the floor. Another time I was talking to my daughter, and I got a really bad headache. I sat down and blacked out and then apparently had a seizure. I don't know when they are going to occur. Sometimes when I have seizures I turn blue because I am not getting oxygen. It concerns my wife and me, because she works during the day and I am often alone.

Dr. Mike and a neurologist I am seeing explained that I have different kinds of seizures. Pseudoseizures are when I'm unconscious. Sometimes I am aware, sometimes I am not, but I can't do anything. I have had six grand mal seizures in a row, which are the most intense seizures; you have violent muscle contractions and a loss of consciousness. My heart rate drops really low to 36 beats a minute. Then I go into a grand mal seizure and my heart rate jumps from 36 to 140. When I come out of it I am extremely disoriented. In December 2011 I injured my knee from having the seizure. I have probably had over a hundred seizures since February 2011. In one week I had four seizures. I had never had any seizures in my life until the oil spill took place.

For a long period after the spill my throat constantly hurt, my ears would itch and my sinuses would act up. When I looked in my throat I could see blisters and yellow puss sacks which the doctors are calling cysts. I have developed a tumor on the side of my tongue.

The less energy I exert the better I feel. This has completely affected my lifestyle and sense of purpose. I used to work 10 to 15 hours a day on historic restoration projects, and now I spend most of the day sitting. Before the oil spill I rebuilt and restored our historic home on the bay. It was completely gutted after Hurricane Katrina, and I rebuilt all of the windows and the entire back half of the building and raised it up. I did the electrical, plumbing and brick work. Now I can't do anything without putting myself or someone else in jeopardy. I have accepted no longer being able to drive, because I don't know when a seizure will occur. My greatest fear is hurting someone else by blacking out and crashing my truck.

JG.

7. SEAFOOD

Before the oil made it to the shores, I went fishing three times under the Bay Bridge. It was supposedly still safe according to government officials to be in the water during that time. During one of the trips I caught a big red fish and I grilled it. It was a healthy looking fish – no mutations or lesions. I ate it and went to sleep. When I woke up I was in a pool of blood from rectal bleeding. After that experience I decided I would not eat any more fish. I also told a good friend of mine that he needed to stop eating shrimp and seafood. He loves seafood, so he kept eating it until the end of the summer. But then he started getting sick.[4] He has Crones disease but it was dormant for 20 years before the spill. Then, after the spill took place it became real bad; he had chronic bloody diarrhea for over 45 days. He would get skin rashes, and he had to use a nebulizer to breathe properly. After he got real sick he also became concerned that the seafood was not safe, because when he ate it he observed that his Crones disease would get worse. It's difficult to know what is and isn't safe, but after my body responded adversely to the fish, I cannot take any more risks.

According to the FDA if you eat five Gulf shrimp a week, there is a 1 in 100,000 chance that you will develop getting cancer. Of course you won't get it right away, but what could happen years down the road? If you smoke cigarettes you won't get lung cancer that day but if you keep smoking it is possible to develop cancer. When that happens, it is going to be too late; this is going to be a cancer belt from Florida to Louisiana. What is really disgusting is that the government is pushing the Gulf seafood onto our soldiers all across the country at the military commissaries. I saw it on the news as part of a public campaign to feed Gulf seafood to these soldiers and their families.[5]

8. ANIMALS IMPACTED

My dog Blue started having seizures in November, 2010. They started off real small. She would drop to the ground and start acting funny. We took her to the veterinarian and they put her on medicine twice a day. It got progressively worse, and she began having the grand mal seizures that I am now having. We lost her on May 12, 2011 at 12:34 am. It was very sad. She was my best friend; she was the dog that always was with me. Before that we lost BeBe around the same time when all of the dead dolphins were washing up. One day she was bouncing and playing. The next day I saw her go to where my dogs normally go to have puppies. I saw half a puppy sticking out of her. I went up to her and put her in the shop. I pulled the puppy out and it was

---

[4] Jason Berry. "Charles Taylor of Bay St. Louis discusses health problems from the BP oil spill." Vimeo. Oct. 6, 2011. http://vimeo.com/30157895.

[5] Kari Huus, *Panel challenges Gulf seafood safety all-clear*, MSNBC.com, Dec. 27, 2010, http://www.msnbc.msn.com/id/40494122/ns/us_news-environment/t/panel-challenges-gulf-seafood-safety-all-clear/.

JG.

ED_001324_00007754-00190

dead. I came out the next day and her whole uterus had come out and she had died. She only had the one puppy in her and her entire uterus came out. It was very peculiar, because one day she was playing and two days later she was dead. Two photos of the dead puppy and my dog's uterus are included in this affidavit at Exhibit 2.

Their exposure was the same as mine; they were with me every day. A few times they joined me on the boat after the spill and sometimes they would swim at the dock of the bay. Blue would alert me before I had a seizure. She did it the day before she died. She had a certain sound she made and then a few times I remember waking up from a seizure and she was licking me, trying to wake me up. Almost every night from November until she died I had to get up and tend to her because of her seizure. I would nurse her, but in the end it was terrible.

9. MEETING WITH GOVERNMENT OFFICIALS

On August 23, 2011 gulf activist Cherri Foytlin arranged for a group of Gulf residents impacted by the spill to go to Washington DC and meet with government officials. We met with a contact from a government agency that has oversight responsibilities pertaining to the oil spill health response. We met in the cafeteria of the Ronald Reagan Building. We discussed our blood test results with the government contact, and she said that there is little that can be done after exposure to these chemicals.

Another contact from the same government agency told us "You all are being asked to prove something that cannot be proven; you cannot prove you're exposed or that oil went into your body." In the end, the officials that we met with explained that the government is going to run a 10 year study, the Gulf Study, to evaluate our health. However, they proceeded to share that our medical problems boiled down to the issue of health care, and their agency is not in the health care business. They stressed that we need to contact our congressional members about our concerns, because they could not address this issue alone.

In January 2011 I sent a letter to my congressman and several other government officials regarding the widespread health problems in the Gulf following the spill. The only response I got was from Louisiana Governor Bobby Jindal's office, which recommended that I get an attorney. I called the officials' respective offices and got the runaround. When I called Attorney General Jim Hood's office his staff told me that it is a problem for the Mississippi State Department of Health (MSDH). I spoke with a top official at MSDH who said, "I am the right person to talk to, but we only deal with syphilis and gonorrhea."

Attorney General Hood's staff also instructed me to contact Dale Sandler, principal investigator and chief of the epidemiology branch at the National Institute of Environmental Health and Sciences (NIEHS). She is in charge of the Gulf Study. When I spoke with her she explained that

ED_001324_00007754-00191

JG.

the Gulf Study was only about to begin and it was a study, not a medical treatment program. A few days later a representative of SRA International called me. SRA International is a professional health research firm that NIEHS is collaborating with to conduct the Gulf Study. The representative recommended I go to the Bethel Free Clinic.

10. CLAIMS FUND

I first met Kenneth Feinberg on August 23, 2010 at a public meeting about the GCCF. I explained my existing lung disease and how it was exacerbated by the odor from the oil spill. He told me that I had a legitimate claim, along with people who have asthma or breathing problems. He said that I just needed to prove it through doctor's verification, which I later submitted. The doctor verification is included in this affidavit as Exhibit 3.

I again saw Mr. Feinberg at a public meeting on January 10, 2011. There were about 300 people in the audience. Feinberg said that the GCCF had only received approximately 480 health claims by January 10, 2011. At that meeting I read him a note about how his process excludes the poor, sick and handicapped. I asked why the GCCF provides an attorney, but not a doctor. I explained that the government had neglected the damages caused by the BP syndrome. I read, "After today, if you don't fix it, you and your process will be neglecting the suffering from the BP syndrome." After I read that aloud, Mr. Feinberg did not respond, however, a lot of people started standing up and saying they were having the same problems filing a medical claim with the GCCF. I met a lot of other sick people, and we started getting together and organizing. When I got home I wrote a letter to state and federal officials detailing my concerns. All I have anymore is time and I'm glad to share it. Time well spent if you're holding the government accountable.

I used to make on average $650 day; my hourly rate was $65.00 an hour and I worked on average 10 hour days. Now it is not possible for me to do that work due to my health. I don't make any money. Before my wife lost her job this year, she was making minimum wage and didn't have any benefits. They sent my wife and me a check for $11,000 and a final settlement offer for $25,000 if we would accept it. However, if we settled then I would waive my rights to take future legal action against BP. I went around and around with the GCCF trying to explain that their calculations were incorrect, but their offer did not change. I made in five months what they want to pay me for 24 months. We finally reached the point where it was necessary to cash out the $11,000 check. It was not a final settlement but we may be fixing to settle up, because we can't stretch out money that far. I can't qualify for social security due to my prior income. If we accepted the settlement check, I wouldn't qualify for social security again.

We did not accept the final settlement check, but I was still denied disability. I would rather get my health back and return to work than take BP or government money. Under social security I filed for disability. I have learned that they deny most people the first time. There was no reason

JG.

JG.

stated for denying me disability; I was just denied. Similar to the predicament with accepting the settlement check, I wouldn't qualify this time around for disability because we had to cash the check for $11,000.

11. DAILY STRUGGLE, HURRICANE ISAAC DEJA VU

My friend and I last went fishing on June 13, 2010. We were trying to get in fishing before all the seafood became contaminated from the oil and dispersants. I had no idea I was going to get this sick. I thought I had chemical burn from breathing the burnt oil, but that it would go away once I took medicine and life would get back to normal. My main worry at that time was that my business would collapse, because I wasn't receiving any phone calls for contract work. Everyone I know, from brick layers to carpenters and other specialists who I have trained are in dire straits. Their families are falling apart. They are losing their property, one item at a time. My friend explained that he is watching his entire retirement savings funnel through an hour glass. About two months ago I told him he could take my 3.4 ton truck and a ladder rack and start working for himself. He has not been well enough get the ladder rack onto the truck and work. I understand, because when there is something that I desperately have to do, I now pay for it physically.

After Hurricane Isaac on September 6, 2012 I walked along the beach and I found thick rubbery tar logs and what looked like oil sheen. I could see what looked like Corexit foam flowing through the water. There was a heavy smell from the dead animal carcasses; I saw dead birds and nutria on the beach. My symptoms got worse immediately after that. I had a seizure that night, and I was incapacitated for a few days. Since then, the tumor in my mouth has started hurting real bad. The pain in my throat is extremely painful; similar to having strep throat, it feels raw. Sometimes I lose my voice. If I am irritated and raise the level of my voice then I sometimes lose my voice in the middle of a word and I have to stop and drink water.

Fortunately in the weeks since going onto the water after Hurricane Isaac, my symptoms have let up some. I still feel weak and tired all the time, and I have difficulty sleeping. But those have been chronic problems since I got sick after the spill. For almost a year I have been sleeping in a reclining chair, because due to my respiratory problems it is too painful to lie all the way down. What concerns me most is that since Hurricane Isaac a lot of people I know have become sick with symptoms characteristic of strep throat or the flu.

JG.

ED_001324_00007754-00193

I have read the foregoing 11 page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed September 13, 2012.

Subscribed and sworn to before me
this 11 day of October, 2012.

STATE OF MISSISSIPPI
NOTARY PUBLIC
ID # 96965
COLIN T. BOURGEOIS
Commission Expires
Aug. 31, 2014
HARRISON COUNTY

Colin T. Bourgeois
Notary Public

My Commission expires on: _____

JTD

AFFIDAVIT

My name is Jorey Danos. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am 31 years old. I am originally from Galliano, Louisiana which is 30 minutes north of Grand Isle. I currently live in Thibodaux, Louisiana, which is over 100 miles from the Deepwater Horizon site. I worked on BP's Vessel's of Opportunity (VoO) program as a deckhand from May 2010 through August 2010. Throughout that time, the dispersant Corexit was sprayed heavily in the locations where we were supposed to be cleaning up oil. When I requested a respirator, a BP representative told me that wearing one could result in my termination. I subsequently got very sick, and high levels of chemicals from the dispersant and crude oil were found in my blood. I have not worked for 30 months due to my medical condition. However, some of my acute health problems subsided after going through the Gulf Coast Detoxification Program (detox program). I still don't know what the long term damage will be to my health.

1. MONEY TOO GOOD TO PASS UP

Before I worked on the cleanup I was in the fabrication industry. The fabrication industry fluctuates; you have work at some periods and then it gets slow and you look for additional employment. A friend of mine was working on the VoO program, and they needed an extra deckhand. He told me the pay was $300 a day and I accepted. During the spill I worked my uncle's company, Danos & Curole Marine Contractors, which was contracted by BP for the VoO program. For two months I worked in Venice, the closest job site to the Deepwater Horizon. During my final month on the VoO program they transferred us to Grand Isle, which is 50 miles from the Deepwater Horizon.

I experienced health symptoms while I was on the VoO program. However, during the time I thought that maybe it was just a cold. I had an ongoing cough and respiratory problems; it was difficult to breathe (detailed below). In hindsight, I realize that BP paid us to keep our mouths shut about any health problems. If we could be make $3,000 every ten days, should we pay attention to the health effects or risk termination by asking for additional Personal Protective Equipment (PPE)? People around here don't make that kind of money. I like to work and do whatever is necessary to provide for my family. In July, 2011 when I lost my ambition to work, I knew something was really wrong and started paying closer attention to my health.

2. INADEQUATE TRAINING AND EQUIPMENT

Before we began work I took a three-hour shoreline basic cleanup course administered by the company Falk Alford in Houma, Louisiana. However, it was about beach cleanup and our objective through the VoO program was to clean up the oil offshore, before it hit the beach. The course explained that we would be working with regular crude oil and the PPE would be given to us. I was not offered any additional courses.

JTD

JTD

In May, 2010 the first time we went offshore basic PPE was on the boat, including one box of Tyvek suits, latex gloves and rubber boots. After that we had to ask for more equipment if we needed anything. BP wouldn't provide PPE on its own until images showed up in the media of cleanup personnel without protective clothing. The latex gloves were so cheap that they would rip, and we would be touching the dispersed oil barehanded; it would get into my skin and burn. After my exposure to the dispersant I would develop bumps that within 24 hours turned into sores, like a blister or boil. Our rubber boots often didn't fit so we couldn't wear them. During the cleanup BP had speed boats that checked on us and asked if we needed anything. When we did ask the BP representatives or contractors for better equipment, they would tell us there were going to get them, but they would never return with the equipment.

I realized how pungent the Corexit was and wondered why I didn't have a respirator or the right equipment. I asked a BP representative or contractor – I don't recall which – and he told me that if I had one, all of the workers would want one, and it would look bad for BP if the news coverage caught footage of a bunch of workers with respirators. Then, a month and a half into the job, in June 2010 when a BP representative came up on the speedboat and asked if we need anything, I again explained my concerns about breathing in the Corexit and asked him for a respirator. He started laughing and said, "What do you need it for, that stuff isn't bad; we breathe it in all day and it isn't doing anything to us." He explained "If you wear a respirator, it is bringing attention to yourself because no one else is wearing respirators, and you can get fired for that."

3. BP PAPER TRAIL

BP controlled the oil spill cleanup through a series of release forms that shifted the responsibility from BP to the workers if we signed them. Each time a specific issue came up, such as when the environmental groups raised concerns about the turtles and birds getting sick, BP would respond with an optional release form for us to sign. If we did sign it, we did not receive a copy of the form for our own records; rather, we were just told to sign in several places and they would keep the forms for their records. We were supposed to then call a specific number if we saw any sea life in distress. The only literature or paperwork our boat received was a brochure that explained how to respond to sea life in distress. In addition, we had invoices on the boats to calculate the amount of time we worked for our payroll checks. We did not receive any literature on health. I signed a consent form for the sea life. Then we were informed, "If you need anything, we need to know who you are." However, when I or other workers witnessed distressed sea life and tried to follow BPs response guidelines, we couldn't reach anyone or would get the run around when we did. The system was so unresponsive that I refused to sign additional paperwork.

BP had a release form for health effects related to the spill. It essentially stated that if we got sick BP had personnel at headquarters to get us evaluated. If they didn't find anything wrong then we would be on our own to seek medical attention. A BP representative told us, "If you have someone sick you have to report here and call this number and someone will come get you and

JTD

JTD

we will take care of it." He went on to explain that if someone were seriously ill, we should call the Incident Command Center, run by the Coast Guard and BP. The very ill person had to acknowledge that he or she wanted to receive medical attention before someone else could report the problem. However, I repeatedly heard about stories when people who tried to get taken care of weren't helped.

In July, 2010 a friend of mine who worked on the same boat as me in the VoO program was having upper respiratory problems, and he couldn't breathe. He was an older gentleman in his late 50's, and he thought he was having a heart attack. He was airlifted from the boat with a chopper and taken to a BP clinic. However, they released him the next day. He was told it must have been upper respiratory problems. After that experience, they asked me to sign the health release form during my last month on the job and I refused.

Once the oil was out of sight and out of mind, the cleanup personnel's well being was disregarded. I get mad, because I felt blindsided by the health effects from working on the VoO program. In hindsight I realize that since BP covered its tracks with release forms, if workers later raised issues regarding health problems, such as reactions from the exposure to Corexit, BP could point to the form that most of the workers signed and say, "You're on your own." I don't know from direct experience because I did not sign the form, but a lot of people that I know who worked on the VoO program and are now sick and have not been able to receive medical help.

4. SPRAYED BY COREXIT

When they started spraying the Corexit we didn't know what they were doing, because the dispersant planes would fly by at odd hours during the night or day, and we were not given information about the spraying. However, we quickly learned the days that they did and did not spray. The Incident Command Center provided coordinates for our vessel to go to. Each day they would give us the same marine chartplotter, a GPS used to navigate waters, with a longitude and latitude grid that would direct us to our cleanup location. We could track our different locations daily because when we typed our new coordinates into the chartplotter, it left a fingerprint of where we had previously been. We would be in miles of thick tar ball oil one day, and the next day they would slightly tweak our location. As we went to our new location, we would pass the location from the previous day and see and smell the dispersed oil (detailed below). This happened routinely.

When I was working on the VoO program, I was sprayed with Corexit four times in June and July, 2010. When they sprayed the dispersant it would break up the oil and leave sheen and weird metallic colors on the water. The increased sightings of dispersed oil corresponded with our health symptoms. There was an ammonia-like odor that would take our breath away. The dispersant was sprayed heavily – like when you spray a water hose into the wind, it will mist and spray back on you. I don't remember the exact dates, but twice I saw C130's that flew directly

JTD

JTD

over us and then we entered a cloudy haze, even though it was a bright sunny day, and the oil looked like sheen. During those instances the dispersant directly hit me, including my face.

5. ADVERSE HEALTH EFFECTS

When I was working on the VoO program my mentality was, "I have a family. I need to take care of the kids. Don't worry about the health effects. I am making $3,000 every ten days. I'm not going to find that kind of money anywhere else. Look beyond BP and the health effects." However, when I was sick I had a list of problems that ultimately inhibited me from taking care of my family. I am still fighting the residual effects of the chemical exposure today.

After I got sprayed by the Corexit, within 24 hours I had boils on my neck. They looked like a cluster of zits, but when I squeezed them blood and black puss would come to the surface. In September, 2010 I really began to notice my health problems. I lost over 45 pounds in three months. In September, 2011 I weighed 185 pounds and it steadily declined to 139 pounds within three months. I couldn't gain back weight for 10 months and I stayed at 139 pound until I went through the decon program. I had difficulty sleeping and often only slept two hours a night. When I exerted myself even slightly or sweat, my skin would flare up and would get red bumps all over my body. I couldn't be in the sun or even mow the lawn for more than a few minutes without dropping to my knees. To this day I am still experiencing the skin problems and I feel easily fatigued from minimal exertion.

I can't remember when my seizures began. Short term memory loss is one of the worst problems from my exposure. However, after I stopped working the seizures would come and go every other week. I did not know they were seizures at the time. Around September, 2010 I felt like something was neurologically off track, but I didn't realize what it was. I was cognizant of my surroundings, and could feel, hear and touch, but I was lost -- what I call "stuck stupid." I lived with abdominal pain for months, and I couldn't figure out why. It felt like someone had stabbed me in my side and poured alcohol over it, and the pains were sporadic. I lived with paranoia; my kids' bus stop is 15 feet from the front door, and I wouldn't let them go to the bus stop until I could see the bus, with a loaded 380 pistol behind my back.

I had to lie to my mom for three months while I was working on the spill, and tell her that I did not take a cleanup job. Margaret Curole is my mother, and she is the North American coordinator of the World Forum of Fish Harvesters and Fish Workers, an NGO that works with the UN's Food and Agriculture Organization to protect the rights of fishing communities around the world. She would educate me on the health effects that cleanup workers from Exxon Valdez experienced and everything that she shared I was actually experiencing at the time, such as skin rashes and respiratory problems. I also saw that being away from my home was taking a toll on my kids. My seven year old son was in bad health, and I needed to be with my family.

I quit the VoO program in August, 2010. My son passed away on November 16, 2011, two days after I finished the Gulf Coast Detoxification Program, due to health implications unrelated to

JTD

JTD

the cleanup. After I stopped working on the VoO program I started seeing doctors. In September 2010 I had to go to a charity hospital in Houma, Louisiana. They told me that I had bronchitis and a chemical cough or cold, but they were not able to help me treat any of the symptoms. I was diagnosed with bipolar disease, schizophrenia, chronic bronchitis, and when I took a CT scan I was told I had gastrointestinal problems. However, all of the tests for these diagnoses came back negative.

6. GULF COAST DETOXIFICATION PROGRAM

Even with my mother's warnings, I was not convinced that my health problems were directly associated with my exposure. I needed more proof. However, in July, 2011 I found out that the Louisiana Environmental Action Network (LEAN) was paying for sick cleanup workers to get their blood tested for chemicals. I took a Volatile Solvent Profile, which tested for volatile organic compounds (VOCs) in my blood. The test showed that I had high chemical levels in my blood that are found in the crude oil or Corexit, including 95th percentile benzene and 95th percentile ethylene glycol. A copy of my test results is included in this affidavit as Exhibit 1.

Dr. Michael Robichaux, LEAN and Jim Woodworth, the former head of a 9/11 first responders detoxification program, began offering the Gulf Coast Detoxification Program in the fall of 2011. I went through the program for 38 days, from October 8 through November 14, 2011. I was one of the first people to go through the detox program. It was my last resort; conventional medicine had failed me. My routine during the program was very basic and natural. My diet included all fresh vegetables. I took Niacin, a type of B vitamin, used the treadmill for 20 to 30 minutes, got in a 180 degree sauna and sweat out the toxins. Old folks always say "If you have a fever you have to sweat it out." BP was the fever and I sweated it out.

When I began the detox program I still only weighed 139 pounds. The first week of the detox was miserable, because I had reoccurrences of my symptoms; I had paranoia and I couldn't asleep. However, I knew something good had to come out of it, because I was taking vitamins, sweating, eating well and exercising. By the second week I began to realize that I may have to live with residual effects from the damage already done, such as my skin rashes, but my attitude was changing. I was beginning to sleep and relax, my paranoia was decreasing and my earlier symptoms, including abdominal pains and seizures, were subsiding. I was gaining my weight back, and by the third week I was feeling noticeably better. I was eating healthy and could sleep again and do a lot of things I couldn't since the job. I could do some yard work again. I was getting better.

The detox program has a different phenomenon for each person. It not only helped me to accept the residual effects of my exposure, but educated me to live a better life. It taught me how to focus on what is in my control, through the way I eat and exercise, while expelling as many of the toxins from my body as possible. If it is natural, it puts a sense of well being back in the body compared to where it was during the spill. It opened my eyes to an experience I had never had

JTD

JTD

before; I went from a living hell into an attitude that I could accept it is ok to be affected by these chemicals, but I can continue living. Despite the residual effects and unknown long term health consequences, I am feeling much better now.

There are ways to help manage the effects of the exposure. As an alternative to detoxification, there is chelation therapy, or IV therapy. It also uses vitamins to dilute the chemicals in your system and help your body expel them. It is important that anyone who is having health problems comes forward; stop worrying about what doctors and lawyers have to say and get yourself better before you're six feet under. I have perceived a climate of silence, where a lot of people are remaining silent about their effects because they either don't know why they are sick, or they are sick and think they will get compensation if they remain silent. What is the money if you're dead? The more people that come forward will help demonstrate the scope of the health effects from the spill.

7. PUBLIC HEALTH CRISIS, MEDIA BLACKOUT

A lot of the chemicals from the spill became airborne, turned into condensation and precipitation. Consequently, children and people throughout the Gulf Coast are affected, in addition to those working directly on the cleanup. A friend of mine worked on the cleanup, and he was having a lot of health problems, such as skin irritations and high blood pressure. However, he had no idea what was wrong with him. He had to take a test for diabetes, because the doctors thought that could be the problem. However, the test came back negative. His blood pressure is so high that now he can't get a job. Before the spill he didn't have any blood pressure problems; high blood pressure is a common health affect from the chemicals we were exposed to.

Nearly two years after the oil spill we don't hear anything in the media about the health effects. Why isn't the current public health crisis along the Gulf on Channel 4, AC 360 or Fox News? You have to go to the internet to learn what is taking place. I have to go on YouTube to see Gulf activist Cherri Foytlin, who walked from New Orleans to DC to make a point about the health of the Gulf. Kindra Arnesen has been vocal about the health problems since the dispersant spraying began in her community in Venice. Why do they have to go to Facebook and YouTube to get their stories out? Why isn't Channel 4 interviewing them and airing this coverage during the soap operas when every grandparent in the bayou is watching?

The media blackout is my greatest concern, because if people are not educated about health symptoms that could be a result of chemical exposure from the oil spill, then it is easier for BP and the government to ignore the scope of the medical impact. In February, 2012 Cherri Foytlin, musician and activist Drew Landry, and I We went to Lucedale, a small black community in Mississippi, to have a community meeting about health problems associated with the oil spill and cleanup. In preparation, Cherri contacted the local media and newspaper about it, and it was supposed to be more publicized then it ended up being. Only two people showed up; no one knew about it. Why can we turn on the TV and watch coverage about the Syrian dictator killing

JTD

JTD

his people but there is not coverage about how BP is killing us out here and what we can do to help one another?

The meeting in Lucedale was held at a community park. Once word got around about why we were there, a handful of people showed up during the day that were involved in the cleanup and experiencing health effects. Before I said a word about my health problems, several former cleanup workers shared the same symptoms that I have: a cold year-round, shaky and paranoia. These workers were so poor that after the spill began and cleanup jobs were advertised, they traveled 50 miles from their house to work for $12 dollars an hour. They get contaminated and sick like we did in Louisiana. There is a list of classic BP symptoms. If you fall into that category, stand up for yourself to get yourself better and stand up for the next person in line to get them better. My public relations campaign is to get this information out. The BP commercials are constantly running, "Come to the Gulf Coast and eat seafood." Where is the BP commercial about the health effects?

8. DISFIGURED SEAFOOD AT MARKET

My local supermarket has fresh seafood catch. During my most recent trip in February, 2012 the shrimp sold in the market had no eyes. I have seen photos of shrimp with no eyes since the spill, but not in person. I know what to look for on shrimp; their eyes grow on their sides. However, these shrimp didn't even have the eye sockets. The red snappers for sale had black fungus looking spots and lesions all over their scales, right here in Thibodaux. Before the spill I used to catch red snapper; it should be a solid pink color. The salesman behind the seafood counter asked me if something was wrong, and if I had any complaints. My wife told me to let it be before we got frustrated with the situation, so I left it alone. However, I have never seen anything like that before.

JTD

I have read the foregoing seven page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on February 26, 2012.

Subscribed and sworn to before me
this 10th day of April, 2012

Notary Public

My Commission expires on: w/ life

KERRY P. PAPA
NOTARY PUBLIC
PARISH OF LAFOURCHE, LA
COMMISSION IS FOR LIFE

NOTARY ID NUMBER
026361

KERRY P. PAPA
NOTARY
PUBLIC
PARISH OF LAFOURCHE, LA

56

AFFIDAVIT

My name is Joseph George. I am submitting this statement without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I was a deckhand for the Vessels of Opportunity (VoO) program at three different sites in Alabama from May through August 2010. I started having health problems about two weeks into the job, but they progressed to the point where it hurt my throat to even speak. On September 5, 2011 I was diagnosed with throat cancer. I am 49 years old.

I have lived in Mobile Alabama since 1975. I have been a shrimper for 25 years. In May 2010, I worked with the VoO program as a deckhand in the Gulf side of Dauphin Island, approximately 100 miles from the spill. I took two courses on maintaining the boom and setting the boom. The VoO program did not provide any safety training. We didn't even have masks or a pair of gloves when we were out on the water. The oil by sight was about half a mile wide and eight miles long and two to three inches thick on top of the water.

Each day I had to arrive around 4:30 am to sign in. I was on the water from 6:00 am to 3:30 pm. We were told to ride around on the boat, look for oil and provide the lead boat coordinates for where oil was located. We would not lay boom, however. We would just watch the oil until it was time to go back to the dock. As I arrived for work, I would always see a Coast Guard plane fly over us toward inland right before daylight. I believe the Coast Guard took the coordinates during the day where oil was spotted and sprayed the dispersant on it at night, because we would go back to the same locations that we spotted oil at the day before and the oil would be gone for miles. By the time we got the boat out of the water and trailed it back to the departure location, it would be getting dark and we would see the Coast Guard C130 planes heading back offshore. I never saw them spraying dispersants directly, but the oil always would be gone the next day.

We asked my supervisor every day at Dauphin Island for safety equipment. We were only given boom and very few materials to work with. We wanted to pick the oil up, because those were our waters getting ruined. We need to make a living out there. The people in charge at the docks had an 18-wheeler with safety equipment but they told us it wasn't for us, it was for people on the beach who were walking. There was boom, garbage bags, latex gloves, Tyvek suits, rain suits and water boots. We just wanted to have it on the boat in case we did find some oil and could contain it. In late June 2010 VoO discontinued the boat I was working on at Dauphin Island. It was the draw of the hat; your boat comes up and you get laid off. However, I couldn't figure out why they laid us off at Dauphin Island. There was still oil out there, including tar balls washing onto the beaches.

I transferred from Dauphin Island to Dog River. I finally received gloves, garbage bags and boom. We patrolled the western part of Dog River. I saw slicks like oil sheen, whereas at Dauphin Island I saw crude oil. The sheen looks as if you took diesel fuel and poured it in the

ED_001324_00007754-00203

water. Mother Nature basically heals herself with the sheen, because eventually it will evaporate. If we saw oil on the eastern shore, we couldn't go out there and give them coordinates on it. A different company was running the eastern shore, but it was still VoO personnel.

I was at Dog River for 28 days, and then our boat got laid off and I went to Bayou La Batre at the end of July. I was not offered safety equipment, and I didn't see any equipment there. They gave us a roll of garbage bags and gloves and that was all, but we were told we could not pick up the oil. I continued to provide coordinates when I spotted oil. After three weeks my boat was laid off. For all three sites that I worked at in the morning I just signed in and in the evening I signed out. I did not sign any forms or provide contact information when I was hired. The man on the boat would pay me directly, and he was employed by the VoO program. All I had was a badge that the VoO supervision gave me, and the boom certification. They dismissed the boat I worked on and it wasn't under contract anymore, but by that time the shrimp season waters were closed. In the summer of 2011 I began shrimping again, but I have had to stop since I was diagnosed with throat cancer.

My health wasn't as bad during the VoO program as it is now, and I didn't know at the time that some of my symptoms could be related to the spill. My health problems started progressing three months ago. My esophagus swelled up, and it would hurt to speak. My voice was scratchy. It was hard for me to even eat or swallow and I would spit up yellow mucus looking stuff all day. My ear hurts too, all the time. In the morning it is worse. Now I have to wear sunglasses if I go outside. Otherwise my eyes will burn when I am exposed to bright light. With the exception of being diagnosed with throat cancer, I don't know what these other problems are due to, but I didn't have any of these problems before I worked on the VoO program.

In the summer of 2011 I went to two doctors and spent $400, because I don't have insurance. However, it didn't do any good. I went to the Family Medical Clinic in May 2011. The second doctor I saw in July 2011. Both doctors prescribed me the same thing, and unfortunately my health has only gotten worse since taking the medicines. The first doctor gave me two shots in my hip and put me on antibiotics. I reckon he just thought I had an infection, because he put me on amoxicillin. The clinic went out of business, so I went to another hospital in Mobile since my health was declining. I told the second doctor that I was prescribed amoxicillin already and it didn't help. He prescribed the same thing still, but gave me two shots. I have not been back to those doctors, because I was paying out of pocket and I only got worse after I saw them.

In September 2011 I was diagnosed with throat cancer and in April 2012 I had surgery for my cancer. I lost my ability to speak from my mouth and now I wear a devise from my throat to help me communicate. While I did not think to make the connection previously, no doctors have discussed a possible link between my health problems and my work on the VoO program.

JG

I have read the foregoing two page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on June 28, 2012.

Joseph Deerge

Subscribed and sworn to before me
this 27 day of July, 2012

F. Vickers

Notary Public

F. Vickers
Notary Public
Alabama State At Large
My Commission Expires
March 21, 2016

My Commission expires on: _____

My name is Kindra Arnesen. I am submitting this statement on August 15, 2011, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am 34 years old. I'm a resident of South Plaquemines Parish Louisiana, which is at the mouth of the Mississippi River. When BP's Deepwater Horizon exploded, I lived in Venice so I was one of the closest residents to the site of the spill, approximately 70 miles from the Deepwater Horizon explosion. I have since moved to a house that we've been rebuilding for six years, since Katrina. I moved in the first week of May 2011, and "For Sale" signs are still in the yard. The reason that the "For Sale" signs are in the yard is because of BP's negligence. I am very well aware of what oil spills can do to the unity of a community, to individuals, to children, to food sources, and everything that they touch and destroy. If sharing my experience can educate and help others, then I've done what I can do. I want people to understand what we're dealing with.

1. BACKGROUND

I was born in California but raised in Plaquemines Parish since I was nine. My step dad was a commercial fisherman, so I have been on the water on and off since I was 12. I have done every kind of fishing you can do other than long lining. I know the area, I know the water, and I know the people. I've been on my own on and off since I was 14, so my community helped raise me. They are my extended family, so we worry about each other. After Katrina we all helped each other clear the yards and rebuild houses. If someone is trying to add skimmers on the boat, we get out of the truck and help them. If the boys go out and kill hogs, they butcher them and bring them to the old people. We help and take care of each other.

My son was five and my daughter was eight when the spill began. After I learned about the public health threats of Corexit, I had to evacuate both of them. My daughter was already getting rashes within the first few weeks after the spill. Separating from them was the hardest decision I have ever had to make in my life, but I felt I responsibility to stay in my community and continue to try and get us help. Because I was an involved community member, I was given special VIP access as a volunteer community liaison to the Venice Operations Section of the Command Post in and the Incident Command Center in Houma, Louisiana.

Money has been real tight since the spill. My husband is a fisher and not only is our catch over 50 percent lower than it was this time before the spill, but we don't want to sell what we're catching; it's coming back with oil in the meat of the seafood and even deformities. I've spent most of my life on the water, helping catch. My step-father was a fisher. I know what healthy seafood looks like, and I have never seen anything like our current catch. As another source of revenue I owned a BBQ restaurant, but I could not afford to stock it and pay our bills, so I left it closed this year.

ED_001324_00007754-00206

2. JUST ANOTHER SPILL, OR NOT?

My brother works offshore at times, so when the spill first took place our first concern was whether anyone was hurt. The workforce in Plaquimines Parish Louisiana is fisherman, oil field workers, and oil field support company workers. It is a very intertwined community. With some families, two brothers own a boat and have the same deckhand and alternate the captain job and the oil field job. So our first concern was where were the people on the rig, how many were killed, how many were hurt? We were talking about the families, too. Could we put any support groups together for them?

We have ongoing oil spills here, nonstop. There have been six or seven around this peninsula in the last 17 months. They are not all massive. For example, a barge hit a well during the spill, in June or July, 2010 around Barataria Bay and it was spewing oil into the air. The spill was large enough to require a cleanup crew. Discharge of oil into the water is an ongoing issue here. We'll go out there fishing, and there will be a 30 mile slick. If you go to the rig where the oil is pouring out the side like a black waterfall, call the Coast Guard, and go back two weeks later and it may still be discharging oil.

The Deepwater Horizon spill wasn't just another spill, though. It affected parts of our environment that are normally protected from oil. The Mississippi River is our source of drinking water. After the spill, they were allowing normal boat traffic to go through the oil and travel up the river without decontamination ("decon") until after the cleanup was said to be finished. In effect, we were concerned that our drinking water was contaminated but the parish never confirmed it. At first there were not decon stations, but there should have been because the boats were exposed to dispersed oil. After we raised concerns about the lack of decon stations, BP put stations in to make it look like they were cleaning the boats, but they were not. They did not use the stations until the end of a boat's job, if they even went to decon then. Many vessels were not cleaned by the decon stations at the end of the contract.

My husband David is a commercial fisherman, in both state and federal fisheries. He fishes red snapper, mangrove snapper and lane snapper, beliners, king mackerel, grouper, pompano, blue fish, blue runner, shark, mullet, white shrimp and brown shrimp. David has been fishing throughout the northern Gulf since January 2011.He said there is broken up oil floating everywhere. This is not surprising because oil reached the marshland in Bay Jimmy and Barataria Bay. The marshes are the most important part of our estuary. The estuary is the nursery to the aquatic species in the Gulf, the estuary acts as a filter. Also, a large percentage of birds migrate through the estuary each year. However, instead of cleaning and removing the oil, after the spill BP started using barges with a backhoe to dig up the oiled marsh, place it in rollup dumpsters, and dump the contaminated marsh offshore in the Gulf.

ED_001324_00007754-00207

During the 2011 season offshore fishers were catching amberjack, king mackerel, and mangrove snapper with holes in the walls of the stomach, and black sludge in their stomach that appeared to be leaking into the meat. We're catching fish with lesions and growths that looked almost like a miniature brain. One of the fish looked like the growth was from his eye to his nose. We're catching shrimp with no eyes, and crabs that have black all inside of them.

I was raised to think spills were normal. When the Deepwater Horizon explosion happened, I figured the rig went down and they will clean it up, then we will move on with business. I'm ashamed of that, because I had no idea how much damage was really being done until I started researching this last year. It's truly, truly sad what they have allowed to happen to the northern Gulf.

3. WARNINGS FROM EXXON VALDEZ

The first few days we were just worried about the people who were actually on the rig. Then we were upset when we saw that the media was invading personal privacy by trying to climb over fences toward the family members who were waiting for news about their loved ones who worked on the offshore rigs. The first week after the spill I met Riki Ott, a toxicologist who worked closely with workers and communities after the Exxon Valdez spill. She came to Venice and we had a very small intimate meeting with only commercial fisherman and their wives. It was at the local council woman's restaurant for District 9, Marla Cooper. She is also the wife of the Vice President of the Louisiana Shrimpers Association, Mr. AC Cooper. At this meeting Riki started telling us the health symptoms to look out for. She explained how people from the Exxon Valdez spill had gotten really ill, that this was not a game or something to take lightly, and that we should demand respirators for the cleanup workers.

At one point during the talk Riki said that the Exxon Valdez workers got sick, and then she jumped to a different topic. I raised my hand and asked her, "Well, what do you mean they got sick?" She started to explain the things that they ended up with and the medications they ended up on. It's in the film Black Wave: The Legacy of the Exxon Valdez. She gave us a copy of the documentary and we took it home and watched it. It shows former Exxon Valdez workers with pill bottles all over the counter. I began to realize this isn't a quick death or something that you are going to die from in five to ten years. This is going to be a long, drawn out, medically expensive ordeal. I knew early on that BP, the contractors and the government weren't going to be providing respirators because none of the workers were wearing them. I have been pretty good at convincing people to do what I want them to do in my life, so I decided to get involved.

Right after meeting with Riki, on the ninth day of the cleanup I went out to Breton and Chandelier Islands with a camera documentary crew and a local charter fisherman. That's where

we first located dispersants, and then the first area that we located oil was about 15 miles from the islands. You can clearly see where the plane comes through and the strips where they sprayed the dispersant. There is no oil 15 miles anywhere in the area; it's just dispersants in the water. My friend Sarah Cury had a friend who worked at Louisiana State University (LSU), so we took samples of the dispersant in the water and Sarah took them to LSU. Shortly after, we heard announcements that LSU was getting a lot of money and around the same time the samples disappeared. Sarah kept trying and trying and trying and trying to get a hold of her contact that she provided the samples to, but there was no response. This stuff got sticky quick; people were spooked, I guess.

4. EVACUATE THE VULNERABLE

After Hurricane Katrina, I had to live separate from my husband with my children. He came to Venice with a camper trailer. We were under martial law. At 5:00 pm there was curfew; no one was allowed to be on the roads. Emotionally we went through a lot. When you separate a family that is used to being together every single day - I fished with David every day for two years before we had Aleena - it really does something; I don't know how David and I are still together. Once I started researching the health problems associated with the dispersant that was being sprayed, I realized that at some point I was going to have to take my children and separate them from their dad. Aleena was already starting to break out in rashes (detailed below). I knew David wasn't going to leave; he was trying to get a job on the oil spill response, and I understood why. We had a family to look out for and figure out what we were going to do, and there was an opportunity to support us.

From May through mid-June I would wake up every morning crying because I knew I was going to have to leave, and then I would finally get mad. I would stop crying and go out and do what I had to do. Then, at night when I slowed down I would cry again, because I knew we had to leave. My friend was expecting a baby, so I sent her a lot of literature about the public health threats from the dispersant, anything I could get. I didn't want her on the Gulf Coast while she was pregnant. She was high risk and miscarriages were occurring more frequently during the oil spill, so I was persistent about her needing to leave. The second week of June my friend called me. I was standing on a dock waiting to board a boat to Barataria Bay. She said, "I'm taking my girls and I'm leaving." I said, "Can you do me a favor? Can you go to my house and get my kids and take them with you?" That was the hardest decision I have ever had to make in my life, but I knew at that point in time I couldn't leave. Because of the role that had dropped in my lap, I felt a responsibility to the people in my community.

My friend went to my house, packed up my screaming children, forced them into her car and left. David and I fought about it the whole night. He was really upset with me that I didn't leave with them, but there were several reasons and I felt I could send them with her and they would be ok.

ED_001324_00007754-00209

People don't realize what kind of problems a disaster of this scale causes. I felt so torn over it, but so obligated to my children's wellbeing that I felt they needed to leave. I wanted to send them to a healthier environment even earlier during the spill, but we couldn't afford to.

We were in a trailer in Venice at the time of the spill. Katrina destroyed our home, but we didn't settle with our insurance until August 2009. Right before the spill happened we bought everything to reconstruct our home. Then BP happened and it shut the project down. David has been working on it for six years, and redid it completely. We were finally able to move back this summer and now we need to sell it, because we can't stay in this environment. We still aren't over Katrina; we still have stuff we're rebuilding. I had a BBQ restaurant, and we built my restaurant twice in two months. Because of the seasons I would only open it from the beginning of May until the second week of October after 2009. The first three years after Katrina was a false economy, because we had all of the cleanup crews and people rebuilding in the area. After Katrina, I realized I could open it in mid-March and close in mid-October, make good money, and then be off most of the winter which freed me to be mom during the winter. So I had the best of best worlds. The restaurant didn't pay my bills; it allowed us to go on vacations, shop and so forth.

After the spill, I had a choice. I could either pay that month's bills or I could stock the restaurant. I decided not to stock the restaurant; I left it closed. It is a good thing I did, because my mom manages the restaurant. I had to evacuate her with my kids the second time that my kids left Venice. My mom is 58, and she couldn't breathe after they started spraying the dispersants. During the spill, when we walked outside of my house in Venice, 50 feet from my front door there was a gray haze from the top of the trees to the ground. She lived in a FEMA trailer, and it was around 200 feet from her dwelling to our mobile home. She would walk into the door and be completely out of breath, heart racing, sweating and completely white in the face. Before the spraying started my mom was working hard and was generally in fine health. She smokes, but she used to go back and forth to my house 20 times a day and would walk perfectly fine without breathing problems. She's not the only one; there are other adults in our community who had no problems before the BP disaster and are now on rescue inhalers

My friend that had our kids went into premature labor after only having the kids a few weeks, so I picked up the kids on July 4, 2010 and came back down to Venice with them. I only remember it was July 4 because as we were driving down the road, BP was throwing a big firework display at the local lodge for BP personnel, contractors and responders. They also invited the local public. Five days later I called our timeshare and said, "Where do you have a condo that you can send me?" On July 9 we pulled into Branson, Missouri. We stayed for a week, and then I called the timeshare again and asked, "Where can you send me?" We had enough money for gas and food. I had no choice; my mom couldn't breathe and my daughter was breaking out in rashes, so I left. Within a week of leaving Venice, my mom was fine. Every time I took Aleena out of

Venice her skin would clear up. Then when I brought her back, she would break out in a rash again. She had little red dots, some were bigger than the others but it looked like something bit her. When it first happened I didn't think too much about it, but it was all over her torso and not on the bottom of her legs or her arms where a mosquito would bite.

The first week of the spill, we weren't knowledgeable about what was going on and I still let my kids go outside to play. Then by the end of the second to third week I had read enough and started to get concerned. I put the bikes in the shed and drained the pool. When I found out chlorine was a binding agent with other chemical compounds, I decided it wasn't a good idea for the kids to swim. I basically locked them up in our mobile home. PlaqueminesParish.gov would send outs automatic emails for the air sampling. The emails said "unusually sensitive people should refrain from exertion." At the local town hall meetings officials told us to stay inside and turn our air conditioning on recirculation.

5. OFFICIALS WARN, "STAY INSIDE, BUT EVERYTHING IS OK"

On May 13, 2010 in Port Sulphur, Louisiana we met with Darryl Willis, BP's public relations spokesperson for the spill, and representatives from the Occupational Safety and Health Administration (OSHA), the National Oceanic and Atmospheric Administration (NOAA), the Environmental Protection Agency (EPA) and the Coast Guard. One of the representatives told us to refrain from exertion if we got headaches or nausea. I asked, "How do we do that?" AC Cooper asked the same thing. We, the community, were really upset at that meeting.

At the meeting I asked Captain Stanton with the Coast Guard, "Don't you think the squalls forming over the Northern Gulf are going to pick up some of these chemicals, bring them inland and dump them on people?" He replied, "Oh, no, we're not spraying anywhere within 30 miles of land. We're spraying 30 miles and further offshore." We know they sprayed closer than that. But it wouldn't matter anyway if they were only spraying 30 miles out, because the rain clouds form over the northern Gulf outside of the peninsula during the mid-summer and into the fall; anything sprayed within 70 miles of the coast could be swept inland. We warned the representatives that we would be exposed to the pollutants from the spill, and they were less than unconcerned. At that meeting I was in tears, I feared for my kids. I came to the realization of how bad the situation was and that we couldn't rely on our government or the responsible party to recognize the problem, much less respond. When I walked outside Channel 10 asked me, "What are you going to do?" and I said, "I guess I am going to have to get my kids out of here, I have no choice."

My best friend's six-year-old went to the beach in Biloxi in 2010. The commercials said, "The beach is fine, you all come down." Four days after they left the beach her daughter slowly broke out in blisters all over from her knees to the ends of her toes, between her fingers and the mid-

section on her arms from right behind her wrist up to the middle of her arm. She still has scars all over and broke out in blisters all over her face. She had a pre-existing skin problem. The people who have pre-existing conditions seem to be ten times worse than anyone who was what I would call normal before this happened. That's the thing; parents knew their children's health, and for us all to be talking now and seeing the same problems after the spill is alarming. When the kids went back to school this year they were breaking out in the same rashes, over a year and a half later.

6. KIDS SICK, CAN'T GET TREATED

Frank Wesley, the national director of The Children's Health Fund based out of New York, came to speak with our community after the spill. During his visit another resident and I pushed for a medical unit. After the spill a lot of people lost their livelihoods, and a lot of people never got hired for the cleanup, so their income was shut down and I was concerned that a lot of parents would not have the money to see a pediatrician. In Venice, it is a seven and a half hour round trip to take a child to see a pediatrician because the closest one is in the West Bank across from New Orleans. Once you arrive, you have to sit there for three hours in our pediatricians' offices because they are all overbooked since Katrina. The gas is expensive and time adds up. I was concerned that a lot of people would have to make the choice to not take their child to see a physician because they were not in a position to pay for it.

After the Children's Health Fund investigated the situation more, it brought in a pediatric medical mobile unit in Port Sulphur in October 2010. They started examining the kids in the community, having meetings with parents, and realized there was definitely a need for a medical unit to examine and treat the kids. When Frank visited he conducted a tour of the schools and met the principals. When he went to Boothville Elementary in Plaquemines Parish and they opened the medical closet, it was full of nebulizers. A nebulizer is a devise used to administer medication into a mist, which is then inhaled into the lungs to help with breathing. We have 400 children in Boothville Elementary. How many nebulizers should we have? Where's the red flag? What is causing that many breathing problems with that number of kids? That is abnormal. At Boothville Elementary we have sick kids all over the place who are suffering from upper respiratory infections, severe asthma, skin infections, blisters in between their fingers and arms and on their legs and their feet. Some kids have blisters all around their mouths and their noses. These kids were perfectly fine before the spill and the spraying of Corexit began.

We went to the EPA, we went to the Food and Drug Administration (FDA), we went to Gulf Coast Claims Fund Administrator Kenneth Feinberg, we went to BP, we went to our local officials, and no one cares to admit just how bad things really are. We were glad to get the medical mobile clinic, and I even went to the ribbon cutting. However, I spoke with Frank early on about the need to put the unit on the front road where people could see it so that it would be

utilized. It wasn't being utilized for a long time, because they first placed it on a back road and parents didn't know about it. Now the medical unit pulls out in front of the school.

I will go through a few examples to demonstrate the scope of the problem, but there are many more. One of my neighbors has two grandchildren that she has helped raise. Both ran sports and were perfectly healthy before the spill. Now the oldest child has heart palpitations and his heart races. He has chest pains, and the younger one has bald spots all over his head where his hair is actually falling out, and he has frequent nose bleeds. In another family where the grandmother has raised her three grandchildren, the eleven-year old was just put on medication because she couldn't stop throwing up. The doctors can't figure out what is wrong with her; it's been going on for months and months and months since the spill. They finally put her on some kind of stomach medication to control the nausea. The middle child is four years old; he has blisters from head to toe and upper respiratory infections. Before the spill, he was on antibiotics once in his entire lifetime. Since the spill he's been on antibiotics fifteen times.

My nine year old Aleena was a healthy, beautiful, vibrant, straight-A student, great kid. Now she is constantly sick, but it the last two months it has subsided some and I finally am at the point where I can talk about it. So far my six year old isn't as bad as her, but he's sick on a more regular basis than what he was before this happened. The government reported that the oil was gone and that Corexit had not been sprayed since July 2010. We believed them, so we brought Aleena and David back in August 2010. She has been sick with high fever, upper respiratory issues, and sinus infections every four to sick weeks like clockwork, from September 2010 until two months ago. Now she complains every day and every night that her stomach hurts, "Mommy I'm nauseous, I feel like I'm going to throw up."

They gave Aleena treatment last week at school, because she had an episode; she could not breathe due to the chest pain. She went from perfectly fine to getting winded and chest pains from limited exertion. One day she took off trying to fly a kite and dropped to her knees with chest pains. We were in a Girl Scout trip in north Louisiana in March 2011. These were flat roads, and we were just walking. She started having chest pains 15 minutes into the hike. The doctors have her on Flonase to treat nasal congestion and a rescue inhaler. We finally had her diagnosed at Children's Hospital. They ran an EKG, which is a test that checks for problems with the electrical activity of your heart. It came back abnormal, so they called us back to see a pediatric cardiologist.

The cardiologist did the ultrasound on her heart and lymph nodes. A week later they called and told me she is ok. As far as her heart, they don't know what the chest pains are due to and want to send her to a pulmonary specialist. Last week when she had the episode at school I brought her into the mobile medical unit. The doctor said he doesn't think it is asthma. He thinks it's an anaphylactic reaction, which is a life threatening type of allergic reaction. However, months ago

ED_001324_00007754-00213

when I took her to him, he said it was anxiety attacks. A lot of people in my community are having breathing problems since the spill, however, the doctors keep saying that it is due to anxiety attacks. If they are having stomach issues and throwing up, the doctors say it is acid reflux. If they are having skin issues the doctors say it is scabies. Aleena's breathing problems and chest pains may not have anything to do with BP, but it seems awfully convenient to me that she has gotten so ill repeatedly since I've brought her back to Venice. The doctors around here don't make a connection, though.

7. BP AND GULF DOCTORS IN DENIAL

Originally we were told and it was announced in the media that a medical mobile unit, separate from the pediatric mobile medical unit, was being brought into Venice by Health and Human Services (HHS). The media and local politicians announced that it would be for residents and workers. People who used it had to be triaged and sent in to see their doctor behind a security gate with BP security officer's line. The medical mobile unit was located in a BP compound.

In mid May 2010 I began breaking out in bumps that would turn into skin lesions. It continues to this day, though it is not as bad now. Two skin disease doctors told me it is staph, but the doctors at local medical clinics and at the medical unit insist it is scabies. I've been in Venice most of my life and scabies don't run rampant down here, yet the local doctors and medical unit continue to diagnose people with scabies. If it is scabies, it isn't BP's problem because it is a parasite. It started in my eyes in the middle of May 2010. It went from my eyes to little blisters on my neck, my chest and my shoulders. Two months later, at the end of July I woke up and found three knots in the back of my right leg. Within 24 hours it was nine knots and within 48 hours it was 27 knots. .

On July 26, 2010, the second day after I broke out with these knots on my leg I went to a skin disease specialist in Hammond, Louisiana who diagnosed me with staph. I asked the specialist "Can this be from scabies?" because I wanted to get rid of it. It was horrible huge holes. He told me, "Kindra, you don't have scabies." I asked, "How can you be sure?" He showed me a book with an adult's arms that show where the scabies looks like something goes into the skin and makes a tunnel. Later I went to an infectious disease doctor in New Orleans because I needed surgery on my back, and I had to be cleared for the staph before the surgery. They said it was staph too, and that it couldn't have anything to do with scabies. I had two specialists telling me it was not scabies at the same time people from our area was breaking out in the same type rashes and being diagnosed with scabies.

On July 27, 2010 I was in the heat all day passing out gift cards to people who didn't have a job and needed food money. By 5:00 pm I went to my house in Venice and told my husband something was wrong. I asked him to pull my jeans off because it hurt, and there were 27 knots

ED_001324_00007754-00214

when he counted. The knots were really hard. The biggest one went from the tips of my fingers to the back of my palm, and was on the very top of my left leg right below my buttocks. It was horrible, the worst thing I've ever had to deal with. I have had adult acne since I'm 19. This is nothing like acne. It was so painful, and still is. When they first started there was no break in the skin; I thought something bit me, just as I had thought with Aleena at first. They itched and were the size of a green pea, but by the first night the knots on my leg swelled rapidly and it continued to escalate.

The night that it turned into 27 knots I went to the Plaquemines Parish Medical Clinic in Port Sulphur. I asked for a white blood cell count, and to test my thyroid because I had lost 33 pounds in six weeks. The doctor gave me a shot of antibiotics, did tests, came back and told me, "You have scabies." I told her, "I don't have scabies. I am aware that you and the medical mobile unit that are behind secure lines down at the BP operation section are diagnosing people that have skin problems with scabies. That is why I went to a skin disease specialist in Hammond and was diagnosed with staph." I asked her, "Why are you diagnosing people with scabies? You're asking them to put 5 percent Elimite cream on their bodies which is a pesticide. They already have all of these chemicals in their body, and you are misdiagnosing them and treating them for something that they don't have, while not treating them for the real ailment."

I guess she was mad and decided to hit me in the pocket, because I went to check out and it was over $290. I asked what the codes were for and the assistant said that it was a liver and kidney test, thyroid test, glucose test, and a test for bacteria in my blood. I had bacteria in my blood, but it couldn't be identified until it went to the main lab for further testing. They took all of these extra panels that I didn't ask for or authorize. The doctor came out after I questioned the charges and said to me, "You asked for the test; you get what you ask for," and walked into the back. It's an embarrassing situation when you pay a physician to do a job and they do something like that; I felt helpless. It feels like we've been scoped out and lied to, and at this point who can we trust?

When I got home from the clinic I soaked in two pounds of Epson salt and two pounds of baking soda and hot water, every two to four hours. It basically stopped the break out. When I got out of the bathtub I sprayed it with peroxide, then alcohol, then benodine and triplot antibiotic cream and covered it with big bandages for the seepage because some of the knots burst and big chunks of rotten meat came out. Once I started the baths I didn't break out with more. Then I broke out again with one knot on September 27, 2010. It was my husband's birthday; we buried his dad that morning, and I broke out with staph that night.

To this day, when I get the blisters on my shoulders, they are little blisters that come up and turn green within a couple of days and pop. When they pop sometimes other ones will break down around it and it gets worse. I usually wipe my legs all day long with alcohol. It hurts like somebody has really, really, really cut you or it's a burn, and it doesn't go away like a pimple

ED_001324_00007754-00215

would. These little spots will stay on my arm for about four or five weeks until they will go away and then all of a sudden the other arm will pop up with them all over the place.

The workers had skin issues too, and breathing problems and headaches. My husband is 44 years old. He was perfectly fine before this happened; he was the type of guy who would get sick once every couple of years, and now he's sick all the time. He wakes up, and the first thing he says when he starts to gets sick is "I'm dizzy." Since the spill he has had high fever and upper respiratory infections, to the point where his ears get blocked up and brown liquid starts flowing down his ears. I know of a worker who went blind, had kidney failure, was passing blood and had rectal bleeding, and a lack of muscle control. I know another girl whose face and hands began jumping after the spill, as if she had an involuntary twitch, but it was the muscle in her face and hands. Now it is common for people around here to have muscle spasms, and for people to hurt from head to toe for no apparent reason all of a sudden. I went through that right before I broke out in staph.

8. BP AND GOVERNMENT TOWN HALL

On May 24, 2010 we had a town hall meeting. It was announced that Captain Roger Laferriere would replace Captain Edwin Stanton for the Coast Guard. At that meeting I stood up and got into a combative conversation with an EPA representative. On May 20 the EPA had issued a directive to BP to consider less toxic dispersants than Corexit, so at the meeting I asked if the EPA now endorsed the dispersant? He kept trying to talk around the question and I said, "No sir, this is a yes or no answer. Does the EPA currently endorse this dispersant, or does the EPA not endorse this dispersant." I finally got him to say "Yes, the EPA does endorse it…" The crowd cheered, because it took about ten attempts to get him to answer the question.

Then the floor was handed to the BP representative and I asked him, "BP says that you are going to be in this long-term, what is long-term and are you willing to put it in writing?" He kept saying, "Well, long-term is long-term." I said, "No sir, is it going to be six months, one year, five years?" He said, "When the federal government tells us that we fulfilled our responsibility then that will be long-term, however, BP has many assets in the northern Gulf and we have been here for 30 years." I responded, "No sir, the federal government doesn't have anything to do with this. Our trip tickets will tell you when we can make 100 percent of our income; that is when your responsibility will be fulfilled." Then I talked to Captain Stanton a few minutes and asked him questions.

One of the community's main concerns has been the protection of our estuaries. A lot of people don't understand how important the estuary is. Estuaries are the kidney of the United States; it is where all the pollutants go through, and your estuaries clean all of that out before it goes into the Gulf or whatever body of water the estuary borders. There are tens and thousands of acres of

ED_001324_00007754-00216

estuaries; it looks like a lot of water, but it's really a lot of land broken up. It's important for the whole Gulf because a lot of juvenile fish come into the estuary to mature.

After the spill, the local fishermen sat down with me and we took several nautical maps and said "OK, they have a lot of current that comes in and out of this pass for tide, no current here, this is closeable, this is closeable…" and marked up the map for estuaries that needed to be preserved. A week before the town hall meeting, in mid-May the oil was projected to hit the west side of the peninsula so several fishermen and I went out there. Within a 35-mile span, which is the distance of the coast line between Venice and Grand Isle, there was not one response boat or piece of boom. There was one spot with 150 feet of sand bags dropped off to close one gap. They had a month to prepare before the oil was projected to hit one of the largest estuaries in southeast Louisiana, and they did nothing other than place 150 feet of sandbags.

Toward the end of the meeting I was talking to Plaquemines Parish President Billy Nungesser, and Captain Laferriere approached me and introduced himself. He shook my hand and said, "You seem like you're really involved with your community, we would like to give you a citizens tour." I said, "Really, that sounds cool. Why don't you step into the backroom for a second? Since you're taking over, I want to show you something from our perspective." The Captain and Darren Angelo, Billy Nungesser's right hand man throughout the spill response, came in the backroom of the gym. There was no table, so I spread the nautical maps on the floor. I explained that we wanted them to close off as much of the estuary as possible to protect it from oil; we wanted them to close the whole coastline in that area. We knew that it was possible because we have seen projects of that scale take place; since Hurricane Katrina the government has come up with a lot of money and built levees out in the water along the coastline.

After looking at the maps, I also told the Captain that I knew people on the land and peninsula who were getting ill, and that there were several issues I wanted to address with him. He said, "OK, we want you to come down to our base of operations in Venice and meet with our lieutenant commander and we'll move forward from there, but we definitely want to put you on a chopper and give you a tour." I guess at that point he didn't realize how much of this area I really do know, because he tried to send me locations that were not heavily impacted by the oil spill.

9. VIP ACCESS AND BP OPERATIONS

After the town hall meeting my family and I were gone for six days. We returned, and the first week of June 2010 I went down to the Operations Section on Coast Guard Road in Venice and met with Coast Guard Lieutenant Commander Pat Eiland for the first time. He brought me into the office and told me I needed to come down the next morning at 10:00 am to the local heliport in Venice to meet him to have my first flyover. I asked if I could bring a video camera and camera, and he said yes. He brought me out there, put me on as a "BP Volunteer and Operations

Section" and gave me an ID card. I didn't know if I was legally bound; I was not fully informed at that point, and I didn't really know what was going on.

They flew me out of the west side of the peninsula over Barataria Bay. What they didn't realize at the time is my husband was not just a bird boat; David was *the* bird boat to pick up oil birds. He had a 34 foot crusader with tarp pulling in from the front of the cabin all the way to the stern, so the veterinarian liked his boat for bird transport. The whole thing was covered and the veterinarians would not put the birds on anybody else's boats. The little boats went out and caught the birds, brought them to the veterinarians in Grand Isle, and then David went and picked them up with his boat and brought them to Port Sulphur. When he went from Venice to Grand Isle he would come through the Gulf side if it wasn't rough, or else he would have to go through Barataria Bay. The day before I flew, it was rough and he went through Barataria Bay. The next day when I flew there was response everywhere; boats everywhere, boom everywhere, people everywhere. I later found out that I flew at 10:00 am that morning, and President Obama flew at 2:00 pm that afternoon.

The day after I flew, it was rough and David had to go back to Barataria Bay. I asked him "What is the clean-up response in Barataria Bay look like today?" He said, "Kindra, there is no response." The day before President Obama flew and I flew, there was no response as well. I had an open door invitation to go into the 8:00 am meetings at the Venice Operations Section. At the morning meeting they discussed logistics for the following 24 hours. I observed that the meetings moved really fast and there were a lot of people crammed into one room. There was a u-shape of tables put together; two on each end, the long white six-foot tables and then a table in the middle. There were representatives from BP Logistics, BP Safety, Plaquemines Parish, Plaquemines Parish Sheriff Office, EPA, weather monitoring, several Coast Guard members, HHS, contractor bosses, what seemed to be all of the head honchos.

The first time that I met with Lieutenant Commander Eiland I went to the morning meeting and they were showing me all of these maps on the wall. Then this young Coast Guard member walked in, threw his hands up in the air and shouted "Ponies and Balloons, Ponies and Balloons." When he turned and noticed that I was sitting in the other chair, he had an awkward expression and quickly walked out. I did not understand what he meant by Ponies and Balloons, until I witnessed the staged response for President Obama's flyover the following day. You stage a response on the ground, a politician flies through and says "good job fellas," flies out and then they pick up the operation, move it somewhere else and continue to spray the area with dispersant, rather than mechanically clean the oil through boom and skimmers.

After the first helicopter trip, I asked Lieutenant Commander Eiland, "Do I have to keep these photos and video to myself, or can I give them to anyone?" He said, "Kindra, I don't care what you do with them." I was like, "Hmm, well maybe this isn't such a cover-up after all." I left, and

that night Captain Laferriere called me and asked "Hey, how was the flight?" I said "The flight was good, but I know this area Barataria Bay is a very small part of it and I know what your aim is." He replied, "Really, what's that?" I said, "Your aim is to convince a community member that you guys are doing a superb job. The only way you are going to get me to convey that back to our community is if you show me the entire situation. I want to see it all."

Throughout June, 2010 they granted me clearance, and basically anytime I wanted a boat, I got a boat. If I wanted to get on a chopper, I got to go out on a chopper. At one point I got in a Coast Guard plane with a media tour and flew out to the Deepwater Horizon and viewed it. For the most part, they tried to do the things that would appease me. The boat was the easiest thing to get. Usually I would have to wait a few days for the flight, and I would have to have a special Coast Guard escort with me everywhere I went.

During the first few weeks that I was in there, I was quiet. I felt like it was a learning experience and I needed to keep my mouth shut; be like a fly on the wall and not say anything. I was just learning their process and what different terms meant that they would say. However, the more I saw, the less likely I was to be an "appeased community member." I was disgusted by everything I was seeing. After about a week into my access, I was very disappointed. During the flights I didn't see any hard boom. There was a little absorbent boom that was rotten and broken loose. From what I saw, the boom was never positioned where the oil was hitting. These were huge bays with some scattered boom and about 10,000 feet gaps in between these pieces of soft boom. It was so pathetically handled that it's not funny. Everything that I saw when I was out there was ponies and balloons, a big show for the politicians. It was a show for the media as well; BP set up a spot at the end of South Pass, Louisiana to take the media. A lot of the pictures look the same because they were all staging areas that BP would fly media over and take them to. I was taken there once, and I asked not to be brought back again.

10. INCIDENT COMMAND POST Q&A

I went to one meeting at the Houma Incident Command Post. We flew out of there to go to the Deepwater Horizon site. Before the meeting, I had a two-hour conversation with the Coast Guard Deputy Safety Officer. I asked him about the use of respirators for workers, and he told me the following key points: A respirator should be used as the last resort; if workers start to feel sick, evacuate the area and also request evacuation of the area; air monitoring is being done and the tests are coming back well below dangerous levels of volatile organic compounds; if workers to get respirators, they have to first fill out OSHA medical questionnaire; everyone filling out the questionnaire, before they can retain a respirator, had to have an evaluation with physicians; physicians were only looking for healthy people to wear respirators; lungs may be compromised; it is hazardous to wear masks; and asthma patients, people with chronic obstructive pulmonary disease (a type of lung disease), emphysema and enlarged hearts couldn't wear respirators. I

ED_001324_00007754-00219

asked him about OSHA's right to wear voluntary respirators. He said, "Without the air sampling exceeding the limits, the workers still fell under BPs rules. As long as BP says they can't wear respirators, then they don't have a job if they wear respirators."

Two days later I went to the Incident Command Center in Houma. Went I first went in, they had to give me my Operation Section Clearance. However, the Coast Guard Deputy Safety Officer was assigned as my escort around the facility, and when he looked down at my ID he said, "Operation Section? You don't have to have an escort, you can go anywhere." I walked off and started looking around. I didn't know what I was looking for, but I was trying to obtain whatever information I could. I toured the facility and went out to get on the plane, but my escorts weren't ready to meet so I toured the facility further. Most of what I observed was just crazy numbers and a lot of maps all over the walls.

I met with my escort, BP safety officer Rusty Thibodaux and OSHA representative Dean Wingo. I sat down at a table with them that evening, and went over the same health concerns that I discussed with the Coast Guard Deputy Safety Officer a few days earlier. Every time I asked a question, depending on who the question was about, one of them would pop in with a response. They were polite, and we sat there for a while discussing my concerns, but we did not get anywhere. The OSHA representative wanted to know, "If your kids are breaking out in rashes and children and adults are having respiratory issues, for the rashes have you guys changed your laundry soap, etc." I said, "We've changed nothing. The only thing that has changed in our environment is BP." I discussed the fact that when we come out of our front door, there is a gray haze from the top of the trees to the ground. I said, "Something is not right."

I went to our local representatives Billy Nungussar, Marla Cooper, the EPA representative, BP's offshore head of cleanup Fred Lamond, and Lieutenant Commander Eiland, about the health of pregnant women, children, the elderly and anyone with a preexisting condition. I got next to nothing back from BP and the government, other than explanations for why they were taking the approach they were, and not evacuating people.

I asked Lieutenant Commander Eiland over and over again, "If you lived here, would you evacuate your family?" He said, "Well, Kindra, I guess that I'm not in that position so I can't make that choice for you." I asked him, "Well, what should I do? What would you do in my position? Talk to me, tell me." He always diverted, did anything he could do not to talk about it, and then something happened. The day after I evacuated my kids the first time I had to deliver paperwork for a special boom to the BP Operations Section. The problem with boom is that it is never high enough and the skirts are never long enough. I found a system where the boom sits three to four feet off the water; it is filled with the same foam that the unsinkable boats are filled with. The skirt can be 12 to 16 feet long, and it is linked together with cable and anchored down with really heavy anchors every 12 foot links. I found a man in Florida who sold this stuff; what

I call super boom.

The man who sold the super boom drove from Ft. Lauderdale to Venice, and I drove him to the BP Operations Section, walked in, and met with Lieutenant Commander Eiland, BP's Mr. Lamond, and two contractors I wasn't familiar with. They looked at the product in the parking lot and agreed to buy 3000 feet of it for a trial, at $75 a foot. I was responsible for bringing the documentation back to Lieutenant Commander Eiland, so that they could handle the paperwork with BP. I looked at him and said, "I evacuated my kids yesterday." He looked at me right in the eyes and said, "You are smarter than the average bear," and went right on to talking about something else. What did they know that we didn't know?

11. LESSONS LEARNED, CONGRESSIONAL BRIEFINGS

I've been burnt plenty of times over the years trying to work with difficult people, but I've opened my door and worked with just about anybody who walked through it. All I wanted was for the truth to come out, and that's all I still want; to hold BP accountable and pay the people who were hurt, take care of the people who were poisoned. What have we learned as a country from this situation moving forward? The Norwegian company that investigated the blowout preventer found that it is engineered to only work 65% of the time. When I went to Washington, DC and met with congressional members and participated in a Senate briefing, that was one of the issues that I brought up repeatedly, "How can we move forward using the same blowout preventer in future leases and drilling? Why can't we newly engineer a blowout preventer and minimize that 35 percent gap with the technology we have?" They are using a blowout preventer that cannot withstand the pressure, but they continue to use it because it meets industry standards. The standard needs to change. In response, all I have gotten from officials is some variation of "protect the oil company, protect the oil company."

I went to Washington, DC for a Congressional briefing to meet with elected leaders, including Representative Steve Scalise (R-LA), Representative Jeff Landry (R-LA) and a few Senate offices. I walked into Represenative Landry's office with Ryan Lambert, Vice President of the Louisiana Charter Boat Association, and Regan Nelson, a Natural Resources Defense Council (NRDC) lobbyist. The Congressman was late for the meeting, then all of a sudden he blew through from his office into the foyer area into the other office and slammed the door. A few minutes later he came out and said, "I'm real sorry you all, I have a committee meeting to go to, I won't be able to sit with you today." As he turned, our eyes were locked and I looked at him and said, "Congressman, I flew all the way here from Venice, Louisiana for five minutes of your time. I expect five minutes of your time." He looked me and said in a loud voice, "You have five minutes."

We walked into his office, leaned on his desk, crossed his arms and bowed up at me. I said, "I

ED_001324_00007754-00221

know you're a busy fellow, I appreciate your time and I'll make this as quick as possible." That's all I got out of my mouth before he started screaming at us and talking about how educated he was. Then he started telling me all this stuff about the history of oil companies and the mistakes they made and that everything was still fine, including the shrimp. A few times I tried to get my point on the blowout preventer in and the importance of making sure the fishermen got paid and others who were affected, but he just kept screaming at me. He also kept pointing his finger at Regan and said to me, "You come in here with these people trying to shut my oil industry down; I don't think so."

I looked at him and finally said, "Congressman, why are you screaming at me?" When I said that I felt my voice crack and he continued raising his voice. I finally said, "That's it, I'm done" and I went to walk out the door. He said, "Oh, no mam" and I said "Yes, sir" and slammed his door. It sounded like a bomb went off; I made sure it was loud, I was mad. We had the Senate briefing that morning and everyone was civil. I cried through the earlier meeting because they showed the StoryCorp video that NRDC helped produce with of all of my friends and family in the Gulf who were torn up and sick, and of the fish dying.

12. WHOLE WAY OF LIFE AFFECTED

This isn't just about money for us. This isn't just about an income. This is a whole way of life; we depend on the Gulf for everything. We depend on the Gulf to water our plants, we depend on the Gulf for our recreation, we depend on the Gulf for our income, and we depend on the Gulf for our social life. People go all over the place on the fourth of July. However, we would always go up to a private beach that no one can access unless they have a boat and know how to get there. It is all locals, and we set up tents and fires and BBQs. Before the spill we did everything on the water. We can't do that now.

My family and I have gone to check out the fisheries in North Carolina, because we are hoping to move. Normally we would stop in Destin and the Emerald Coast in Florida, but we spent all of our time in North Carolina. I'm torn, I don't know what is and isn't safe and I can't trust anything that our government says. I am a very different person than I was a year ago. I used to think that we could pay our taxes, work hard, be productive members of society and raise our children to be productive members of society as well. We would work hard and be able afford to give them something we never had. David and I both came from nothing; we built everything we have, twice in twelve years.

13. CONCLUSION

Given the state our government and society are in, how are we doing our part to raise our kids to be productive members of an unproductive society? I feel obligated to do whatever I can do to

ED_001324_00007754-00222

try to make some kind of change but before the spill I had no clue how bad things were; I thought I lived in the best country in the world. I still think that to a large degree but the politics are so corrupt.

I don't want to be in Venice anymore. Everywhere I go people call me the BP kid or the BP girl, "Hey, what's BP doing today that you're pissed off about?" After fixing the house, now we have to sell it, because I can't stay in the Gulf anymore. I don't want to sell seafood; I don't want to sell a product that I won't put in front of my own children. I cannot see staying here waiting for things to completely fall apart. Hopefully the Gulf will bounce back, but as oil spills continue I just don't see how it is possible. I hope that this never happens to a community again. Change must happen.

ED_001324_00007754-00223

LB

AFFIDAVIT

My name is Lorinda ("Lori") Bosarge. I am submitting this statement without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I live in Coden, Alabama (AL), which is a quarter mile from the shore of Portersville Bay about 100 miles from DWH.

In August 2010 I was sprayed by the dispersant Corexit, in Bayou La Batre, AL at the boat wash decontamination booth. The mist came off the sprayers as the wind blew from the Gulf. In September 2010 my health began to rapidly decline. Chemicals from the crude oil and Corexit were found in my blood. Most doctors that I spoke with couldn't figure out what was causing my health problems. An infectious disease (ID) doctor explained to me that there is not enough information about Corexit to conclusively say that it is the reason for my symptoms. However, a kinesiologist and naturalist doctor later attributed my health to chemical exposure from the spill.

Health problems are widespread throughout South Mobile County, but people are not receiving help. I am not from here, but I have lived in the house my husband grew up in for 11 years. The people keep to themselves; they are humble and proud, but they're being treated wrong. I am providing this statement, because I care about people's health and I if I have information that can provide answers for those in my community who are suffering, I want to share it.

1. BACKGROUND

From May through August 2010 there were five airboats with dispersant tanks that would run up and down the Bay from Bayou La Batre to Dauphin Island, AL. I could hear the boats from my house. They would stay far enough offshore so that you couldn't see where they were spraying the dispersant, but you would smell the sweet citronella chemical smell. As I stood on the Coden waterfront my throat would start closing up. We would notice this black saw dust looking stuff, and a whitish foam would wash up on the shore hours after they would spray.

Another unusual thing I noticed is that from May through September 2010 in the Bayou we did not have mosquitoes, yellow flies or gnats. In our area we have these pests daily, but much worse in the summer. We never left our doors or windows open, but we could tell when there was a southwest wind because the strong smell of the crude oil and dispersant would seep into our house. From May through October 2010 C130 planes and big green military choppers, usually two planes at a time, would fly very low over our house above the tree tops. On August 21, 2010 I was sprayed by the BP decontamination boat wash in Bayou La Batre. The wind came off the Gulf and the mist from the decontamination booth covered my face and arms. At the time I wasn't too concerned and did not think it was dispersant, because we were told that the Corexit wasn't being used as of July 2010. However, by that afternoon my face was red as if I had been sunburned.

LB

ED_001324_00007754-00224

LB

Before the spill the only planes we used to see were small private ones or planes going to the oil rigs. Smaller aircraft continue to fly over frequently and run grids over Portersville Bay at night. I have been told by two individuals that ~~periodically~~ once in the past six months they have seen a big aircraft flying with no lights on, with a smaller craft with one red light on following very low flying east to west across Portersville Bay. They usually go out in the evening and return a different route.

Before the spill my health was generally fine. I once had vertigo in 1992 after an ear operation, and one other time I had an allergic reaction to Monosodium glutamate (MSG), but that was the extent of it. Then I started to get vertigo in September 2010. The vertigo comes and goes even now in 2012, but it hasn't been as severe as in 2010. In October 2010 my left eye started running. There was no itching, it wasn't like pink eye. I would put saline drops in it and keep it washed out. Then from October to November 2010 I started breaking out in hives, mainly on my face, including my mouth and lips. At first I thought it was due to something I had eaten, but it would come out of nowhere. I would get dizzy, lightheaded and experience short-term memory loss. I would be at an interview talking about my health symptoms, and my mind would go blank.

Since I was sprayed in August 2010 I have developed sensitivity to regular smells, like our Lysol house cleaners. I have used Dial soap since I was a baby, and I can't use it now. It causes my throat to close up like an asthma attack. In January 2011 there was a meeting at the Coastal Response Center in Coden, AL. I listened for two hours and took notes, and I drank two bottles of water. When I went to leave, I couldn't talk; my throat was almost completely closed up. However, I wasn't aware that my throat was swelling up, because it has never happened to me before. I went home, took Benadryl and kept drinking water and juice. I survived the night, but remained hoarse for about two weeks. My health issues sometimes just level off. I may have the fatigue, and the dizziness remains. I don't use drugs or smoke, but it's almost as if you inhaled helium and feel light headed.

2. BLOOD TEST

In November 2010 I began looking for a doctor in Mobile County who would run the Volatile Solvent Profile test by Metametrix Lab. The test identifies levels in the blood from chemicals that are found in the crude oil and dispersant from the spill. I called the Local Bayou Clinic, and they told me they didn't do the lab work. I called Mostellar Medical Clinic in Bayou La Batre, and they told me that they did not perform that blood test. I called the Mobile Health Department and asked them if they were treating people for chemical exposure from the oil spill. They acted like I was from a foreign planet and said they were not treating for this, as if they had no idea that the chemicals from the oil spill were affecting anybody's health. I had hit another wall; I couldn't locate any doctors who would run the test.

In January 2011 I sent a letter to Alabama Governor Robert Bentley requesting help in Bayou La Batre for awareness of the chemical toxins and treatments. I also stated that I was concerned that

LB

the insurance did not cover the cost of the Metametrix test or treatment. From what I understand, the only way to treat for chemical toxins is by natural detoxification, which is not covered by my insurance. During the summer of 2010 there were at least 200 to 300 small boats from Coden and Bayou La Batre to do spill cleanup on a daily basis. I was very concerned about sick workers not having access to medical treatment. In my letter to the Governor I pointed out that the local Bayou Clinic is run by Alabamian and U.S. Surgeon General Dr. Regina Benjamin. Dr. Benjamin is recognized for helping the poor and allowing people to swap chicken and shrimp for medical treatment if they can't pay. She stood down here, day 52 into the oil gusher, and publicly stated, "I am the voice in Washington DC for the Bayou." To my knowledge, the Bayou Clinic is not providing the test, and there is still no treatment for chemical exposure in Mobile County. I have never heard back from either of them.

On February 15, 2011 I went to Atlanta, Georgia to see my grandchildren. I was gone for ten days, and during that time I did not experience health problems. I came home on February 25. It is hard to believe that chemicals can do to the body what I am going to describe. However, I have read about it and understand now. When I woke up the following morning I had a severe cough with bloody mucus balls larger than the size of a quarter. I was wheezing and could barely talk. I started to run a fever as well. It was Saturday, so I knew that my only option was the Emergency Room (ER). I also knew that they were not going to consider my chemical exposure, so I held out until Monday. I know people in this area that have had these health problems, too, and the hospitals have not been responsive to discussing a possible connection to toxic exposure from the spill. Folks would tell me that the doctor would tell them they have an upper respiratory problem, give them antibiotics and steroids and send them home. I had heard this time and time again by people on the coast.

Throughout the weekend I continued to cough up the same stuff. Oddly, it went on for two weeks and I went through nine boxes of tissues. Usually when you have a sinus infection you blow your nose for two days, and it becomes sore and red. However, my nose never chapped or dried, and my throat never got sore. I simply ran fever. I have since learned that this reflects the way the chemicals attack your body organ, compared to a regular infection. This was explained to me by a doctor who has an understanding of toxins. She explained when the chemicals get in your bloodstream it usually attacks a weak part of your body and continues to violate all of the organs. Also, once it gets in your fat cells it is also dangerous. This is what I'm suffering with now. Since October 2011, only natural homeopathic treatments have helped mitigate my symptoms.

Instead of going to the ER, I went to the website for Project Gulf Impact, and found a list of doctors in the Mobile area who perform the Volatile Solvent Profile test. On Monday, February 28, 2011 I started calling the listed doctors. The first doctor I called had retired. The second doctor I called had answered her cell phone, but she had closed her practice and was working at Charity Hospital in New Orleans. The phone number was disconnected for the third doctor. At that point I was panicking, because I was concerned there were no doctors that I could go to. The

LB

fourth doctor was in Gulfport, ~~AL~~ MS which is about an hour away. I spoke with his receptionist, and she said, "I am so sorry, we can't help you. The doctor has fallen ill and is closing both of his practices at the end of March." I hung up the phone and just felt alone. It was overwhelming, because I knew this was not a normal case.

Finally I found another doctor in Gulf Shores, AL that did run the Volatile Solvent Profile test. It was 75 miles one way and my husband drove me the same day I inquired, on February 28. They told me I would have to pay for the test up front because insurance does not cover it. It was $314.00. My insurance is Blue Cross Blue Shield, Individual Blue, AL. That day my fever was almost 103, and the first thing this doctor ran was a flu swap. It came back negative. Then he did a chest x-ray and my lungs came back clear. He said, "Because both of those tests came back negative, you are a candidate for the Metametrix test." The nurse drew ten vials of blood and as she was doing it, I could actually feel the chills leaving my body. I wondered if some of the toxins that were so built up were leaving me. The doctor gave me antibiotics and a puffer and nose drops. I was not aware the puffer was aerosol steroids. I have had instructions from a French cardiologist and naturalist who told me, "Do not take steroids if you have chemical toxins in your body."

Three days later my symptoms still weren't subsiding, so I took the inhaler and nose drops, which made the problem worse. My body was so exhausted I didn't even want to breathe anymore. When I had that reaction the doctor told me to stop the steroids. I was in really bad health after I returned from Atlanta, throughout March, 2011 and every since. It has been very draining. However, there were three days, March 14 through 16, 2011 when I actually felt ok. All of my flu like symptoms just stopped, but then they came back. Before the spill, I didn't have blood sugar issues and I was not diabetic. However, when the doctor did my other blood work in addition to the Volatile Solvent Profile test, I was diagnosed as diabetic. I told the doctor, my blood level has always been around 120 to 125, but it was skyrocketing then. He put me on 500 milligrams (mg) a day of Metformin, to treat type 2 diabetes. My blood pressure was up so I took something for that, too. Since going to the hospital (detailed below), I am taking 2000 mg of Metformin a day. Since beginning my detox treatments in October 2011, I have been able to reduce the Metformin from 2000 mg to 1500 mg, and the hypertension Licinapril from 10 mg to five mg.

In February, 2011 when I took the blood test, the doctor told me it would take two to three weeks for the results. After three and a half weeks I had not heard from him, so I called and inquired. The receptionist told me the test had not arrived yet. I waited another week, and when I called they told me it was not back yet. It was early April, 2011 At that point I decided to contact Metametrix Lab directly. I emailed them and gave them my phone number, and I got a call back from them right away. They couldn't discuss my lab work, but they told me that it was sent back to the doctor ten days after they did the lab work, on March 10, 2011. My immediate thought was, where did my test go for three works? I have not questioned this doctor, because it doesn't do any good and you do get scared. When I went to the doctor I wanted to ask him if he was

LB

being funded by BP, but I was afraid he would turn me away and I was so sick. I felt so vulnerable. He finally called and emailed me the results in April 2011. The test results are included in this affidavit as Exhibit 1. I had levels of ethylbenzene, m,p-Xylene, hexane, 2-methaylpentane, 3- methaylpentane and isooctane, which were compounds found in the crude oil and Corexit.

3. HEALTH PROBLEMS WIDESPREAD

On July 18, 2011 we had a funeral for my father-in-law. I was extremely depressed and fatigued. I noticed my leg swell on July 20. I blamed it on me standing up too long and overextending myself. The swelling went down and the following week, on July 25, I noticed that a small bruise on the inside of my calf turned into a blister, the size of a quarter. I showered and it settled down. On July 26 South Bay Community Alliance, a community group that I am a part of, held a small health fair for general care and to bring awareness to people the symptoms of chemical exposure from the dispersants and crude oil. By that point the blister had doubled in size. However, I went to the fair, because I wanted to reach out to people who had exposure from the spill and health problems, and were not aware about a possible connection. I feel like this community has been left behind, not only with Katrina but in regard to the oil spill, too. I spoke with about 40 people. As soon as I would share a list of the symptoms I had, almost all of them would say they had similar problems or knew someone from the cleanup who had them. The scope of associated health problems is not well known, because the media and local government are not discussing it.

For people who were interested, I told them I would keep their information confidential but when I found something out I would be happy to share the information with them. One woman is now almost legally blind in one eye. One lady who worked on the cleanup told me she has had ear infections since October 2010. I asked if the hospital gave her antibiotics and steroids and she said yes, and I asked her if the symptoms come back and she said yes. I told her, "It's probably not just a regular infection." It's not common for adults to get ear infections, but since the spill a lot of people in Mobile Country have them. Rashes were another common symptom people shared with me at the health fair. Ear infections, blood draining from ears, rashes, breathing problems were some of the illnesses people spoke about.

When I returned from Atlanta I noticed that my arms felt dry. At the health fair they felt scaly, like a reptile. By July 27 they were starting to turn into blisters. These blisters were a little smaller than a dime, but within 48 hours from when they began they were hideous looking. There were more blisters on my arms than non-blistered areas on my arms. My legs were different, and looked like I had some flesh eating infection. On July 28 my leg wound more than doubled in size, to about four inches wide and six inches long and was draining through the bandages. It did not hurt or burn, but it looked like my skin was rotting off. Clear liquid would pour out of my leg. That same day I found a holistic doctor who said "Yes, come in and we can work on health problems related to chemical exposure." When I arrived and he saw my leg he

said, "I never thought these words would come out of my lips, but you need to leave and go to the ER." He said, "You have to get this under control" because he was afraid I was going to lose my leg. He said that once I got my health stable he could help me. I choose not to go back to this doctor, because I didn't care for the open workout and treatment areas. It was like a gym.

4. HOSPITAL STAY

On July 28, 2011 I went into Infirmary West Hospital in Mobile, AL. They put me in the ER without making me wait. During that visit I stayed in the hospital for eight days. I requested not to receive steroids; I provided a copy of the Metametrix test results and explained how I had been exposed to chemicals found in the oil and dispersant. During my time in the hospital I was seeing an ID doctor and an internal medicine doctor. A photo of my leg during that hospital stay is included in this affidavit as Exhibit 2. The internal medicine doctor looked at my leg and immediately diagnosed me with cellulites, which is a skin infection caused by bacteria. Then I showed them my arms and they instantly began antibiotic IVs twice a day. They changed them and increased the dosage. They drew blood just about every other day. They started me on insulin, because my blood sugar was up. The ID doctor explained that whatever infection I had causes my blood sugar to go up. However, the internal medicine doctor explained that I had high blood sugar, because my diabetes was out of control. The leg that they said was cellulites did not hurt or burn. I ran no fever for eight days, and did not have any staph infections.

On August 3, 2011 I asked the internal medicine doctor if he had looked at the Metametrix Test that I given him in the ER and if he had contacted Dr. Lord, the chief doctor at the Metametrix lab. Dr. Lord could explain how the chemicals affect the body. He responded, "I didn't see you in the ER," and said that he wasn't aware of the Metametrix test. That was unnerving for me to hear, because every time this man was in my hospital room I spoke about the symptoms of chemicals, rash, hypertension, blood sugar elevated and headaches. I had seen him and his name was on the medical bracelet that I received when the ER admitted me.

After I inquired, however, he did go into the hallway with my charts, came back in my hospital room and read the bottom of the Metametrix disclaimer, "Finding a measurable amount of one or more Volatile Solvents in whole blood does not mean that the level of one or more of these causes an adverse health effect. Whether the concentration reported here a cause for health concern is not yet known; more research is needed." He then raised his eyebrows, shrugged his shoulder and that was it. He walked out of my room. I was thinking, "How much more do I need to go through?"On August 4 he told me I was going home the following day. I panicked, because the blisters on my arms were extremely red and infected, and I couldn't bend my arms due to the swelling. I asked the doctor how he could send me home when my arms were actually worse than when I arrived. He said, "Your insurance is not going to pay for you another day, so who is going to pay the bill?"

5. SPECIALIZED DOCTORS CONCERNED

ED_001324_00007754-00229

The ID doctors expressed more interest in examining a causal link to my chemical exposure than the internal medicine doctor. When I was in the hospital they would see me sometimes two to three times a day. I joked that I was their lab rat, but I felt that they were there to really try and better understand my health problems. They continually photographed my rashes and monitored them. On August 1. 2011 my main ID doctor did two biopsies on the backside of my shoulder. I feel she is a godsend, because she loves knowledge and wants to know what is going on. Then she reported to me that through biopsy lab work they could not determine the reason for the rash. On August 4 my arms were more swollen and the internal medicine doctor told me that I was going to be discharged. That same day, the ID doctor told me that what I have is equivocal, meaning that due to my blood sugar levels they cannot say that it is the volatile compounds in my body. From my understanding the internal medicine doctor called the ID doctor due to the leg wound. The ID doctor sent four more biopsies to a derma pathologist who examines skin biopsies. The derma pathologist wanted to call the rash on part of my arm pemphigus, which is a rare blistering autoimmune disease. However, when they sent him the lab work he could not detect that it was pemphigus.

I saw the ID doctor for a follow-up appointment on August 9, four days after I had been released from the hospital. She told me that they sent all of my biopsies to the Mayo Clinic. She said it could possibly take up to two weeks, because they are very thorough. She told me that the derma pathologist couldn't decisively say that it was pemphigus, and then her next comment was, "There hasn't been enough medical research for the Corexit." Whatever the problem is, I felt validated to a degree. I have been reaching out to the medical field to help the people that I knew were sick, before I was sick, and that was the first time that I heard a medical professional even say Corexit. She did her homework with CDC, the Mayo Clinic and the New England journal trying to find more out.

It took almost seven weeks to receive a response from the Mayo Clinic, which came in September 2011. Like the derma pathologist, my ID doctor informed me that the Mayo clinic said they could not determine what my rash was. I have received no further response from Mayo Clinic. When I went home on August 5 they had a PCC line in my arm so that I could have intravenous IVs at home; they wanted me to do it myself, and I was to keep it in for seven days on my own. When I saw the ID doctor on August 9, she noticed that it looked like there was a lot of improvement. She said, "You've been on IVs for 13 days, you don't need this anymore." I was thankful; it scared be to death to use the IV line at home by myself.

Even if doctors don't have knowledge of how to treat chemical exposure, for them to write it off as something else is extremely frustrating. What upsets me most is how children of the Gulf have been medically affected since the spill. Children are having their tonsils removed at record numbers and staying sick with colds. I have a friend who took her two children to the beach in Gulf Shores in the summer of 2011. They didn't go in the water, but after they returned from the beach they all kept getting ear infections. Before that trip, her kids were never sick. At first she thought maybe her health problems were in her head, because she had been following the news

ED_001324_00007754-00230

from the disaster. She had symptoms like memory loss, headaches, sore throat and sinusitis which is inflammation of the sinuses. When she noticed it with her kids she became really concerned, because children couldn't fake these illnesses. However, she asked the pediatrician if he thought it could be from going to beach, and he told her no.

My family recommended a doctor they have been treated by during the past 20 years. He practices kinesiology, (treatment where the doctor tests different vials of allergens and understands the muscle reaction from the vials placed on my body) and nutrimedicine (nutritional and herbal medicines). I went to him on September 28, 2011. He tested me for petrochemicals and identified a correlation between my health problems and chemical exposure from the spill. On December 13, 2011 he wrote a letter on my behalf that states, "It is my professional opinion that Mrs. Bosarge's health problems began when the chemicals were used during the oil disaster. They caused her to have an allergic reaction and variety of health problems since she was continually exposed to these agents." The letter is included in this affidavit as Exhibit 3. I continued to see him to monitor my health, and on February 29, 2012 he wrote an additional letter, stating "It is still in my professional opinion that her problems are a direct result of the oil spill and the chemicals used for cleanup…" The letter is included in this affidavit as Exhibit 4.

6. CALL FROM INSURANCE

The week after I returned from the hospital, in mid-August 2011 I got a call from the Blue Cross Blue Shield representative. I have a case open with them, because I have had home nurses since being out of the hospital. The representative asked me, "Have you always had allergies and rashes?" I told her no, and gave her the history of my exposure, and told her that the Metamerix Test found I was positive for compounds present in the oil spill. She said that she saw the test in my charts, and then she read "Benzene, it is consistent with the problem." I said, "Would you repeat that please?" She said, "I read Benzene is consistent with the problem, but I can't give any more information. That is all it says." I was so shocked that there was actually something in my charts mentioning Benzene, which only came up as "non-detect" in my Metametrix test, and that it was repeated by a representative from Blue Cross Blue Shield. Then I named all of the symptoms that have been occurring since the spill and said "Blue Cross has to have hundreds, even thousands of insurance holders who have been to Gulf hospitals with these symptoms since the spill. I would like to see the company start researching this."

7. UNUSUAL ENCOUNTERS

In July 2010 my husband and I rented a car to travel to Atlanta. It had a Georgia tag on it. Before we left we drove down to the BP command cleanup center in Bayou La Batre. A Bayou La Batre police officer pulled out behind us. It was odd, because I had never seen the police leave the command post. The police officer followed us real close for four to five miles, and I thought he was going to pull us over. He eventually turned around. I know there have been people who were

ED_001324_00007754-00231

very uncomfortable going down to the Gulf with cameras, after they heard that on more than one occasion film crews documenting the oil disaster were searched and questioned in airports.

From December 2011 through March 2012, my phone started to make a clicking noise. Then the call would hang up when I would discuss specifics about BP, about 20 percent of the time. Beginning in September 2011, sometimes when I go on my Facebook account and try to make a comment about how the cleanup was poorly handled or regarding health related concerns, it will cut off in the middle of what I am writing. As if my computer has a virus, it will start skipping words and operate real slowly. When I log off of Facebook the problem stops, however. This once happened when I left a comment on a BP disaster video on YouTube as well.

8. FRESH BP OIL

In February, 2012 I received a phone call from a neighbor who has lived in Coden for 60 years. She has been skeptical about health problems related to the oil spill and the prospect of oil still washing up. I was surprised then, when she called me and said, "I think this is the stuff you have been talking about for the last two years." She had identified a foam like substance washing up on the shore at Bayou La Batre. After the oil spill, BP set up a boat decontamination site at Bayou La Batre, which is also where Corexit containers were stationed during the spill.

On February 27, 2012 I went down to the location that my neighbor told me about, and took pictures. The city of Bayou La Batre was digging up around the boat launch, most likely to get it ready for beach traffic that we get during spring break. As they dug, a thick looking foam was oozing out of the sand. I put the photos on Facebook. A photo of the foam from that day is included in this affidavit at Exhibit 5. Within hours Marylee Orr, Director of the Louisiana Environmental Action Network, called me and asked me if I would be willing to take samples. I agreed to, and she put me on the phone with a chemist, Dr. Wilma Subra, to make sure that I collected the samples correctly. I went back to the location and collected foam, water and sediment samples. I documented the time, location and date. The following day, a lab sent us a cooler to place the samples in and my husband and I overnight mailed it back to them. The test results from the samples were almost identical to test results for BP fingerprinted oil from March 2011. [1]

[1] "Sea Foam Contains PAHs Almost Two Years After Oil Spill." Louisiana Environmental Action Network. April 5, 2012, http://leanweb.org/our-work/water/bp-oil-spill/sea-foam-contains-pah-s-two-years-after-oil-spill.

I have read the foregoing nine page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on April 12, 2012.

Lourida Bosaye

Subscribed and sworn to before me
this 12 day of April, 2012

Judy M. Franklin
Notary Public

My Commission expires on: 9-21-13

AFFIDAVIT

My name is Lorrie Williams. I am submitting this statement without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. My boyfriend and I work in the crabbing industry and live in Ocean Springs, Mississippi. Since the oil spill we have stopped crabbing due to concerns with the chemical contamination of the crabs resulting from the oil spill, as well as the dramatic decline in the catch. Our catch fell by more than 50 percent from 2009 to 2011, and the price for crabs per pound fell by more than half from 2009 to 2011.Since the spill my family and I have had to refocus our attention on our health, because we are experiencing severe health effects associated with exposure to the chemicals from the oil and dispersant.

1. BEACH UNPROTECTED

Our beach, Lake Mars Gulf Park Estates (Lake Mars) in Ocean Springs, was one of the first affected. We live two blocks north from the Mississippi Sound ("Sound"), which spans from Louisiana to Alabama. The Sound is separated from the Gulf of Mexico by a series of narrow islands and sand bars, and it receives Gulf water through several passes. We had put our crab pots out on April 16, which was the beginning of the crabbing season. On April 30 the media reported that all crabbers needed to remove crab pots from Mississippi waters, because the city was going to deploy boom – the tarp used to skim, isolate and collect spilled oil. They did not close the crabbing until July 1, three days after the oil arrived. They were closing it in sections, so in one 20 foot stretch it was closed and 20 feet on the other side it was opened. No boom was deployed, and the oil hit shore on June 26, 2010.

Through local news I learned that on June 24 Gene Taylor, our congressman at the time, was conducting an aerial view and he saw the oil coming on shore. It was coming through Dog Keys Pass - a cut in between two islands – but he couldn't get a hold of anyone to deploy any boom. Also, there were very rough seas when the oil arrived, which made it difficult to deploy boom. A week after the oil hit, only 200 feet of donated boom was deployed over two miles of beach. For a week in August 2010 the beach was lined with thousands of baby dead crabs that looked like they had been soaked in bleach.

2. IMPACT ON SEAFOOD INDUSTRY

I have lived here in the same location for 20 years. My boyfriend, Bubba, has lived in Ocean Springs his whole life and he is 47. He has worked in the seafood industry since he was four years old, and he is 47. I have worked in the industry since 2007. In the Gulf crabbing industry, about 75 % of the catch is shipped to the East Coast and West Coast; however, most Gulf crabs go to the East Coast. We sell the Blue "Jimmy" Crabs to Maryland and they are sold as Maryland Blue Crabs. The largest amount of Gulf crabs and seafood is supplied to the East Coast in the summer months, when tourism is big in Ocean City, Maryland and the New Jersey and

Law

Delaware shores. This raises serious questions as to whether contaminated Gulf crabs are currently being shipped to the East Coast and other parts of the country.

Crabbing was the last seafood to reopen for catch, on August 24, 2010. Crabbers went back out, but the catch was not good and everyone we knew couldn't find a buyer. The FDA was reporting that it was safe to crab, but when you have a sharp decline in catch it is clear that something is wrong. You can crab year round, but usually our crabbing season lasts from mid June through the second week of October. That is when all of the Gulf crabs come into the Sound to go into estuaries and start laying their eggs. The Gulf crabs are a beautiful blue color; however, we didn't see the Gulf crabs in 2011 and that is our most lucrative crab. The crabs that we did catch were from the Sound, and they were in bad shape (detailed below). I believe that all the crabs that got killed from the spill in 2010 and all the babies that washed up on shore should have been our season in 2011.

During the summer of 2009 we were catching 800 to 1,200 pounds of crabs a day. We made approximately $1.00 per pound, and our net profit for July, August and September in 2009 was $14,000. After the oil spill, we returned to crabbing in May 2011 and our catch was never more than 400 pounds a day. Louisiana and Mississippi couldn't supply enough crabs to the buyers in Alabama, so they cut us off. In 2011 Bubba and I were one of 11 crabbers supplying for a seafood processor in Bayou La Batre, located Mobile County, Alabama. We were all put on shutdown because we could not supply enough crabs, and in September 2011 the table switched and the processor began buying crab from North Carolina. It is devastating, because before the oil spill September was one of our busiest months for crabbing. We stopped crabbing in September 2011 all together, because we were losing money. The price of Mississippi crabs per pound dropped from $0.95 in 2009 to $0.35 in 2011, and by the time we paid for bait and gas to transport the crabs we were in the hole.

This predicament is widespread throughout the Gulf seafood industry. Riki Ott, a toxicologist who researched the health and environmental impact of the Exxon Valdez oil spill, predicted that the impact to seafood would be seen within three to five years. Within a year and a half we are already seeing huge declines in catch across the seafood industry. In 2010 during the oyster season the Mississippi Department of Marine Resources (DMR) released that 89% of oysters were dead due to the oil spill. Shrimpers are also barely catching anything. At one point Alabama crabbers came to Mississippi to crab because their catch was low, and they couldn't get anything. For one week between July and August, 2011 our whole catch was dead. It wasn't just crabs; there were dozens of dead fish floating to the surface, including flounder, black drum and stingrays.

In 2011 we reported a total of three dead sea turtles and a dead dolphin; Bubba has been crabbing his whole life and he has only seen dead sea turtles once or twice, before the spill. In August we found a dead sea turtle at Lake Mars for the first time. We reported to the Mississippi Department of Marine Resources (DMR) and they responded that it was caused by low oxygen

Grace

in the water and some kind of mysterious algae bloom. Normally when there is oxygen depletion in the water, also known as red tide, it is reported on the news. That did not happen in this case. In addition, we were speaking with crabbers along the coast pulling up dead crabs, and red tide does not take place throughout the whole coast at the same time.

3. CRABS WITH PARASITES AND BLACK LUNGS

From May through September 2011 we crabbed for about 90 days. In October and November 2011 we crabbed for 10 days as consultants for local attorneys. In the years before the spill we could put our crabs in a box all day and they would not die. In 2011, we had mortalities within 45 minutes of taking the crabs out of the picking tray, putting them in an iced box and taking them to the processor. We can't sell the crabs if they are dead. I have a crabbing license for our crabbing boat and we sell to processors. Some of the crabs would have black thick stuff on them.

When they reopened crabbing we pulled a few crabs and brought them home. We wanted to know what the conditions of the crabs were. Our attorney told us to open them, see what is inside and video tape it. When we did, we smelled petroleum and there were hundreds tiny pink two headed creatures eating crab lungs from inside of the crab's body out.[1] Since then we have opened several oiled crabs with parasites. We never saw parasites in our crabs before the spill, but some crabbers from Louisiana told me that even before the spill, they would sometimes find parasites in crabs that were in a dirty environment. In 100 pound box, 10% of our catch was visibly in poor form.

When crabbing was re-opened in 2010 we would not crab, because we had too many food safety questions. Mississippi Governor Barber was adamant that everything was fine, and a public panic was not necessary. His stance throughout the spill was that the spill won't be harmful to the environment or seafood. In June 2010 the University of Southern Mississippi Gulf Coast Research Laboratory (GCRL), which is located in Ocean Springs, tested baby crab larvae. The head of the research lab announced that the crab larvae contained oil droplets.[2] Since then, no one has said what happened to the crab larvae; did they die or live? When I pose that question or other food safety concerns to the DMR at public meetings, I can't get a clear response.

In the summer of 2010 when crabbing was closed, I approached DMR Director Bill Walker about crabs with black lungs. He tried to convince me that the black lungs were normal, because they came from mud. I told him they came off of Barrier Islands which are all white sand. We kept going back and forth and I finally told him, "If you have any more questions for me, talk to my attorney." He responded, "Who are you suing, us or BP?" I just replied "Talk to my attorney." On September 10, 2010 during a public meeting for fishermen, I asked Mr. Walker

---

[1] LorrieofOceanspring. "Blood Beach Blue Crab Covered in Oil and Parasites." YouTube. Sept. 6, 2010. http://www.youtube.com/watch?v=J7cpYf8MsEY.

[2] Geoff Pender, *Oil Found in Gulf Crabs Raises New Food Chain Fears*, McClatchy Newspapers, July 1, 2010, http://www.mcclatchydc.com/2010/07/01/96909/oil-found-in-gulf-crabs-raising.html.

about the prospect of our catch being chemically contaminated from the dispersant Corexit. He explained that they were not testing for dispersants in the seafood. This greatly concerns me, because people are still pulling out crabs with orange brown substances. It is normal for crabs to have mud on them, but this is something different. When I was crabbing I could scrape this substance off the shell. When I tried with a hot knife it scraped off like wax.

It was depressing to go out and work for six to eight hours, not make any money and witness the devastation of the crabbing industry. Crabbing mentally destroyed me, because Bubba and I were not going to eat the crabs, yet we were crabbing to sell them to the public. We were seeing the crabs with oil and parasites in them, yet we had the FDA, NOAA and DMR telling us they were perfectly safe to sell and consume. How can the government and BP deem the seafood safe after crabbing was re-opened within six weeks of when the Macondo well was plugged? How can they announce it is safe for human consumption if we don't yet know what the effects of the chemicals are?

The only reason I began crabbing in 2011 was because I had to prove to BP that our catch had declined. In order to get BP compensation under the Gulf Coast Claims Fund (GCCF) for loss in revenue (detailed below), I had to show taxes prior to the spill and records from 2010 and 2011. We also returned to work in order to pay our medical bills. My two sons, Bubba and I fell sick within months of the spill (detailed below).

4. GCCF NIGHTMARE

The GCCF filed my crabbing boat as an individual, for my business claim to demonstrate loss of income. They would not let Bubba file a claim, because he worked on my boat and we lived together. In August, 2011 I turned in paper work to the GCCF that showed BP owed me $78,000 for September 2010 through August 2011. I had received a check from BP $11,600 to cover my losses from April, 2010 through August 2010. I felt that first compensation was just. Then they switched to the GCCF, and it was a very difficult process to file a claim. I went into the GCCF office and did everything the representative told me to do; I added the cost of bait, fuel, profit, and then I broke down my losses for each month. It took me weeks to put it all together, I turned it into GCCF and the representative offered me $5,000 based on what I provided. I was stunned by how low it was, and I did not accept it. Then he explained that the problem was that the GCCF mistakenly filed my claim as personal, not business. I gave him additional paperwork and he changed the claim to business.

Several days later a different GCCF representative called me back and said that they needed to process my claim in a different way from how I was initially instructed. When it changed from personal to business I had to write a hardship letter, which is included in this affidavit as Exhibit 1. In the letter I explained that Bubba and I run our household, and we are losing our home. I explained I don't have time to continue to wait for my claim to be processed because due to our loss in income, we could not meet our mortgage payments and we were going to lose our house.

I feel that they saw I was between a rock and a hard place. The GCCF representative told me that a $25,000 payment could come in a week, and I took it. I regret taking it now, because it cannot fill the vacuum left by the spill; there is no seafood, there are no crabs to catch. This is the reality throughout the Gulf now.

5. COREXIT SPRAYING

We have been gulf residents for years and never saw C130s flying around here before the oil spill. Throughout the summer of 2010 it smelled like petrochemicals whenever we walked outside. The federal government and BP announced that they stopped spraying in July 2010. However, throughout the spill and continuing to this day, C130 planes that are used to spray dispersant fly over our house at low levels. On October 13, 2010 I was sitting in front of my house and I heard a horrible noise, then I realized it was C130s flying over us. I ran to my truck and I could see a fine mist hitting the windshield. The plane went toward Lake Mars and circled the Sound at low levels.

Bubba, my then 10 year old son Noah and I tried to follow the planes and videotape them in order to get evidence if they were still spraying. We were sitting in the back of the truck and the mist covered Noah's eye glasses. In the video you can hear Noah say, "It is on my glasses."[3] I believe they were spraying Corexit. An investigative journalist came to our home a few days after in mid October 2010. Whatever they were spraying had hardened on the truck's window, however, the journalist took samples from our pond. He also took samples from the beach at Pass Christian, Mississippi. The lab results of the samples came back positive for the chemicals found in Corexit. The lab results are included in this affidavit as Exhibit 3.

6. HEALTH IMPACT

Noah, Bubba, my older son Dustin and I were noticeably sick by July 2010. However, until August 2010 we didn't realize that our health effects could be attributed to exposure to the chemicals in Corexit. I wanted to know why we were suddenly developing the similar health problems. I began researching the health symptoms associated with the chemicals from the oil and dispersant and they mirrored what we have experienced (detailed below). Through the support of chemist Dr. Wilma Subra and the Louisiana Environmental Action Network, we got our blood tested. On December 6, 2010 Noah, Bubba and I took a Volatile Solvent Profile test, which is used to identify and measure chemicals in the blood. We had to drive to Destin, Florida to see a physician who would draw our blood for the test. Our lab results are included in this affidavit as Exhibit 4. I was told by Dr. Subra that Noah tested higher than 300 adults for chemical levels in his blood. Bubba's results were lower than mine and Noah's, but still outside the range of chemicals that should be found in his blood.

---

[3] LorrieofOceanspring. "Plane That Went Over Our Home." YouTube. Oct. 13, 2010. http://www.youtube.com/watch?v=jgFUiliRhno.

Before the spill took place, we would go to the beach on a daily basis. It was only two blocks from our house and it provided our livelihood. After the spill that all changed. I still went out there to document the spill, but we stopped going from recreational use. From May 2010 through August 2010 when I walked out my back door it smelled like I was putting my head in a used oil can; the oil smell was that pungent. After residents started asking officials and the media questions about the safety of the spill, because everyone along the coast smelled petrochemicals, the local news station announced, "If you have any respiratory problems or compromised health, you need to stay inside." The closer the oil came to hitting the shore, the worse our health symptoms got. I had been on the beach almost every day taking photos of the oil before my health got too poor.

Noah stopped going to the beach in July 2010, after he woke up one morning and his nose was gushing with blood. He won't go outside anymore; he says when he does, it makes him sick. It is a horrible way for a kid to live, but we live on a corner so the side road is a direct shot to Lake Mars. There is nothing to obstruct the chemical smell. I have learned that one of the symptoms from Corexit exposure is brain fog, when the short term memory is affected. When Noah returned to school in the fall of 2010 he had a very difficult time. He kept saying he couldn't remember what he was learning. I took him to a child psychologist's office and they put him on medication for Attention Deficit Disorder, which did help him focus. However, Noah did not have those difficulties in school the prior year. After the oil spill we both had difficulty remembering things. I call it "Corexit Brain." We would get disoriented and our brains would go into a fog like state. Sometimes I still experience this.

Bubba developed sinus infections and a bad cough, big white scabs all over his arms as well as boils behind his ear, but he does not have health insurance. The boils start out as bumps, and when you pinch them puss comes out. Currently he has eight of them from the back of his ear down to his jaw bone. I have them all over my chest. When I bump or scratch myself now, I end up with blood spots.

My daughter had a baby, Avereigh, on June 7, 2010. Before I realized how dangerous the air was and that young people with compromised immune systems shouldn't be outside, we would take her on the porch with us every morning. Since Avereigh was born, she has been to the pediatrician at least two to three times a month. She has hand-foot-and-mouth disease, a respiratory condition known as croup, upper respiratory infections and sinus infections, ear and eye infections, and yeast infections in her mouth and private parts. They moved to St. Augustine, Florida for two months and her infections cleared. They returned in March 2012 and Avereigh's problems have returned. When they were in Florida, Noah, Bubba, Dustin and I visited them for six days, and during that time we all felt better. We had our life force back. Then when we returned to the Gulf our health symptoms began to repeat themselves.

Noah and I both have asthma but it got worse after the Deepwater Horizon explosion. By the second week of May 2010 we had to go on additional breathing support, and the doctor has

doubled Noah's asthma medication. We have always had a nebulizer available. If Noah had a cold we would give him breathing treatments for a few hours every few days and he would be ok. During the spill we were both doing breathing treatments every four hours. It lasted from May through the summer for Noah, and the two weeks in May for me. Since this began, we have been on antibiotics and steroids back and forth and I believe it compromised our immune systems.

We have stopped even walking on the beach because it tends to exacerbate our symptoms. However, in March 2012 we took a journalist to the beach. Immediately after going out there, Bubba was sick for three days, I got sores in my mouth and my throat was sore. It used to be that if you had a head cold and went to the beach, the salt water would clear up your sinuses. Now it doesn't do that, had opposite effect.

7. HOSPITAL RESPONSE

Noah and I have Medicaid but it only pays for 12 visits in a year and renews each July. From mid May to the end of June 2010 we used all of our visits. My son Dustin was our deckhand when we were crabbing and he went on the boat with us several times after the spill. We took him to the Emergency Room (ER) in July 2011 because he got a hard cough and started coughing up logs of bright red blood, as if his throat had been cut up. The ER said they couldn't find anything wrong and he needed to see a lung specialist, but he doesn't have insurance. He also got a horrible urinary tract infection that lingered for three months in the summer of 2011, which the doctor said is very rare for males to develop. In November 2011 he was raced back to the ER because he was coughing up blood again. During his first visit they gave him antibiotics, and they put him on antibiotics again.

My nurse practitioner has seen my health decline and she believes it is from the spill. There isn't a day that goes by that I feel good. I was perfectly healthy before the spill and now I feel as if I am withering away to nothing. I was 179 pound in February, 2010. As of December, 2011 I weighed 126 pounds. My 9 year old golden retriever, Cajun, lost a lot of weight too. Within a month he went from 100 pounds to approximately 50 pounds. The veterinarian said that he had no bladder by the time we put him down. She said normally it would be a progression before he passed, that you don't lose a dog to cancer in six weeks. I would have had an autopsy done if we had the money.

In October 2010 I started having really bad pain in my lungs. I was feeling poorly and coughing up a thick yellow puss-like substance, and my mouth was raw with sores. On December 21, 2010 I went to the ER at Ocean Springs Hospital and they told me I had ammonia. A week later I went to my doctor, who put me on antibiotics and steroids. My doctor started giving me Avelox, which is a very strong antibiotic. You take it for seven days. However, whatever infection I had kept coming back. Bubba took me back to the ER and the doctor looked at my lungs from based on my medical records from March 2011 to December 2010. He then told me that no ammonia

would last that long. He explained that I had a mass in my lung, which had grown from the size of a gulf ball to a soft ball, and my lung had collapsed in a location very unusual for infections and masses. He told me to stop taking steroids, because they would make me weaker. He gave me a CAT scan and referred me to a lung doctor.

I picked up the CAT scan disk at the hospital, and the receptionist gave me a copy of the written diagnosis. My liver was mildly fatty. In February 2011 I took it to a lung specialist, Dr. Rotenberg in Ocean Springs. He looked at the disk I gave him, listened to my lung and told me my lung had collapsed, there was a mast in it and I needed a biopsy. I said "Sir, I think is caused from chemicals in oil spill." I said, "I have very high levels of the Volatile Organic Compounds in my body." At that point it seemed like he understood my concern; the expression on his face led me to believe that I wasn't the first to identify chemical exposure from the spill. He took a sample from my lung for testing, and I had a biopsy done.

Two weeks later Dr. Rotenberg called and said that the results were in. When I went to his office he said there was no infection, there was no mass and my lung was not collapsed. He even told me that I don't have breathing problems. I was stunned; I responded, "I can barely get out of bed in the morning" When I saw my nurse practitioner the following month, she listened to my lungs and said something in my left lung is still have problems.

Seven months ago I started having a burning pain in my stomach, which continues to this day. It feels like someone took a hot pipe and jammed it into the right side of my stomach through my back. I got scanned and was told it is acute pancreatitis. It comes on gradually, or suddenly hits me. Sometimes I will go from sitting normal to being doubled over. I can't eat normally. When I have an attack I can't consume any food for 24 to 48 hours. The pancreas is used to break your food down, and when it does it regulates the insulin in your body. In general I have low blood sugar. However, now it is constantly fluctuating and is high before attacks. I have to take enzymes before I eat to regulate my insulin and help me to digest the food; if I don't then I can barely eat. I will have to have a throat and a lower gastrointestinal endoscopy. Living this way is miserable.

I am trying to get all of my medical records gathered for a medical claim. From what I understand, anyone who lives south of Interstate 10 will be able to file a health claim through the settlement between BP and the plaintiffs' attorneys. My concern is that, like the GCCF, this will be a new BP compensation system that does not account for the people most affected by the oil spill. At the beginning of the spill BP gave money to everyone, from Walmart to Wafflehouse employees, but the seafood businesses that were most affected have been starved out. At this point we are most concerned about our health.

8. CENSORING

Mississippi announced on July 2, 2010 that all beaches were open to the public. For tradition, on July 4, 2010 we drove to a local recreational beach. There had been cleanup workers on the

beach earlier in the day scrubbing oil off of the rocks. When we arrived, two West Jackson County Sheriff's Department officers were blocking off the entrance and said that we couldn't enter because it was closed for BP. I got out of my car with my camera and one of the policemen told me to get back in my car, that I was not allowed by the water. I called the sheriff's department, and the dispatcher informed me that the officers I spoke with were getting paid by BP. I responded that they shouldn't be wearing county uniforms. At that point I started paying closer attention to the security presence at our beaches.

A few days after that incident, I went to Rock Jetty at Lake Mars to take pictures of oil. It was a thick nasty orange and brown rainbow colored oil. Everything it touched it killed. I have been walking this beach for 20 years and I have never seen anything like it. I was approached by BP and Coast Guard officials. The BP representative approached me and asked what I was doing. I told her I was documenting the oil spill and she asked, "Are you finding anything? " I said, "Yes, there is oil all over the place." She left to speak to a Jackson County worker in a truck. Within minutes an officer with the Jackson County Sheriff's Department told me that was told that it was closed and I couldn't be there. It always seemed like when I took photos either the Mississippi Department of Environmental Quality (DEQ), the Coast Guard, BP or the sheriff's department showed up. There were a lot of families on the beach that day and everyone had to leave.

I called the mayor's office in August 2010 to report oil that I spotted. They asked where I saw it and I said "You can come over and I will show you thousands of photos that document the oil." Two guys from DEQ came to my house and I started going through photos with them. Neither said much, then they got into their vehicle and left. Several days later I was at the beach and I spoke with a different DEQ representative. I raised concerns with him about oil that I continued to see. He explained that it was just deteriorating plant matter; DEQ stated that repeatedly after the oil spill when residents raised concerns about oil. When he said that, I mentioned that I had documented the oil, and two other DEQ representatives had come to my house to view them. He responded that they would not have visited my home. I said, "They came in a DEQ truck with DEQ shirts. How are you going to tell me that they were not DEQ representatives?" He brushed it off. However, two days later this same DEQ representative who I spoke with at the beach began circling my block daily. He stopped driving around my neighborhood around the same time that we had to put our dog down.

I have read the foregoing nine page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on April 12, 2012.

Subscribed and sworn to before me
this 24 day of April, 2012

STATE OF MISSISSIPPI
NOTARY PUBLIC
ID # 91
MICHEL YRICK
Commission Expires
Jan. 4, 2013
JACKSON COUNTY

Notary Public

My Commission expires on: Jan 4, 2013

AFFIDAVIT

My name is Michael Robichaux. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am a 67 year old Ear, Nose and Throat (ENT) physician. My practice is located in Raceland, Louisiana. Raceland is approximately 60 miles from the Gulf of Mexico. Since the summer of 2010, I have been treating scores of patients, from Florida, Alabama, Mississippi and the Louisiana coast, who are the victims of exposure to chemicals produced by the Deepwater Horizon tragedy. Most of the individuals I have treated do not have health insurance and the majority of my initial work was done pro bono, as many of these victims were too ill to work and without the resources to obtain medical care otherwise.

One of the truly amazing observations I made after seeing an ever-increasing number of patients was that the symptoms being described were different from anything I had ever observed in over 40 years as a physician. Throughout that span I have seen the consequences from many oil spills. Something was different here. Another readily apparent observation was that the patients from Florida, Alabama, Mississippi and Louisiana all had remarkably similar symptoms. After seeing firsthand the tragedies that have resulted from exposure to the waste products of the spill, I feel it is my duty as both a physician and citizen of our state and nation to alert the public to the horrendous health problems I have been observing.

1. BACKGROUND

I have been in practice as an ENT physician in Raceland, Louisiana since 1975. Before me, my father was a physician in our community for over 30 years. I attended Louisiana State University (LSU), and then LSU Medical School. I have been a community activist for decades, fighting for stronger public health and environmental policies. My wife was the principal chief of a 17,000 member Native American tribe, the United Houma Nation, for 13 years. She was still Chief when the Deepwater Horizon debacle occurred. She has since retired from this position. When my wife became principal chief in 1995, I ran for the Louisiana State Senate. I was a senator for a term and a half. Trying to maintain a medical practice and serving as a public official took a terrible toll on our finances, and I was forced to resign during my second term in office.

Following Hurricanes Katrina and Rita, storms that left approximately half of the population of the United Houma Nation homeless for months, my wife and I opened a resource center at our home, and we had as many as 80 people staying with us at a time for approximately eight months.

During the first months following my awakening to the health crisis being experienced by many of the people in our community who were exposed to chemicals associated with the Deepwater Horizon tragedy, I was able to supply little more than band aid therapy and moral support for the myriad of serious symptoms being experienced by a group of very ill patients. The bottom floor of our home served as a makeshift clinic for the majority of these health-related visits.

ED_001324_00007754-00244

In the summer of 2011, I partnered with Marylee Orr, Director of the Louisiana Environmental Action Network (LEAN), and Jim Woodworth, former director of the New York Workers Restoration Project, to create the Gulf Coast Detoxification Project (detox clinic) for sick workers and residents. It was modeled after a treatment plan used for first responders from the September 11 attack, and it is working remarkably well. I am the physician consultant, and I have been present nearly every day since it opened (detailed below).

I have a history in public service, largely in efforts to prevent these public health threats from occurring in the first place. During my time as state senator, I was active at both the local and federal level, and I attempted to remedy an exemption in the law that involved the management of oilfield waste. In 1976, the Environmental Protection Agency (EPA) was given the mandate to regulate the handling, transportation and storage of hazardous waste materials. In the early 1980's, the federal government, bowing to the pressures of the oil and gas industry, provided an exemption to the toxic designation of substances created by the exploration and production of petroleum products. Known as NOW, or Non-hazardous Oilfield Waste, it is a soup of anything and everything found in the oilfield. When an EPA-funded study acknowledged that some oilfield waste was toxic, the original study was suppressed and an edited report was presented to Congress. Under this guise, hazardous materials such as benzene, hydrogen sulfide, lead and cadmium were exempt from the stringent standards required for all other industries in the handling, transportation and storage of these materials.

In 1997, CBS produced "Ed Bradley on Assignment: Town Under Siege." This one hour program examined the damage caused by the NOW exemption, in a small Louisiana town named Grand Bois.[1]

In 1984, the state of Louisiana employed the NOW exception to provide permission for a corporation to dispose of oilfield waste in open pits at a site adjacent to the largely Native American community of Grand Bois, which is about 50 miles from the coast. Carol Browner, head of the EPA at that time, stated in an interview with Mr. Bradley, "The big oil companies got a sweetheart deal," referring to the NOW exemption.[2] From 2009 through 2011 Ms. Browner was the White House director of the Office of the Energy and Climate Change Policy in the Obama administration. At the beginning of the oil spill I hoped to revive this issue and shine some light on it, because the oil spill waste falls under the NOW exemption. Unfortunately, I was not able to make any headway with her office." [3]

This exemption has greatly impacted the health of our communities, now compounded by their exposure to waste from the spill. There are several Louisiana coastal communities involved in the oil spill. Grand Isle, Port Fourchon and Venice are three such communities that share proximity to the spill, a large number of citizens with exposure, and economies that incorporate the multiple aspects of the oilfield and fishing industries.

---

[1] Walter Goodman, *It Smells, But Does it Also Kill?*, New York Times, Dec. 23, 1997, *available at* http://www.nytimes.com/1997/12/23/arts/television-review-it-smells-but-does-it-also-kill.html

[2] *Id.*

[3] Details of this issue can be obtained in a Senate report I prepared. See Michael Robichaux, Report of State Senator Mike Robichaux to the State Committee on Oilfield Waste (1998) *available at* http://senate.legis.state.la.us/senators/Archives/1999/Robichaux/topics/oilfield.pdf

ED_001324_00007754-00245

The vast majority of the deep offshore drilling in the Gulf of Mexico originates out of Port Fourchon. Port Fourchon is located at the mouth of Bayou Lafourche and is the epicenter of the most active energy corridor in the United States. There is an additional port, the Louisiana Offshore Oil Port (also known as LOOP), located 18 miles south of Grand Isle that can accommodate the largest supertankers in the world. These huge tankers can download their oil safely offshore, avoiding any possible collisions with other vessels and near shore structures. The oil is then sent through pipelines to onshore salt domes, and transported through additional pipelines to refineries throughout the United States.

Following the Deepwater Horizon tragedy, the entire coastal fishing industry was unable to function. BP, in an effort to clean up the horrible environmental crisis it had created, hired many of the fishermen and utilized their boats to clean up the oil that was attacking the Louisiana coast. The program was called the Vessel of Opportunity or "VoO" Program.

Initially, LEAN – the oldest and largest environmental group in the state of Louisiana – purchased boots, gloves, Tyvek suits and respirators to be worn by individuals working the spill. Amazingly, BP company policy resulted in the boat owners and workers being threatened with loss of their jobs should they wear respirators while working for the company. Even BP employees working the oil spill site were denied the usage of these protective devices. This was shared with me on several occasions by my patients.

As a populist who has lived on the bayou all of his life and whose patients are mostly from the southern part of the parish, I know thousands of fishermen and oilfields workers who were involved in cleaning up the oil spill residue. In November 2010, long after the spill was contained, Marylee asked me to draw blood for a commercial diver from Mississippi who had fallen ill since diving in the oil plume in the Gulf of Mexico. I agreed to do so, and met with this gentleman and several others referred by Marylee at my office in Raceland.

2. THRONGS OF SICK PATIENTS

Although I was still skeptical that their health problems were related to toxic waste exposure from the spill, I drew blood on several sick individuals to see if there were any patterns between chemical levels found in their blood and their health problems. What was interesting at the time was that none of these patients were from the community that I normally serve; they came from throughout the Gulf Coast. Additionally, every one of these patients had very convincing stories to tell, and when I was able to sit down with them and get a comprehensive history, their stories became quite compelling.

I was particularly concerned with the plight of a three year old child. In June 2010 he and his family went on vacation to Orange Beach, Alabama. He had been swimming in an outside pool that was beachside, while workers were cleaning oil soaked booms on the beach. When he returned home he became violently ill, and was rushed to a hospital in Baton Rouge. The doctors at first believed that he was suffering from a severe urinary tract infection, and they even performed surgery on this three year old when they suspected he had kidney stones. After a week or so in the hospital, his father asked the doctors if they would draw blood to see if his trip

ED_001324_00007754-00246

to Orange Beach might not have exposed him to chemical compounds resulting in his illness. They flatly refused to do so, and abruptly discharged him without a final conclusive diagnosis. Even with this history, I was not convinced that the child was ill from this exposure, and I recall being a bit impatient with his father when I was trying to work my way through the throng of people who had come to my office. After seeing several other sick workers and residents exposed to similar conditions, I later realized that this poor infant actually was ill from his exposure. I was soon drawing blood from patients from Florida, Alabama, Mississippi and the entire Louisiana coast.

I quickly began to learn the symptoms that these individuals were experiencing and, amazingly, the symptoms were almost identical for everyone from Florida, Alabama, Mississippi and Louisiana. Some of the information regarding exposure was undeniable, while others had only scant evidence that their illnesses resulted from products of the oil spill. What brought all of these individuals into the same pool was the fact that their symptoms were almost identical, and were different from anything that I had ever observed in my 40 plus years as a physician. Interestingly, other workers and residents who worked or lived side by side with these ill workers and were exposed to the same chemicals had little or no problems.[4]

As I observed these patterns in my patients I was also able to see a positive correlation between their symptoms and blood test results that I had been obtaining through the generosity of LEAN. At this point my feelings went from being skeptical to being extremely alarmed, and I began seeing these patients in a somewhat different light. I learned what questions to ask so that I might obtain information that they wouldn't necessarily associate with their illnesses.

The initial symptoms that many of the victims experienced included coughs, respiratory problems and congestion, along with skin rashes. However, many of these same individuals soon began developing headaches, memory loss, irritability, fatigue and fatigability. Some patients had dizziness and many exhibited blood sugar abnormalities with hypoglycemia. Acid reflux disease, which can produce heartburn, regurgitation and stomach discomfort, as well as other abdominal pains, was also relatively common. Some of these symptoms, such as the chronic coughing that was present initially, cleared up spontaneously for most patients.

Several patients also had a unique neurological disorder that one victim coined, "Stuck Stupid." This "condition" consisted of the patient being cognizant of his or her surroundings, but unable to move or to speak. My first encounter with this phenomenon was in the summer of 2011, when a patient described sitting on his porch while facing his truck. The truck door was open and the motor was running. He could not walk, talk or otherwise move. He described this episode as

---

[4] A government report that examined why some veterans became ill and others did not following the 1991 Gulf War explains this phenomenon: "It is well established that some people are more vulnerable to adverse effects of certain chemicals than others, due to variability in biological processes that neutralize those chemicals, and clear them from the body. The enzyme paraoxonase (PON1) circulates in the blood and hydrolyzes organophosphate compounds such as pesticides and nerve agents, converting them to relatively harmless chemicals that are then excreted. Individuals who produce different types and amounts of PON1 differ, sometimes dramatically, in their ability to neutralize different organophosphate compounds." *See* Research Advisory Committee on Gulf War Veterans' Illnesses, Gulf War Illness and the Health of Gulf War Veterans: Scientific Findings and Recommendations (U.S. Government Printing Office 2008) p. 13 – 14.

ED_001324_00007754-00247

lasting for about two hours. His memory of the entire event was quite vivid. He later experienced similar problems in different settings.

Another patient, who lives in Bay St. Louis, Mississippi, described similar experiences. He lived on the coast and near a landfill created to dispose of waste from the spill. He also took his boat into the Gulf periodically after the spill. It was not uncommon for his wife to return home from work to find her husband lying on the floor, unable to move or talk. This gentleman has been unable to pursue his profession as a cabinetmaker due to his illness, and has no medical insurance. He avoids going to the hospital or even to see a physician, as he is unable to pay his medical bills and does not want to lose his home due to medical debts. Probably the most frustrating part of his problem is having a complex symptom that no one understands and an illness that few feel any sympathy or compassion in treating, especially since the treating physicians aren't certain that such a disorder actually exists.

With much urging, I was able to get this patient to prepare a video of his symptoms, as a few months later he went from being "Stuck Stupid" to having full-blown seizures. I have a copy of a video he made while he slept on his recliner.[5] Within a few hours of falling asleep, he experienced a full-blown seizure. This video is a remarkable illustration of the problems that have occurred as the result of exposure to the chemicals associated with the Deepwater Horizon crisis.

In addition to this gentleman's seizure disorder, he also has developed multiple chemical sensitivities (MCS), a condition in which a large number of chemicals can cause exaggerated and severe symptoms in response to their exposure. This disorder is well recognized in individuals who have experienced contact with toxic chemicals. People with MCS are often hypersensitive to household cleaning products and many other materials that contain even small amounts of aromatic chemicals. Additionally, these patients often have adverse reactions to products they commonly used prior to their toxic exposure, such as scented soaps or common household cleaning products like Windex.

In November 2010, my wife and I were visiting with a close friend whose husband had been using his fishing vessel to clean up the oil spilled in the region immediately west of the bayou that ends at Port Fourchon. Our friend stated that she had been quite ill, and doctors at a local charity hospital thought that she had leukemia. Her husband is a fisherman who worked the VoO program. I asked her when her symptoms began. It was immediately apparent that she had been washing her husband's work clothing and was exposed to toxic chemicals through this route. On one occasion his clothes were so soaked with chemicals that she had to throw them out, rather than trying to clean them. Interestingly, while he had worked for 95 days with his boat, his location had little oil present. He actually skimmed oil for less than a week and the oil was heavy for only about three days. However, he explained that he saw planes releasing dispersant throughout the time that he worked on the VoO program.

I obtained a comprehensive history on our close friend, which indicated that she had far more symptoms than she had first indicated. Her husband had never considered himself to be ill. However, I also met with him, and his answers to my questions indicated that he was also

[5] This video is on file with the Government Accountability Project.

ED_001324_00007754-00248

severely affected by his own exposure. Their symptoms included irritability, memory loss, headaches and excessive fatigue. Both have since been through the detoxification treatment program that I oversee, and they have done amazingly well since that time; the memory loss, headaches and fatigue have subsided noticeably, and the irritability is no longer present.

In a nutshell, common symptoms experienced by my patients include impotence both in young and older men, memory loss, headaches, extreme fatigue, irritability, abdominal cramps, seizures, and a trance like state that many patients and their family members have observed. These symptoms are quite common among workers and even some residents who live along the Gulf. However, until people are educated about the symptoms associated with exposure to toxic waste from the spill, we cannot assume they will make the connection. I continue to witness this disconnect and these symptoms on a daily basis.

In September 2011, Dr. Kaye Kilburn, an 80 year old physician and scientist, came to Golden Meadow, Louisiana and conducted studies on 14 people who had a history of exposure to BP's toxins. Dr. Kilburn is a distinguished physician and scientist, and since 1982 he has investigated chemicals and the human brain. He has published over 250 scientific papers and three books. When he left to return to his home in California, he said, "Mike, I have been doing this my entire professional career, and this is the greatest public health crisis I've encountered in my lifetime."

Since that time Dr. Kilburn, LEAN chemist Dr. Wilma Subra, and I have been attempting to obtain funds to perform objective studies on the victims of the spill and to document the success of various treatment endeavors. One of Dr. Kilburn's proposals is included in this affidavit as Exhibit 1. While our studies would cost a pittance of the amount of money already appropriate for medical issues, we have, to date, been unable to obtain any funds to carry out these studies (detailed below).

3. THE GULF COAST'S "GULF WAR SYNDROME"

The post oil spill syndrome (which I refer to as "BP Syndrome") is extraordinarily similar to the symptoms experienced by the soldiers who returned from the 1990 to 1991 Gulf War in the Middle East. Their illness was dubbed "Gulf War Syndrome," and it affected over 175,000 veterans returning from this conflict. Gulf War syndrome is a chronic multi-symptom disorder that has been affecting veterans and civilians since the Gulf War. Its effects were not only experienced by American troops, but also by troops from all of the allied nations that served in the conflict. As was the situation with Agent Orange in Vietnam, many of these veterans were labeled as malingerers, and were denied both assistance and the credibility they deserved after serving their country in a foreign war.

Gulf War Syndrome, and the government's response to this disorder, has proven to be painfully similar to the BP debacle. In both instances, evidence suggests that the illnesses are the result of the ingestion, inhalation or contact with various chemicals to which the soldiers and workers were exposed. The pattern of denial and the efforts to suppress information on "Gulf War Syndrome" and "BP Syndrome" also have been very similar.

In 2008, 17 years after the war had ended, a Congressionally-mandated Research Advisory

ED_001324_00007754-00249

Committee on Gulf War Veterans' Illnesses reported that "Federal Gulf War research programs have not been effective in addressing issues related to Gulf War illnesses."[6] Furthermore, it found that federal research methods were ineffective in addressing the health problems of Gulf War veterans. It concludes, "Substantial federal Gulf War research funding has been used for studies that have little or no relevance to the health of Gulf War veterans, and for research on stress and psychiatric illness."[7]

Like the Gulf War experience, large sums of money have been reserved to perform studies on residents and workers who were possibly exposed to chemicals. None of these studies will have any effect on the health of those individuals who are truly ill at this time, and not a single penny from BP or the government has been made available to actually *treat* patients, many of whom are extremely ill, and some of whom may yet die, from this tragic event. At best, they will be guinea pigs for future lessons learned about exposures that never should have happened in the first place.

4. TREATMENT FACILITY

In January 2012, LEAN, Jim Woodward, my wife Brenda and I began the Gulf Coast Detoxification Program in my family home in Raceland. The purpose of the program was to treat cleanup workers and residents who had become ill since the spill. Mr. Woodworth had managed detoxification programs for many years, including a program to treat the first responders following the September 11, attacks in New York City. My introduction to him began in late 2010 when Marylee Orr gave me a call and shared that there was a foundation interested in treating people who had become ill as the result of their exposure to chemicals from the Deepwater Horizon debacle.

Mr. Woodworth's story was too good to be true, but the documentation of the effects of the program he ran in New York for the 9/11 victims was impressive. Since I was at a loss to be able to do much more than practice band aid treatment for illnesses that I did not understand and for which there was little I could do, I decided to look into the program and see if there were any benefits from its treatment protocol. The patients I had been working with were as desperate as me, and we agreed to work with Mr. Woodworth on this project as we felt that nothing ventured, nothing gained.

One of LEAN's qualifications in partnering with Mr. Woodworth was that we would not have to charge for the treatment; sick individuals are already knee deep in medical bills, and they would not be able to participate otherwise. It costs approximately $4,000 a person for them to complete the program, and Mr. Woodworth obtained enough money for the treatment of 100 people. We have not charged BP or anyone else a nickel for our services.

My initial skepticism about a program that used nothing more than vitamins, minerals, plant oils, exercise and sweating in a sauna to treat problems that neither myself nor any other physicians were able to treat effectively using conventional medicines was quickly replaced with

---

[6] Research Advisory Committee on Gulf War Veterans' Illnesses, Gulf War Illness and the Health of Gulf War Veterans: Scientific Findings and Recommendations (U.S. Government Printing Office 2008).
[7] *Id.* at 4

ED_001324_00007754-00250

enthusiastic optimism over the results of treatment for the initial wave of patients who entered the program.

The basic concept of treatment used in this program begins with an understanding that many of the toxins that are present in our bodies are attached to fatty tissues. Experience has shown that these toxins can be mobilized by a combination of exercise and the use of progressive dosages of Niacin (Vitamin B3). The Niacin dilates our blood vessels, often causing flushing of the skin, and it assists in shearing toxins from our body's fatty tissues. Following exercise and the ingestion of progressively increasing dosages of Niacin, the patient spends from one to five hours daily in a moderate temperature sauna. Hydration and ingestion of adequate amounts of Sodium, Potassium and other minerals, along with some nut oils, completes the daily nutritional program. Each patient is weighed daily and has blood pressure readings recorded.

Some patients begin emitting odors related to the chemicals that have accumulated in their bodies. This is not uncommon, and is an excellent indicator that the program is working. Manifestations are incidences when the chemicals being eliminated from the body are released into the blood stream, causing some of the same symptoms from when they were first encountered. Once again, these are desirable events, and run parallel to the improvements experienced by our patients.

No prescription medicines are administered during the program, and only a few prescription drugs are allowed during treatment. The most difficult aspect of our treatment protocol is that it requires the participants to be present for treatment on consecutive days for up to a month, and each day requires up to five hours of exercise and treatment in a sauna. Everyone involved in administering this program is required to participate in the program personally. I spent 25 days in treatment and became the program's first graduate.

For the next eight months I was present in the detox facility every day (seven days a week, holidays included), and I had the pleasure of watching miracles unfold. The results of our treatment far exceeded anything I had anticipated, and we made major improvements in the lives of most of our patients. To date we have managed approximately 100 individuals at our clinic, and I have treated probably 50 or so additional people who did not receive detox treatment. It has become apparent that while our accomplishments have been remarkable, there is still much to learn from this disorder and much more that needs to be done to help the victims of this tragedy.

To spend much time discussing our lack of complete remission of symptoms in some patients would not do justice to the amazing improvements we have witnessed. However, there are those individuals who, although much improved, still suffer with significant problems from long term medical damages that are difficult to treat and equally difficult to understand. Additionally, many of our patients have had to return to contaminated environments, and are experiencing problems in those settings. One female boat captain can no longer work on her boat, and her husband and fishing partner must now run their vessel alone.

On the successful side has been the observation that memory loss, headaches, irritability and fatigue experienced by a large percentage of our patients have improved amazingly. Having

ED_001324_00007754-00251

been a physician since 1971, I never have had a patient tell me that my treatment made them "Happy." Yet, one of the most common descriptions of well-being that our patients have expressed to us is that by the time they complete their treatment they are genuinely happy. Speaking to family members has confirmed great improvement in irritability, memory, energy levels and overall disposition.

One of our most amazing experiences involved a patient with multiple sclerosis (MS), who was exposed to the toxins through her job supervising the feeding of hundreds of workers assigned to clean contaminated boats. When she first began the program, she could barely walk into the detox facility, and she had to rest immediately upon entering the room. Her first few days of exercise involved being led, hand in hand, by one of the program administrators. However, when she finished the program she was on the treadmill and walking fast for over 35 minutes. Her recovery was nothing short of amazing. And while she revels in her own recovery, she loves to tell the story of her brother, another family member who underwent treatment, and who also had an equally amazing recovery.

As an individual who has been a physician for over 40 years, I haven't seen miracles very often. However, the detoxification program has provided health improvements that have been truly amazing. Some of our more affluent patients, those with insurance and other resources, have described seeing ten or more physicians in their quest to obtain relief from their illnesses. The time and money spent in these quests have been as impressive as the predictable failures of their treatments. Few physicians, myself included, understand the mechanisms of toxic exposure and the manner in which we become ill from these disorders. Even more alien to our conventional thinking is the manner in which people with toxic disorders are treated. Few, if any, groups have seen and treated as many individuals as we have at our modest detoxification clinic in Raceland.

As an Ear, Nose and Throat physician, I have no experience in toxicology or in the treatment of people with chemical poisoning. Yet, three years after the spill occurred, where are the studies being performed to elucidate the true scope of the illnesses being experienced by our friends and neighbors? Who is leading the charge to study the people who are actually sick, as opposed to long term inconclusive studies designed to dilute out the susceptible individuals who have become ill with the overall population who have not suffered by exposure to these toxins? Who is their champion outside of our small circle of donors and the handful of activists who are working feverishly to save the lives and protect the health of these victims?

We have not had any assistance from any of our local, state and federal officials in treating patients impacted from the oil spill. At one congressional hearing held in Houma, Louisiana, Congressmen Charles Boustany and Jeff Landry were in attendance, and they represented many of the victims of the spill. Neither of them bothered to even feign interest by asking any questions of my wife when she discussed what was undoubtedly the most important issue on their agenda - the health of their constituents. They spent most of their time discussing what a wonderful job the Gulf Coast Claims Fund administrator at the time, Kenneth Feinberg, was doing in distributing BP funds to deserving individuals. Their opinions and the observations of these congressmen were not shared by many, if any, of the individuals attending the session.

In Louisiana we have not received any assistance from our Governor. Neither of our U.S.

ED_001324_00007754-00252

senators has assisted us. Only one U.S. congressman, Representative Cedric Richmond, has voiced concern over our plight in regard to the health impact resulting from the spill by holding public meetings in underserved Vietnamese communities. The result of our public officials' tolerance of BP's arrogance is that this foreign corporation has planted a chemical weapon in our environment and they have poisoned our waters and our wetlands in a manner that will, in all likelihood, haunt us for generations to come. The ability of our congressional delegation to be able to assist their constituents and to support the people of their respective districts in their battle with a foreign corporation is enormous. Yet, with the exception of Congressman Richmond, they have done nothing to help the victims of this crisis who they allegedly represent.

I would assume that every day these illnesses remain untreated, further physical, neurological and psychological damages will befall the victims of this tragedy. Does no one else see the urgency of our situation? We have been treating individuals who were rendered ill by a foreign corporation - a corporation that refuses to acknowledge the existence of their worker's illnesses and has refused to take responsibility for destroying the lives of many innocent American citizens.

5. CLASS ACTION LAWSUIT

(The following discussion is that of a non-attorney's understanding of some of the legal proceedings that have accompanied this lawsuit.)

During the legal wrangling that occurred following the Deepwater Horizon debacle, a federal judge, Carl Barbier, was given the assignment of coordinating the legal aspects of any "Class Action" lawsuit that arose from the incident. Judge Barbier, in fulfilling the mandate of that position, appointed a group of attorneys to what is known as the Plaintiff Steering Committee or PSC. My understanding of the arrangement is that the PSC members were required to obtain an agreement with the defendant (BP) to set up guidelines to be used to assign damages to the individuals who were affected by the spill.

I have been personally overwhelmed in trying to maintain my medical practice while working full time on this project. However, I now find myself needing to address the legal interests of my patients. While I am woefully unqualified to address these complex legal issues, my understanding of the settlement between BP and the PSC is that it leaves many deserving victims of this tragedy without any legal remedy or financial compensation for illnesses I know they are experiencing. With this in mind, I wrote to Judge Barbier on three different occasions (detailed below) and I believe him to be an honest and sincere individual. I also submitted a declaration to Judge Barbier on September 7, 2012 detailing my concerns with the medical settlement. The declaration is included in this affidavit as Exhibit 2.

There are two sections of this Class Action Lawsuit. The first involves compensation for losses experienced by individuals and business that were adversely affected by the oil spill. The second involves the medical aspects of this tragedy. While I know little concerning the guidelines agreed to by the PSC and BP for business losses, I have very strong opinions on the medical settlement. From my perspective, there were three glaring discrepancies in the medical aspect of

ED_001324_00007754-00253

the BP settlement.[8]

The first problem involves the Zones designated to recognize non-workers who were exposed to noxious materials and became ill. The second involves the actual long-term (chronic) symptoms being suffered by the victims of the spill. Both zones exclude thousands of individuals who should have qualified for the Medical Settlement. To qualify as a non-worker entitled to compensation, two major zones of residence were established. The first zone, "Zone A," was defined as "certain beachfront areas in Louisiana, Mississippi, Alabama, and the Florida Panhandle within at least 1/2 mile of the water."[9] Out of the estimated 105,000 people who qualified under this designation,[10] only 1,600 were from Louisiana, or approximately 1.6% of the qualified population. This is the approximate population of Grand Isle, the only community in the state where people live within ½ miles of the shoreline.

Although Louisiana suffered the greatest impact of any other location from the spill and a majority of cleanup workers coming from this state, only 1.6% of the people qualifying for this designation came from Louisiana, with the majority of the remaining 103,400 residents coming from Florida, Alabama and Mississippi. It appears that the Zone B is equally absurd. Zone B's parameters are unclearly defined as "certain wetlands within at least 1 mile of the water."[11] It will be interesting to see how many individuals qualify under this designation.

The second travesty in the settlement involves the definition of chronic illnesses associated with relevant chemical exposure. The list of chronic systems that qualify for this more significant designation concerns me because, while there is some overlap, it is not representative of the symptoms that I have repeatedly observed with my patients impacted by the spill.

That list is as follows: Ocular: Sequela of chemical splash to eye, including damage to cornea; Respiratory: Chronic Rhinosinusitis, Reactive Airways Dysfunction Syndrome; and Dermal: Contact Dermatitis, Eczematous reaction.[12]

My personal experiences with these "Conditions/Symptoms" are as follows:

Ocular: To the best of my recollection, I know of only one patient who had any long term problems with his eyes and he has never been a patient of mine. Other patients had eye complaints, but I don't recall anyone who entered the program who had any major problems with his/her eyes or vision.

Respiratory: Chronic Rhinosinusitis: This problem is extremely common in our area and it makes up a large part of my medical practice. Few of my patients undergoing detox treatment complained of nasal and sinus problems and I don't recall many of them asking for medicines to

---

[8] Deepwater Horizon Oil Spill Medical Benefits Settlement: Detailed Notice, Aug. 28, 2012, *available at* http://www.deepwaterhorizonsettlements.com/Documents/Medical%20Detailed%20Notice.pdf.
[9] *Id.* at 6
[10] Medical Settlement FAQ, Mar. 2, 2012, *available at* http://www.marylandinjurylawyersblog.com/Medical%20Settlement%20FAQ%203-2-2012%20%282%29.pdf.
[11] Deepwater Horizon Oil Spill Medical Benefits Settlement: Detailed Notice, *supra* note 8 at 6.
[12] Deepwater Horizon Oil Spill Medical Benefits Settlement: Detailed Notice, *supra* note 8 at 28, 29.

ED_001324_00007754-00254

treat these disorders.

Respiratory: Reactive Airway Dysfunction Syndrome: Some of my patients mentioned that they had coughs early on in the course of their illnesses. However, few maintained these coughs and respiratory symptoms by the time they came in for treatment in our detox center. In none of the cases I treated do I recall pulmonary problems being a major consideration.

Dermal: Contact Dermatitis and Eczematous reaction: Quite a few patients described rashes that developed while working on the oil spill. Most of these rashes improved with time. While participating in our detox program, a large number of individuals developed eruptions of raised, red bumps, especially on their backs and trunks, or torsos. These areas generally improved when the treatment was completed. Some skin eruptions continue to occur after treatment was completed.

In summary, the above-mentioned problems, with the exception of skin disorders, were not among the major problems experienced by the more than 100 patients that I saw during the course of our treatment program. Nor were these problems frequent in the 100 or so other patients who I questioned following the oil spill.

Many of the problems experienced by my patients prevented them from working at their regular jobs, or made their work extremely difficult to perform. The major problems we saw, and the problems that continue to plague many of our patients, were fatigue, memory loss, irritability, headaches, muscular pains, joint pains, insomnia, vertigo, acid reflux, hypoglycemia and abdominal pains were the more common symptoms. As mentioned previously, skin rashes were also commonly experienced. Amazingly, only the skin disorders were included in the chronic conditions/symptoms in the settlement.

The next question that begs an answer is how does an individual qualify for the benefits included in the medical settlement? With reference to the "Chronic Conditions" category the claimant must submit -- "A declaration under penalty of perjury setting forth the condition and the location and time of exposure; *AND* medical records supporting the claim and ongoing care for the asserted condition" (emphasis added).[13] Since a large portion of the people adversely affected by the oil spill have no medical insurance, they also have few, if any, medical records to qualify in this area.

The above symptoms and qualifications are an absurdity, because they have little to nothing in common with the actual significant symptoms being experienced by the people who were exposed to these chemicals.

Why would the PSC and BP settle on these criteria? One reason would appear to be that this designation does provide some major benefits to BP. By avoiding recognition of the actual long-term consequences of these toxic exposures and by minimizing the significance of the illnesses actually being experienced, BP gets to avoid taking responsibility for the far more significant symptoms that truly exist in a chronic setting, such as memory loss, fatigue and severe headaches. In other words, if the actual long-term symptoms were included in this category, BP

[13] Medical Settlement FAQ, *supra* note 10 at 3, 4.

ED_001324_00007754-00255

would have to acknowledge that these problems actually existed. Understandably they were unwilling to do so. Additionally, these chronic symptoms would certainly qualify for more compensation to the victims of this crisis.

The last aspect of the medical settlement with which I take issue is the provision for the "Gulf Coast Region Health Outreach Program." Over $100 million dollars is being put aside for research and clinics, supposedly to study and treat the general population of the Gulf States. However, to my knowledge, not a nickel of that money is designated to either study or treat the people who were rendered ill by exposure to the gumbo of chemicals resulting from the spill. Workers and residents impacted by the spill require health clinics that specialize in chemical exposure. However, the outreach program focuses on primary care, which is a fine service for the general population but does not address the victims of this spill. By not treating these individuals directly, BP is unwilling to admit that these victims actually exist.

BP's oil spill has (probably) resulted in the death of some individuals in our communities, and has permanently damaged the health of many more. BP's reckless disregard toward regulations has devastated our environment and, for many, their ability to make a living. To add insult to injury, during this tragedy BP arrogantly refused to cease using the chemical dispersant Corexit, the chemical that is suspected of causing the illnesses we have been experiencing, in spite of being directed to do so by the EPA in the early stages of the spill.[14] BP continued the usage of toxic chemicals that are not permitted for use in Great Britain. To date, BP has refused to take the responsibility for the resulting illnesses that it has created.

I would like to make the following comments with regard to individuals we have been treating at our detox facility. Because many of individuals are quite ill, this patient population would represent a subset for any study group that was looking for illnesses that were truly being experienced by victims of this calamity. There is an enormous need for us to be able to use this tragedy to obtain information on the cause and treatment of the health problems we have been observing. I have written to Judge Barbier on three different occasions, and he has responded indirectly to each of my requests. I have received calls from members of the PSC twice, and I met with two representatives of the group on one occasion.

My last request to Judge Barbier was for assistance in obtaining funding to enable us to perform some objective studies on the health effects of victims of the oil spill. My letter resulted in me receiving a call from a PSC member and arrangements were initiated to meet with one of the groups receiving funding for studies to see if we could do a series of studies on the people who were actually ill from these chemical exposures. I deferred the meeting arrangements to Dr. (Kaye) Kilburn, who was the chief design architect of our study group. On my last conversation with Dr. Kilburn, he stated that his contact person with the PSC stopped taking his calls and did not return the calls made to him.

The settlement does not account for the more serious medical symptoms associated with the oil spill, and the government has failed to recognize any medical impact. In response to a letter I wrote the Center for Disease Control (CDC) about health problems associated with the spill, the

[14] Directive from EPA to BP on using less toxic and more effective dispersants (May 20, 2010), *available at* http://www.epa.gov/bpspill/dispersants/directive-addendum2.pdf.

ED_001324_00007754-00256

CDC wrote back on June 15, 2011 that there are no trends in illness identified by the multiple surveillance systems used, and that there have been no approved dispersant applications since the summer of 2010. These assertions need to be supported with facts. My letter to the CDC and the CDC's response are included in this affidavit as Exhibit 3 and Exhibit 4. Once again, we have a public document that defies all reality and underlies the intentions of both our government and the private sector to avoid admitting that there are actually people who were rendered ill by this tragic experience.

In speaking to Dr. Riki Ott, a veteran of the Alaska Valdez oil spill, the use of the dispersant Corexit that was used in response to the Deepwater Horizon oil spill is approved in virtually all of the oil spill management plans of all of the companies working in the Gulf. This would provide a simple, and perhaps legal, excuse for the continued use of this chemical in our environment.

While I am skeptical about the claim by BP and the government that there were no approved applications of Corexit for spraying since July 2010, with the exception of one incident in September 2010, I have no scientific proof that this was an inaccurate or intentionally false statement. Anecdotally, however, I have studied repeated reports by concerned workers and residents that spraying continued, and I have spoken to numerous individuals who claim that the spraying of dispersants continued for long after 2010. The experiences they described have been identical to the prior, conceded instances of confirmed spraying. However, I have no proof that those comments are correct.

Unfortunately, and under any circumstances, the illnesses being experienced by the victims of this tragedy suggest that there is a continued presence of toxic materials causing problems that we have not experienced at this magnitude previously in the Gulf.

6. WHAT CAUSED BP SYNDROME

I have lived on the Louisiana coast for 67 years, and spent a considerable amount of time on Grand Isle and in the waterway now named Port Fourchon. The earliest offshore drilling for oil occurred off the coast of Louisiana. At that time, the oil companies couldn't have cared less about spilling oil into the environment. Those of us who frequented the beach at Grand Isle came home with brown feet and stained swim suits due to the oil present on the beaches where we swam and fished. I do not recall a single incidence in which anyone became ill as the result to exposure to either the oil or to the tar balls and tar "rafts" that were present on the beaches.

It is obvious that there is something different about this recent spill. BP insisted, even after the EPA requested an alternative, less toxic, dispersant than Corexit, that they could and should use this chemical to hide the oil that was pouring into the Gulf. It is beyond credible doubt that this decision was the new factor, and that Corexit is the prime suspect for the illnesses ruining the lives of so many neighbors and friends today. It is probably also responsible for the death of our dolphins, and the bizarre appearance of the crabs and shrimp that are harvested from the waters where these chemicals were used. BP's defiance in this situation is similar to its arrogance in ignoring safety guidelines that resulted in the original explosion of the Deepwater Horizon

ED_001324_00007754-00257

drilling rig.[15]

I recently had an opportunity to visit with representatives of BP at its U.S. office in Houston, Texas. The purpose of our visit was to attempt to get a commitment from BP to stop using Corexit for any future oil spill activities in the United States. The two individuals who negotiated with the PSC over the medical aspects of the settlement were present, and I expressed my disappointment with both the designation of zones that eliminated the majority of people from Louisiana from consideration for benefits, and the inclusion of absurd criteria for long term (chronic) illnesses.

By the time we left the meeting, BP asserted that unless ordered by the government, they would not consider discontinuing the use of Corexit as a dispersant in future oilfield spills. They also refused to commit immediately to informing the public when they use these dispersants in the future, but said they would consider action to stop blindsiding the public. Their position was that as long as Corexit was approved by U.S. regulations, they had the right to use the chemical in responding to an oil spill.

Upon leaving the meeting in Houston with representatives of BP, my wife was quiet and obviously disturbed. With tears in her eyes she muttered repeatedly that "[t]hey really don't care," and that "[n]othing is going to be done about our requests!" Brenda understands all too well that we cannot expect these wealthy corporations to concede anything remotely resembling honesty or fairness, if it is not in their best interest to do so. That means accepting responsibility and accountability for their actions, instead of doing or saying anything to avoid liability. She also realizes that our elected officials, who allegedly represent our interest, will never defy their wealthy benefactors and provide justice to those who they have pledged to represent.

7. CONCLUSION

We currently have the opportunity to take action on health problems that have defied identification and treatment for over 50 years. We squandered our opportunity to do objective studies on the "Agent Orange" fiasco that characterized the Vietnam War. I can vividly recall the controversy surrounding the illnesses experienced from exposure to the toxic brew of chemicals used to defoliate the jungles of Vietnam. We mistreated and misdiagnosed our heroes of that conflict and it was years before our nation finally acknowledged what was already known about these chemicals and the illnesses they caused.

Over 20 years ago we had another foreign conflict and once again our troops returned home ill, with over 175,000 of them being affected with a condition that became known as Gulf War Syndrome. Once again, these heroes were labeled as malingers and malcontents and were shoved into the background and ignored. Seventeen years later, Congressional studies indicated that these soldiers were definitely ill, and their problems were finally acknowledged.

Shortly after the 1991 war, a retired Colonel from California named David Root testified in a Congressional hearing that he had treated several veterans who were suffering from Gulf War

[15] Jad Mouawad, *For BP, A History of Spills and Safety Lapses*, The New York Times, May 8, 2010, *available at* http://www.nytimes.com/2010/05/09/business/09bp.html?pagewanted=all.

ED_001324_00007754-00258

Syndrome and they all responded very well to his treatment.[16] There was no follow-up assessment of his testimony and there was no support at the time of Dr. Root's treatment experiences. Ten years later, Dr. Root was the physician who supervised the successful treatment of about 1,000 victims of the 9/11 crises in New York City. The techniques used by Dr. Root to treat the Gulf War Veterans were the same techniques used to treat the victims of the 9/11 attack and they are the identical techniques used to treat the victims of BP Syndrome in Raceland, Louisiana.

If all of these statements are correct, and if successful methods have been established for the diagnosis and treatment of these disorders, why have these techniques not been studied, written about and taught to physicians in anticipation of there being future generations of doctors who can truly understand these problems and are qualified to treat these disorders? The answer to that question is contained in the above affidavit. In our current crisis, a large, multi-national corporation has decided that they do not wish to acknowledge that the chemicals they insisted on using, and which are outlawed in their country of origin, have harmed anyone, anywhere at any time.

---

[16] *Public Hearing Before the Presidential Special Oversight Board for Department of Defense Investigations of Gulf War Chemical and Biological Incidents* (1998) (statement of Dr. David E. Root, M.D., , M.P.H., F.A.C.O.M. Colonel, USAF, M.C., Ret.), *available at* http://www.detoxacademy.org/pdfs/testimony.pdf.

ED_001324_00007754-00259

I have read the foregoing 16 page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on October 11, 2012.

Michael Robinson

Subscribed and sworn to before me
this 29TH day of October, 2012

Susan A. Matherne
Notary Public
My Commission expires on: at death

SUSAN A. MATHERNE
NOTARY PUBLIC ... PARISH, LA
MY COMMISSION EXPIRES AT DEATH
NOTARY PUBLIC NUMBER 9257

AFFIDAVIT

My name is Scott Porter. I am submitting this statement without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am a coral and oyster biologist, and I've been diving in the Gulf for over 20 years. After the BP oil spill (spill), a small dive team and I took water and coral reef samples close to the Macondo well (a.k.a MC 252 or the Deepwater Horizon site) for the Natural Resource Damage Assessment (NRDA) process, which is housed under the National Oceanic Atmospheric Administration (NOAA). NOAA assured us that it was safe to dive; however, after it obtained our samples, it backed out of our agreement to share the test results with us and to compensate us for our dives. Furthermore, since diving I have become sick, and chemicals from the crude oil and Corexit have shown up in my blood in high levels. My main complaint throughout the spill response is how closely NOAA has worked with BP and has neglected to present sound science to the public. I am providing this statement in order to educate the public on what has taken place. There are no restrictions on this statement's use.

1. EXPERTISE

In 1986 I went to Louisiana Technical College, for biomedical engineering. I realized I didn't want to be a doctor and switched to computer engineering in 1987. I took some classes at the Louisiana Universities Marine Consortium (LUMCON) on marine biology. For a short period I worked as an environmental biologist and chemist. I worked for two different environmental laboratories in the late 1980s at their bioassay department, where I would set up bioassays of wastewater and analyze the wet chemistry involved therein. A bioassay, or biological assessment, employs standard methods for measuring toxicity of a compound on aquatic organisms. In 1989, I worked at Lee & Ro Environmental Laboratories in Westlake Village, California. Given my experience, I was in charge of the bioassay program. In 1991 I realized the importance of aquaculture and went into Marine biology at Nicholls State University, located in Thibodaux, Louisiana. I graduated in 1997 with a Bachelors of Science in marine biology.

In 1991 I was hired as a diver for an oyster biologist. As a scuba diver and biologist myself, it behooved me to begin my own company rather than work for the biologist periodically. I opened my own company, EcoLogic Environmental Consulting, in March 1992. It is an oil field consulting and diving company, and I primarily work as an oyster biologist consultant between the state of Louisiana, oyster fishermen and oil companies. Prior to the spill, over 90 percent of my work was for the oil industry. While I still receive 70% of my earnings from the oil field, my income is only at 10 to 30 percent of what it was prior to the spill, because the Gulf oil spill moratorium reduced the typical demand for my service.

Over the past 25 years I have seen myself as a forensic investigator, and I have performed over 6,000 dives. If there is any damage or potential damage to an area, my clients contact me to try to figure out what happened or may happen. My first questions in examining the scene are: what

conditions exist in these oysters or coral reefs, are they normal or abnormal, and why do they exist that way. Then I try to determine if the implications are good or bad for the normal environment.

As a consultant, I work with oyster fisherman and oil companies when they are required to perform an environmental survey prior to bringing the equipment in to work. However, the environmental survey requirement is like slapping the oil industry with an empty glove. There are no fines associated if they don't perform the assessment, but if they do perform the assessment and there is damage documented then it reflects poorly on the company. Along with these surveys, I also document passage of oilfield equipment through the marsh, and give it a Global Positioning System (GPS) rail of speed and direction. The companies that act as environmental stewards take the risk and do what they can to address any problems that the assessments and rig move reports reveal, but the majority do not perform the assessment.

2. ECORIGS AND PLATFORMS

Since 2006 I have also worked for EcoRigs, a nonprofit organization that is trying to preserve the platforms of offshore rigs for the ecological oasis that they represent. EcoRigs' primary concern is the preservation and research of coral reef communities. I have been studying coral reefs on platforms offshore of south Louisiana for 14 years. These reef habitats occupy most of the continental shelf and all of the continental slope. The continental slope has platforms with unique footholds on it in order to exist in their specific environments. We want to preserve some of the more pristine coral reef habitat that exists on these structures, because there are potentially hundreds of species with the potential for natural biomedical properties that we may discover. Photos of EcoRigs staff and me working with coral are included in this affidavit as Exhibit 1.

For at least the past 20 years the Bureau of Oceanic and Energy Management, Regulation and Enforcement (BOEMRE), formerly the Mineral Management Service (MMS), was open to examining platforms for living corals. Prior to the spill I was excited about leading them under the platforms for an investigation into Tubastraea micranthus, an invasive coral species I recently discovered in the northern Gulf. However, since the spill my oil field consulting and this coral research has dramatically declined; there has been practically no work the past couple of years to produce corals on the commercial market.

Another reason to save many of the offshore platform structures is because we have the technology to put sensors on the bottom of the platforms to determine if the plugged and abandoned wells ever leak. This is the big monitoring tool that most oil companies do not want. If a well ever leaks and the Coast Guard detects the oil, the company will be liable for the cleanup and a fine. Oil companies prefer to keep doing what they have historically done, which is to plug and abandon the well, remove the platform and stop all liability. It would be helpful to have one of these sensors on the Macondo well. Other divers and I were worried about oil leaking from there because, even after the well was capped, we continued to see fresh oil coming

up and fresh plumes in the vicinity of the Macondo well and within an approximate 40 mile radius of the Macondo well. In September 2011 and October 2012 it was confirmed that fresh oil was coming from the location of the Macondo well, and it was identified as BP MC 252 oil.[1] Photos of fresh oil within the vicinity of the Macondo well are included in this affidavit at Exhibit 2.

The Gulf waters east of the Mississippi River (the river) used to have areas with relatively consistent clear, blue water because there is an offshore current in the Gulf that flows east to west across the face of Louisiana, and the current typically pushes the river water away from northeast of the river. The current typically pushes most of the sediment load from the river south and west across the Louisiana coastal zones and leaves portions of the northeast side of the river clean, clear and blue. The spill happened in the worst place, because east of the river is where most of the oil came inshore and damaged some of the most pristine reefs. Then it happened in deep water where oil and dispersed oil is virtually impossible to recapture and could potentially destroy living creatures from 5,000 feet down and up.

Prior to the spill, if we ever had a film crew that had to get shots underwater, we would normally bring them to the northeast side of the river to Main Pass (MP) 311, which is located about 40 miles northwest of the Macondo well. Before the spill, the water was typically cobalt blue and some of the most pristine reefs were located there. When we dove, we could see all kinds of living organisms, such as sea turtles, manta rays, angelfish and sharks. After the spill the water became pastel green or brown, like a tan tint color. We have video that compares that location in 2008 to after the spill in 2010 through April 2011.[2] The contrast is shocking. By August 2010 I was noticing an absence of damsels, blennies, and gobies near the surface during our Louisiana dives. Photos demonstrating the changes in MP 311 are included in this affidavit as Exhibit 3.

After the spill, I dove numerous times with a small team, including members of EcoRigs, to collect water and coral reef samples in the vicinity of the Macondo well. We wanted to examine the environmental effects from the spill, so we dove at MP 311. The ridge that we dove in is 200 to 220 feet deep of water; however, when you move closer to the Macondo well it drops to 5,000 feet. When the spill occurred, these offshore reefs were the first organisms to come in contact with the dispersed oil. Fish can swim away, coral reefs can't. In effect, the oil that was dispersed at the surface around the Macondo well moved into the first line of major reefs, which were located on the continental slope, such as MP 311. The first reefs to be affected were the corals

---

[1] *Fresh Oil Sheen at Deepwater Horizon Site*, The Maritime Executive, Oct. 11, 2012, http://www.maritime-executive.com/article/fresh-oil-sheen-at-deepwater-horizon-site.

[2] Video footage of MP 311 before the BP oil spill is on file with Government Accountability Project and available upon request. Associated Press. "AP Exclusive: Scuba Diving in the Gulf Oil Spill." YouTube. Jun. 9, 2010. http://www.youtube.com/watch?v=FGX7krQYI_4.; Scott A. Porter. "EcoRigs MP 311 coral sample 1 at 20m." YouTube. Jun. 10, 2010. http://www.youtube.com/watch?v=_hoIYshYVNE. ; Scott A. Porter. "40 miles North of Deepwater Horizon sets MP 311 SCUBA samples at 15m June 7 2010." YouTube. Sept. 30, 2010. http://www.youtube.com/watch?v=G4W7pTHJcCs.

ED_001324_00007754-00263

and oysters on the platforms scattered across the continental slope and shelf (detailed below) respectively. Ultimately the dispersed oil made its way into the inshore oyster reefs in the coastal zones.

Before the spill the only university and government entities that expressed interest in receiving EcoRigs' coral reef samples were the curator at the Smithsonian and the University of Southern Florida (USF). We sent them representative samples of typical reef organisms. The Smithsonian requested samples of the coral skeletons which will be kept on file, and the coral skeletal structure will be studied. We were told by our contact at USF that they lost the fresh coral reef samples that we froze and shared with them in 2009. Photos of these coral reef samples are included in this affidavit as Exhibit 4.

My greatest critique with how the federal government has responded to the spill is that agencies are not examining the reefs in the locations that were first and worst hit by the dispersed oil. Even if they were looking at these organisms, they would need us to explain what they should be looking for and what organisms are no longer there in the aftermath of the spill. To the best of my knowledge, NOAA has to date refused to acknowledge organisms located on the oil platforms. In my experience since the spill, NOAA has been dismissive of these coral reefs and ignored the valuable database that they represent.

1. CORAL SIGNIFICANCE

The artificial coral reefs represented a touchy issue of what was growing on offshore platforms. Before the spill, EcoRigs and NOAA were as two ships passing in the night. We were trying to get NOAA to acknowledge the organisms around the platforms and the offshore reefs that we have been researching for the last decade. There are over 4,000 offshore oil and gas platforms in the northern gulf. However, at the end of the life of a well, under a directive by the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), formerly the Mineral Management Service (MMS), the whole platform is removed. This is unfortunate because 80 to 90 percent of these platforms have some form of coral living on them. Also, there are 10 times more fish around these platforms than around an acre in the marine banks in the same area. If you want to fish or find reef samples, you go to a platform.

BOEMRE claims that the platforms can over time turn into a navigational hazard. However, we are not advocating that the platforms remain up permanently. We argue that for a designated period of time after they are no longer producing, we should have access to the platforms for ecological advancements.

NOAA has taken the position that these coral reefs are not protected under the Endangered Species Act (ESA), claiming it is not required to include the coral reefs found on oil and gas platforms. Corals are protected almost everywhere else in the United States coastal waters under the ESA; however, corals on platforms fall outside these protections because they are categorized as artificial reefs, as opposed to natural reefs. On the flip side, the Magnusson Stevens Act

protects all endangered habitat, including coral reef on artificial structures. I think it is a political matter; NOAA supports the removal of platforms, and if they applied the Magnusson Stevens Act then they would have to require the oil companies to scrape the reef off the platform before they can pull the platform out. This process will cost the companies millions of dollars and hold up the removal of the platforms.

Over the last ten years my company concentrated on the artificial reef in a specific zone along the continental slope. The reefs beyond 10 to 20 miles offshore contain the more exotic reef forming organisms, including large, stony coral. Before the spill, my company was holding off on selling coral until Dr. Paul Sammarco of LUMCON and I could get our report published on this new invasive coral, Tubastraea micranthus. It was important for it to be published, because the organism that we were working with had never been collected in the region; it was new and thriving. In fact, it was the first time it had been found in the whole Atlantic basin. It comes from Indonesia, and it probably came over in the ballast waters of a ship right after Hurricane Katrina. Our paper was published in April 2010 through the scientific journal Aquatic Invasions.[3] Shortly thereafter, the Deepwater Horizon exploded.

The Macondo well is located in a deepwater basin 5,000 feet deep called the Mississippi Canyon (MC). The MP and MC blocks of platforms represent the most substantial reefs in the direct path of the oil. In turn, their reef communities are affected first and the worst by the dispersed oil plumes. Near the northern edge of the canyon, where it comes up 1,000 feet, is where the bottom of the MC 194 (aka COGNAC) platform sits. Their essential fish habitats, reefs, are at the edge of where the oil would begin to surface from underneath or float in from the dispersed oil in the subsurface waters. The MC 280A (aka LENA) platform sits across from MC 194, on the southern edge of the canyon. It also serves as essential fish habitat, where the oil would begin to surface or float in as dispersed oil clouds in the subsurface waters. Maps of these locations and MC 252 and MP 311 are included in this affidavit at Exhibit 5.

1. SCIENCE IGNORES COREXIT; OIL OUT OF SITE BUT NOT GONE

When the spill occurred, most of the local Gulf scientists were employed by universities and had limited scientific freedom, because their findings needed to be approved by their institutions. At EcoRigs we wanted to study reef samples, sponges, oysters, barnacles, but NOAA did not express interest. To date, NOAA has not looked at the damage in the Gulf closely. The oil and dispersants are comprised of Polyclyic Aromatic Hydrocarbons (PAHs), which are known carcinogens. If NOAA doesn't want to know what has been killed from the spill already, it should at least sample the reefs now so it knows the reefs' PAH concentrations.

---

[3] Paul W. Sammarco, Scott A. Porter & Stephen D. Cairns, *A new coral species introduced into the Atlantic Ocean - Tubastraea micranthus (Ehrenberg 1834) (Cnidaria, Anthozoa, Scleractinia): An invasive threat?*, 5(2) Aquatic Invasions 131 (2010), *available at* http://www.aquaticinvasions.net/2010/AI_2010_5_2_Sammarco_etal.pdf.

ED_001324_00007754-00265

Government and media reports on the science of the spill have not addressed external factors that increase the public health and environmental dangers, in particular, the use of the dispersant Corexit to treat the oil. When the government and BP would say "the oil disperses" I would ask, "what happens to these chemical compounds; if they disappear, do they just no longer exist?" (detailed below). BP and NOAA officials argue that when oil is at the surface of the water, some of the volatiles can just evaporate and no longer pose a health risk. Unfortunately, that's not what happens when they spray Corexit onto fresh oil, which is a huge wrinkle.

Total Petroleum Hydrocarbons (TPHs) have a long list of compounds associated with crude oil. The volatile compounds, PAHs, are some of the most dangerous compounds because they have the lowest toxicity thresholds. The lowest toxicity threshold is a technical way of saying that it takes less of the compounds to cause damage or be poisonous. Furthermore, they evaporate easily and are easy to inhale – especially the uppermost or lightest of the aromatics containing benzenes. When controlled burns take place, TPHs and volatile compounds become airborne in large quantities and therefore are dispersed into the atmosphere. There is little doubt that burning fresh crude oil at the surface releases toxic compounds into the environment, but TPHs and PAHs become even more dangerous when you put dispersants on them.

Notwithstanding the highly toxic nature of dispersed oil, the oil industry now depends primarily on the use of dispersants in the event of a spill. Like any good magician, the oil industry has learned that if you can't see something that was there, it must have 'disappeared.' The industry has known for decades that if someone doesn't or can't see an oil spill then it's hard to prove the magnitude of the spill or that it ever existed. Oil companies have also learned that, in the public mind, "out of sight equals out of mind". Therefore, they have chosen crude oil dispersants as the primary tool for handling large, marine oil spills.

Using Corexit in the Gulf made it more difficult to identify BP MC 252 oil. As a dispersant, Corexit breaks down very fast in the environment, and it is supposed to erase the oil signature by breaking down the "fingerprint" of the oil. The fingerprint contains organic hydrocarbons that can be traced, and we have tools to help determine if the oil came from the Macondo well or a different spill. An analysis known as a gas chromatograph provides an interpretation of the oil fingerprint. It can often be difficult to get a 100% guarantee reading that it is a specific type of oil depending on the age of the oil in the environment, but this is the standard and most reliable method available to identify the oil. We can also use a biomarker test to analyze the level of exposure to the dispersants and oil but these tests are not considered as reliable by some specialists. More discussion on analysis protocol is desperately needed.

The dispersant breaks down crude oil into micro-droplets, small enough pieces which can then be dissolved into or suspended into the water column; that is what makes the dispersed oil plume. When oil and dispersant are mixed they break down the long carbon chain, which is crude oil. This process facilitates the release of the PAHs from the TPHs - heavier compounds that then sink. The heavier components of crude oil, such as asphalt, easily sink to the seafloor as

ED_001324_00007754-00266

crude oil breaks down. Oil also sinks when "marine snow", or suspended sediment coated with dispersed oil, eventually descends to the seafloor. However, the aromatics - arguably the most dangerous and some known carcinogens - do not sink so easily. The aromatics typically have a lower specific gravity than seawater, which means that they tend to float near the water's surface. Whether on the bottom of the seafloor, in the water column or at the water's surface, these compounds (i.e. benzene, toluene, styrene and xylene) enter the food chain and then bioaccumulate in seafood over time.

2. SEAFOOD CONCERNS, CHEMICALS BIOACCUMULATE

An important question, which has been absent from government discourse on Gulf seafood safety, is "How are organic compounds biologically accumulative?" As an organism ingests organic compounds they will lock up primarily in the lipids or fat cells of the body and then accumulate with exposure. For instance, algae first eat the oil and then have organic compounds in their cells. Algae are then eaten by zooplankton, which are microscopic water bugs. Other "grazer" organisms, such as crabs and shrimp, eat a wide variety of organic material that they find on the reef, including algae and potentially oil micro-droplets. Crustaceans, or shellfish, eat the zooplankton and plankton. If or when the shellfish is eaten by the fish, all that the shellfish previously consumed begins to bioaccumulate in the fish. This is the organic compounds' typical route into the food web.

Several of the oyster, water and coral samples that we collected matched the Macondo fingerprint, BP MC 252 oil. Oysters are big water filters, so whatever they pick up can remain in their shells and skeletons. In September 2011, I collected oysters 30 to 40 miles north of MP 311, or approximately 80 miles north of the Macondo well. We sent the tissue in for the testing and it came back high in TPH at 260 parts per million (ppm). The test results are included in this affidavit at Exhibit 6. Of those TPHs, 31ppm was diesel. An LC 50 (lethal concentration which kills 50% of the test organisms within two to four days) is a way we begin to describe these concentrations. The LC 50 for the dangerous aromatics (PAHs such as diesel) typically ranges from two ppm to just under 20ppm.

After we received some of the results back from our samples, in August 2011 during a meeting with the Gulf Coast Claims Fund (GCCF) I tried discussing our findings. The first thing that GCCF Administrator Kenneth Feinberg said was, "How do you know it was Macondo oil?" When we showed Feinberg videos of the underwater clouds of dispersed oil he responded that NOAA was not reporting those results to him. He asked a group of seafood lawyers in the meeting why the state would spend $250 million dollars on its seafood program if the seafood was not safe?

Since the spill, EcoRigs and other scientists and commercial fishermen have asked NOAA to analyze the presence of TPHs and PAHs in seafood frequently consumed by the public, such as the offshore fish like red snapper and amberjack, as well as, oysters, shrimp and crabs. NOAA

ED_001324_00007754-00267

would respond that the seafood was being tested daily; however, this was not reassuring because NOAA and the Food and Drug Administration (FDA) relied on sensory testing – or a sniff test – to support its position that Gulf seafood is safe for consumption. As an oyster biologist and forensic scientist, I know that a sniff test means you don't want to find any contamination in tissue sample. The aromatics are what you would be able to smell through a sniff test, and the human nose is only supposed to be able to detect the presence of these gaseous molecules in the triple digit parts per million range and above. Therefore, the lower concentrations of aromatics, even though still chronically dangerous, are extremely difficult to detect with the smell test. Even people trained to smell for these chemicals cannot detect them at low levels.

The aromatics may evaporate and dissipate rather quickly in air, but when ingested they tend to get stored in fatty tissues and biologically accumulate. Even if the levels of contamination are too low to detect by a sniff test, the danger is that as you eat the seafood, the toxins bioaccumulate in the body. PAHs and TPHs are dangerous down to 10 parts per billion (ppb); however, you can only even smell the chemicals at 100 ppm or milligrams per kilogram (mg/kg), which is still 10 times greater than the testing average lethal concentration. This means that if you can smell it, it is already ten times the lethal concentration that kills 50% of test organisms in two to four days. However, to my knowledge these were not the samples being tested by BP or the government. NOAA seemed to only be sampling the organisms that were healthiest and still living, and even those could have unsafe contamination levels that would pass the government's primary testing method.

3. TESTING CONCERNS

Of public concern is the fact that NOAA allowed BP to choose where the samples would be taken from and then allowed BP to hire a laboratory on a contractual agreement to test the samples. Throughout the spill, Vessels of Opportunity (VoO) captains would take scientists to collect samples for BP. Several of the VoO captains informed me and other scientists that BP instructed them away from the oil to take the samples, and in turn they rarely encountered fresh oil. Captains told us that this happened frequently from Louisiana through Mississippi. Later, a FOIA request by Greenpeace found that BP was trying to control where independent research funded by BP would take place, including potentially where the vessels went.[4]

In the 1980's when I worked in a lab, we would get samples in the lab that would not pass Environmental Protection Agency (EPA) requirements and the laboratory director would tell us to run the sample again. At times we were instructed to dilute the samples in order to achieve the desired results. It was a practice that I did not agree with, but there was no tolerance for dissent. It was that way in the late 1980s and this spill has raised the question of whether this practice is still taking place. Similar to the 1980's, competition between labs is still high, and to my knowledge there are no regulations enforced to prevent this practice.

[4] *BP Internal Meeting Notes*, The Guardian, Apr. 15, 2011, http://www.guardian.co.uk/environment/interactive/2011/apr/15/bp-internal-meeting-notes.

ED_001324_00007754-00268

There are greater questions of scientific integrity in the handling of the spill, because to a degree BP is able to control where the samples are taken from and what the public sees. There have been cases where we know we have sent independent labs samples with oil, because we could see and smell the oil at the surface, and the labs still didn't identify oil traces. When that happened my first question was, "How did they test the samples, what were the protocols?" By fall of 2010, several environmental scientists, including myself, were discussing the accuracy of the tests that labs were running and whether they were processing the samples appropriately. We are now looking at their protocols for analysis and raising the concern that their testing methods may be outdated and insufficient to accurately analyze PAHs and TPHs.

As an environmental scientist, I look at the way the government and BP are handling, describing and discussing the spill. A bioassay, or biological assessment, employs standard methods for measuring toxicity of a compound. Further, it is the only way to determine the spill's effect on Gulf organisms. The 48 to 96-hour acute test determines the LC50. A lower LC50 indicates a higher toxicity. This is just the beginning of a discussion from the laboratory standpoint. Based on the LC50, the parameters of the chronic analysis are designed to study the sub-lethal effects. The sub-lethal effects are determined by studying organisms cultivated in variable dilutions of the LC50 until the concentrations are established at which growth rates and reproduction rates are significantly affected and not affected.

The chronic analysis is used for a seven-day test, which is typically standard across the board for any aquatic biological assessment. At the end of seven days you don't want all of your organisms to die; you need them to live in the test water so that you can determine the biological effect that a compound has on an organism, such as growth rates, metabolism (appetite), reproduction, or whether cells form correctly. The goal is for the scientist to find the lowest concentration that does have an effect, and/or the highest concentration that does not have an effect. As consultants, it is the magic number that we can tell our clients how much they need to dilute a chemical, such as wastewater or a dispersant, before releasing it into the water.

Our government has been screening at 100 mg/L or 100 ppm, which is 10,000 times higher than the concentration that can still have sub-lethal effects. We know that Corexit by itself has an LC50 of around 20 mg/L after 48 hours; it will kill 50 percent of the organisms living in a solution of 20mg/L after two days. Crude oil alone has an LC50 of 10 mg/L. Corexit and crude oil create an LC50 at 2 mg/L, which makes the dispersed oil more toxic than the oil or dispersant alone. Despite these additional threats, the government did not account for the increased toxicity of the combined oil and Corexit; its statements were based on the LC50 of Corexit alone and not the dispersed oil seawater solution. Further, it did not test the sub-lethal concentration of the crude oil and Corexit mixture.

The government wouldn't allow for a company to disregard bioassays in other private industry liquid waste and wastewater effluent; they are standard for an industry or municipality. For example, the chemical industry and treatment plants that produce wastewater have to have a

bioassay done on water before it can go in a sewer or bayou or natural stream. However, within the context of the spill, NOAA is not discussing the bioassay of the compounds associated with dispersed oil and what is happening to them in the environment. They won't tell us what the significant dilutions of Corexit are. Why won't NOAA tell us how long Corexit and or dispersed oil remain in the water column? I do not believe that they know the answers to these questions!

There are compounds in the makeup of Corexit that resemble glycol. You can't empty a radiator of antifreeze into the street. Yet we are using Corexit, which contains a type of glycol, in unprecedented amounts in the Gulf, and the public doesn't know how much glycol or how much of the other highly toxic chemicals comprise Corexit. Further, dispersant flight information is not available to the public. That concerns me and other divers, because we continue to encounter and sample what seems to be large patches of fresh, dispersed oil slicks 80 to 100 miles apart in Louisiana in similar patterns, though not as heavy, to what we saw in 2010, and we still do not know if they are spraying these slicks with dispersants. We know that the government entities do not admit to any spraying after July 17, 2010, but we have sampled many fresh, aromatic oil slicks below Louisiana throughout 2011 that appeared to be hit with dispersants.

4. DIVES, NOAA

About three weeks after the spill, the oil plume was 10 feet thick. Other divers from EcoRigs and I were 12 miles south of the Mississippi River on MC 194, the deepest installed structure in the Gulf of Mexico. In early May 2010 we took Jeff Corwin from CBS News in Venice, Louisiana and went diving 12 miles south of South Pass at this same rig. We took video of the conditions and it was relatively clear, but there was a slight greenish tan haze. We experienced a cloud of micro-droplets of dispersed oil at 10 feet thick from the surface.[5] We went back to the same area four and six weeks later with Discovery Channel Canada and the plume was over 30 feet thick. At that point my outlook had changed from "this is something we can handle," to "we actually have an environmental disaster of unprecedented magnitude." The plume had magnified itself to three times the amount of dispersed oil, and it was thicker, more viscous. Not only was it thirty feet deep but the turbidity or murkiness was much heavier. Turbidity is caused by particles suspended and/or dissolved in the water column.

On June 7, 2010 we went diving at MP 311. That day we took out Rich Matthews of the Associated Press (AP) and documented 30 to 40 foot clouds of dispersed oil, which we later began to call dispersed oil plumes. A photo of the dispersed oil from that dive trip is included in this affidavit as Exhibit 7. We dove to 80 feet that day and took samples from 60 feet below the water surface. After that dive, I was ill for several days. It felt like I had chemical pneumonia. I had burning in my chest, a pounding headache and diarrhea. We were just beginning to see the

---

[5] Scott A. Porter. "EcoRigs J Corwin underwater." YouTube. Jun. 10, 2010. http://www.youtube.com/watch?v=LiDYnq2P2Nk.

ED_001324_00007754-00270

thicker dispersed oil at that time. We didn't know the health threat posed by the dispersants then, so we were not heavily alarmed. Rather, we were curious. At 60 feet deep we witnessed six-foot long mucus like strands of what appeared to be oil that was not completely dispersed. I've never seen anything like it, and I've been diving in the gulf for 20 years. We proceeded to film them.[6] Due to a shortage of funds, we were unable to test the samples from that dive.

Our EcoRigs dive videos began going public in May 2010 through CBS Evening News. By June 2010 NOAA wanted us to bring them water samples from the sites covered in our videos. During the talks with NOAA, we explained, "We are reef biologists, let us bring you reef samples because they hold information about what compounds are absorbed and suspended in the water column. As filter feeders, they are like a library in that they are biological databases for hydrocarbons that may have been present in the water column." Our contacts at NOAA made it clear that they wanted water samples; however, they asked us to write a proposal to sample reefs. In exchange, we could use VoO boats to take samples from the locations that we identified as significant. We put together a two year proposal for reef, water, fish and tissue samples to profile the water column and organisms from 100 different locations.

For approximately six weeks from July to September 2010, we continued to discuss dive safety and I brought several of our water samples to the BP Incident Command Center in Houma, Louisiana where NOAA was housed. When I delivered the samples I would ask what they found in the previous samples that we provided. In the early stages of our work for NOAA they would tell us that they were still waiting on the lab results. Throughout this time they continued to tell us that they liked our proposals, and they wanted to get EcoRigs funded for five years in order to continue providing samples.

Between July and August 2010, Arkansas State University (ASU) offered to help us analyze our samples as well. We went to Grand Isle, Louisiana and Barateria Bay, Louisiana on three to four different occasions with ASU, and they found high levels of TPHs in the water and reef samples. Test results from those samples are included in this affidavit as Exhibit 8. When I went to the BP Incident Command Center in August 2010 to drop off more samples, I asked one of our NOAA contacts if they found any oil in the last samples. He said that the samples came back negative for oil. I pressed him on it further, and asked if they found any hydrocarbons or contamination in the samples. He replied that they did not find anything; the samples came back clean. I explained to him that was surprising, because we had sent samples from the same diving trip to ASU and they found contamination. He responded, "Oh, you're having them analyzed by a second source?" Shortly thereafter, NOAA didn't want to work with us.

We later learned that through NRDA, BP paid Louisiana State University (LSU), NOAA and an underwater ROV company $4.3 million dollars to conduct a significantly scaled down report

[6] Scott A. Porter. "MP 311 susp anom at 15m June 7 2010." YouTube. Sept. 30, 2010. http://www.youtube.com/watch?v=Vig4ufCsM84

ED_001324_00007754-00271

analyzing 10 sites of deep-sea coral data that we were also asked to examine. LSU received $430,000 for their part in the project, and NOAA received $1,500 a day for each personnel. We realized that we wouldn't be funded, because they had already paid someone else for similar work after we had provided the background and proposal for something much larger in scale. Therefore, we made an invoice for the water samples that we delivered and gave it to NOAA.

Their final report, released in September 2011 by LSU, showed that NRDA looked at far less abundant and less productive coral colonies than we had proposed to NRDA. Their proposal included 10 sites where corals can be located; however they only examined the four sites that had the lowest priority on their list to study (the sites farthest from the Macondo well out of the 10 sites). Further, they only searched for the scarce species of coral living on the bottom of the seafloor at 5,000 feet, within 10 to 15 miles of the Macondo well eruption. Looking for deepwater coral is like looking for a needle in a haystack, because few coral species live down there. It's too deep for most reef forming Scleractinians, commonly known as stony corals. They did not look at the reefs or the abundant colonies of stony corals on the platforms. They didn't examine any fish or water samples with the $4.3 million payment.

5. HEALTH PROBLEMS, BLOOD CONTAMINATED

After our early dives with NRDA, Steve's contact was still telling us the water was fine and the dispersants were safe to dive into. However, I was experiencing health problems, and I thought there was a connection to my diving. When I first began bringing NOAA our samples in June 2010, I told my two NOAA contacts that my skin was breaking out in itchy rashes. I asked if they were aware of other workers in the field who were also experiencing rashes or other health problems. They told me that they were not aware of this happening to other workers. My dive partners at EcoRigs and I didn't know how serious it was at the time, and no measures were taken by government contacts, including within NOAA, to check on our health.

From May to June 2010 I wore a wetsuit while diving. By the end of June I was wearing a dry suit. In June my dive partners were still skeptical about my symptoms; they did not think it was necessarily associated with my diving, and they continued to wear wetsuits. Most divers in the Gulf of Mexico do not have dry suits because it is fairly warm year-round. In a wetsuit they were more likely to have high dermal exposure from the chemicals while diving. While the dry suit kept me relatively dry, my face and ears and hands were still exposed to water. I was diving more than my dive partners and my health problems persisted. For the first time in my diving career I had a burning sensation that felt like chemical pneumonia in my chest. After each dive I began having chest colds, a burning throat, migraine headaches and itchy skin rashes. A lot of it has continued to this day (detailed below).

By July and August 2010 we were diving several times per month from below Mississippi to Cocodrie, Louisiana. We dove August 8, August 21 and August 23, 2010, which impacted my health more severely than the earlier dives. After the dive on August 8, I really began feeling

under the weather and it took over a week to recover. After each dive my chest would feel worse. At that point it took five to six days to get rid of the burning in my throat, but I stayed sluggish and lethargic and also had migraines. By then, I started to get worried about what I was diving in, and I increased efforts to contact any specialists, government officials and politicians who possibly could shed some light on what we were being exposed to.

In August 2010 I called Billy Nungesser, Plaquemines Parish President, to find out if Corexit was still being sprayed in his coastal parish. During that time, I was diving on oyster reefs in the area and wanted to know what I was being exposed to. His secretary claimed that they didn't know anything, and that I needed to call the state or Coast Guard to find out. Then she proceeded to say "I heard you were fine." I wasn't sure what she was referring to, and I responded that I was having health problems for a while after diving into and filming the dispersed oil plumes.

When we went diving on August 21, 2010 we could not dive the northern edge of the MC platforms around MC 194 because the dispersed oil plumes were too thick for filming or safe diving, and there was a thick green plume, what appeared to be an algal plume (a.k.a. algae plume). Since the conditions were not optimal for diving, we went about 15 miles southeast of MC 194 to MC 280A. We still experienced dispersed oil plumes as large as 40 feet deep and an algae plume. The algae plume was so thick that it blocked out most of the light in the shadow of the platform at the depth of 60 feet. It was so dark that underneath the rig at high noon I could not read my SCUBA gauges at 60 feet. Normally the water would be clear blue and light enough to read a book. After that dive I experienced full body cramps and extreme nausea.

We went back and dove on August 23 for Fox 8 local news. I saw extremely thick dispersed oil plumes during that dive. I had a bad reaction that day; I was violently vomiting over the side of the boat 15 minutes after the dive, and I had muscle cramps that became debilitating from 10:00 pm that night until 6:00 am the next day. I also had flu-like symptoms for over a week following this dive trip.

After the August 23 dive I stopped diving in this region for the rest of the year. I did snorkel, however. At the time, I had a BOEMRE grant to look for invasive coral, but I was also trying to locate evidence of effects from the dispersed oil. Paul Sammarco made the executive call on the BOEMRE grant that he would not allow his biologists to scuba dive in the vicinity of the spill, because he did not want to put us at risk from the oil and dispersants. In October 2010 we conducted an ROV examination of the rig legs on the Grand Isle (GI) blocks' platforms. That location was supposed to be clear and clean. Rather than dive, I snorkeled to study the barnacle reef populations that live at the first five meters of water depth and found an extremely high rate of mortality in the barnacles and reduced populations of blennies and cowfish which are sensitive to environmental changes over 80 miles to the southwest of the Deepwater Horizon site.

In the fall of 2010 we had just come in from a day research cruise with BOEMRE through LUMCON. I saw Louisiana Governor Bobby Jindal getting on the helicopter from LUMCON.

He told me, "We will get this area reopened for you." I responded, "If so, they can't be spraying Corexit." He told me to call him if I needed anything. At his office's request, we sent copies of our videos of the dispersed oil plumes. However, we don't know what he did with them, and we never heard from his office. I am a supporter of the governor, but I couldn't even get a response from his office on whether or not Corexit was still being sprayed in Louisiana. I tried to figure out: is Corexit still being used, and how much Corexit was used from May 2010 to September 2010? It was important because throughout that time NOAA said it was safe to dive, so I had continued to dive. However, my health was getting worse.

I stopped diving in *any* of the open Gulf waters from November 2010 through mid-April 2011. In January 2011 I had a Volatile Organic Compound (VOC) blood test performed to identify chemicals from the oil and Corexit. The test results found concentrations in my blood one to three times higher than the 95th percentile for ethyl benzene and above the 85th percentile for Isooctane. The VOC blood test results are included in this affidavit as Exhibit 9. To this day, I speak with divers who are experiencing similar health symptoms. In fact, since 2011 I have received reports from more divers about similar symptoms including skin rashes. My dive partners, who never wore dry suits, also took the VOC blood test in January 2011. Their blood levels turned out higher than mine. There are chemicals in the water and now we are finding the same chemicals in our bloodstreams in novel levels.

6. THE ENVIRONMENTAL PARTITIONING PRINCIPLE: WHY TOXINS PERSIST IN THE ENVRIONMENT

Partitioning, the scientific principle concerning toxins in an environment, governs the movement of organic compounds through soil, water and air. In a broad sense, this concept states that water will hold more toxins than air, and the soil (or reef material in the marine environment) will hold more toxins than water. Also, partitioning explains that environmental toxins such as hydrocarbons are harder to remove from water than they are from air, and they are even still harder to remove from solid substrate. Soil and reef material have the capacity to capture and absorb the toxins, which are then rereleased back into the environment over time but at a slower pace. In effect, they continue to re-contaminate the water column. Based on the partitioning principle, it is not surprising that we continue to find residue of the oil from the Exxon Valdez spill showing up in various samples from Prince William Sound ranging from soil and sand samples as well as birds' eggs.[7]

Another example of partitioning is between oil and water, which don't mix well. Dispersants are used on oil to reduce partitioning and to help the oil dissolve into the water column, or in other words, to help it disperse into the environment. Because dispersants are dissolvable by water and dissolve oil, they break the oil down into smaller pieces of hydrocarbon chains which are then more easily suspended and dissolved into the water column. As a result, more of the hydrocarbon

[7] *Wildlife Still Exposed to Exxon Valdez 20 Years After Disaster*, Science Daily, Apr. 13, 2010, http://www.sciencedaily.com/releases/2010/04/100414111018.htm.

chains dissolve into the water and become more readily available to the food web where it biologically accumulates. Different portions of a plume have thicker or thinner concentrations of micro-droplets of dispersed oil. We witnessed these plumes underneath the platforms in the northern Gulf of Mexico throughout the summer and fall of 2010 and into the spring and summer of 2011.

BP and the government should have told workers that they were breathing in the chemicals every day. A lot of workers did not even have a day to vent or off gas the volatiles from their bodies. They should have been educated that ethylbenzene and other organic compounds are small molecules that get into bloodstreams and mimic hormones. When they get in the bloodstream they can block Estrogen or Testosterone from getting into a receptor site. In effect, the body starts to age faster.

The compounds can also lock up in fat cells. One way you get them out is by exercising to release them. When released, the VOCs supposedly have a half-life of 90 minutes to two days. Therefore, for up to 48 hours, they can either attach to a hormone site or into fatty tissues or, hopefully, lipids in the bloodstream which can then be expelled from the body. This process can be facilitated by eating light unsaturated oil that helps to put more lipids into the blood that are easier to metabolize. The light oil is also available for bad compounds to hook up to in order to pass through blood and get filtered by liver or kidneys or to pass with stool and sweat.

7. MEDIA BLACKOUT

On April 8, 2011 I went diving for the first time that year, at MP 311. Rich Matthews from AP took me this time, along with a Texas biologist. The water looked better than my dive trips in 2010; however, there were still big waves of cloudy plumes coming through the reefs under the platforms. Immediately after diving I started throwing up on the back of the boat. I had to dive again after a short 45-minute break because I was the only one with a camera who could film underwater during that dive trip.

When I got back on the boat I overheard the other biologist say to Rich Matthews that everything was fine and back to normal in the aftermath of the spill. I qualified his assertion that the Gulf was fine, and I asked him, "How many times did you dive last year?" He responded that in 2010 he did not dive in the Gulf. He also did not have previous experience in the area we were diving in. I was diving in the same region of the Gulf before the spill, throughout the spill and after the spill with footage that proves conditions are nowhere near normal.

Despite our thorough coverage of the impact from the spill, with the exception of one time, the large news broadcasters did not provide EcoRigs credit for the footage that we provided. Further, mainstream news media would not report on the questions we raised about dispersants. In my interviews, news stations consistently edited the portions of the interview where I mentioned

dispersant or Corexit. I believe it is because they did not want to tell the whole story, which was a disservice to their viewers.

10. SCREENING FOR OIL

An Ultraviolet (UV) light is like a metal detector for potential hydrocarbon contamination. It will make hydrocarbons fluoresce certain color spectrums. The more reputable of these lights come with a spectrum chart that shows the colors that hydrocarbons should fluoresce. For instance, the light can be used to identify hydrocarbons from the oil and dispersant that have washed up onto the beaches, have attached to reef corals, or are in seafood. Photos of oiled oysters under normal light and under the UV light are included in this affidavit as Exhibit 10. I have gear that still has oil on it; I couldn't get it cleaned and now I am able to use it and tarballs that we've collected as standards for screening samples. Everything that matches these fluorescent signatures has a high potential to match the oil produced by the Macondo well. Some of the other fluorescent colors for typical solvents and Corexit are also visible in the spectrum produced by samples in which they are present, but we need more data to understand these color patterns more accurately.

Sponges, corals and oysters are picking up the most hydrocarbons, and many of the oyster shells are glowing pastel yellow, orange and tannish brown. They are the same colors that I am seeing in the fresh tarballs that continue to surface in fisherman's nets. Photos of oyster shells and tarballs under normal light and under the UV light are included in this affidavit as Exhibit 11. As an environmental biologist, I have to address the potential of seafood contamination from the nation's largest oil spill in history. As an oyster biologist, I am telling people not to eat the oysters.

8. CONCLUSION, OIL NOT GONE

Before I experienced it firsthand, I would have never believed that you could pollute the northern Gulf so much that it would be dangerous for me to swim in it. In March and April 2011, I called the governor's office, Plaquemines Parish press office and P.J. Hahn, director of Coastal Zone Management, and I asked them, "Are they still spraying Corexit?" I explained "I heard reports that they are still spraying, and I need to go diving but I don't want to if Corexit is still being used." However, no one could answer my question and I still cannot get a definitive answer to this day. I am concerned because we are still seeing dispersed oil at the surface of the northern Gulf on a consistent basis.

My goal now is to get the word out about that damage that has taken place. Nobody is talking about it right now; however, I cannot remain silent around the impact of the spill. Consider the immense impact of the spill on the ecosystem by looking at Valdez, Alaska, where the 1989 Exxon Valdez spill used a small fraction of the Corexit that we have used in the Gulf. You can't catch significant harvests of herring anymore in Prince William Sound; scientists believe that Corexit affected the reproductive cycle (they think it affects the cell wall of the eggs.) Corexit

ED_001324_00007754-00276

might mutate the RNA or DNA. The effects are still unknown to the public and larger part of the scientific community.

After Hurricane Isaac came through, I went with Steve Kolian and another individual to Louisiana's southernmost port, Port Fourchon. When we first got out there I didn't see any large tarballs in sight. However, as we walked to the northern end of the beach the sand got darker, and I noticed these weird looking small mats scattered throughout the sand that look like cooled molten lava spilled onto the beach. They were more like sandy clay, however, when you touched them. Then I realized there were giant mats of this substance further up the beach. When I looked at it closely I could see sheen and a dark red precipitate settling out of the water running off of it, which resembled the tar patties we encountered during the spill. Photos from the oil sheen and tar mats at Port Fourchon after Hurricane Isaac are included in this affidavit as Exhibit 12. New data shows that the latest oil washing up on the Gulf shorelines is in fact BP MC 252 oil. I am not surprised by the presence of oil washing up after storms, based on our earlier dives in the Florida panhandle.

Other EcoRigs divers and I went diving in the Florida Panhandle in July 2011, to collect samples for the Surfrider Foundation. That area is known as the Emerald Coast, for its crystal clear water. When we went diving, however, the water had a brownish white haze that resembled what we saw in offshore Louisiana at 30 feet below sea level. When we dug into the sand in the Florida Panhandle we found anomalous material that resembled tar patties and oil. Photos of the seafloor during that dive trip are included in this affidavit as Exhibit 13. I have never witnessed anything like that since I began diving in the Emerald Coast 20 years ago. The seafloor is typically white sand. There is an area along the Florida coastline that has dark colored runoff (soil that has eroded) from the bays. However, the runoff is normally more isolated and is a black color. What we witnessed during the July 2011 dive was a reddish brown substance on the seafloor that resembled tar and spanned a much larger area than is typical of the natural runoff.

In the areas where the seafloor was covered with the tarlike substance, we noticed much less sea life. There were hardly any sand dollars or crabs and only some fish, whereas we would normally see an abundance of organisms. It was desolate, and reminded me of noticeable drop in sea life during our 2010 and 2011 Louisiana dives.

The most startling observation throughout my Gulf dives in the aftermath of the blowout is the toll of the spill on coral. I observed what appeared to be greater than 70 percent mortality in the offshore barnacle reefs in Louisiana, down to at least 20 feet below sea level. Photos of the damaged offshore coral are included in this affidavit at Exhibit 14. In December 2012, the scientific journal Gulf and Caribbean Research published a paper by Steve, me, Paul Sammarco, and highly respected oyster biologist Ed Cake. It examines BP MC 252 oil found in offshore

coral, and looks at how coral and other filter feeding organisms that live on offshore platforms can be used to determine the breadth and impact of the spill.[8]

[8] Kolian, S. R.; Porter, S.; Sammarco, P. W.; Cake, E., *Depuration of Macondo (MC-252) oil found in heterotrophic scleractinian corals (Tubastrea coccinea and Tubastrea micranthus) on offshore oil/gas platforms in the Gulf of Mexico.* 25 Gulf and Caribbean Research 99 (2013), *Available at* http://www.ecorigs.org/CoralDepurationBPoil.pdf; EcoRigs Nonprofit Organization "BP_CrudeOil_Coral_EcoRigs2." YouTube. Apr. 2, 2013. http://www.youtube.com/watch?v=LrvNsJjAzoo.

ED_001324_00007754-00278

I have read the foregoing 18 page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on April 5, 2013.

Executed on April 15, 2013

Subscribed and sworn to before me
this 15 day of April, 2013

Notary Public

My Commission expires on: For Life

Paula Ann Pontiff
Notary Public # 49283
Terrebonne Parish, LA
Commissioned for Life

ED_001324_00007754-00279

SD DJT

AFFIDAVIT

Our names are Shirley Tillman and Donald Tillman. We are submitting this statement without any threats, inducements or coercion to Shanna Devine, who has identified herself to us as an investigator with the Government Accountability Project. We are married, and have lived since 2006 in Pass Christian, Mississippi, which is located along the Gulf of Mexico, approximately 120 miles from the location of the Deepwater Horizon explosion. The Gulf, the Bay of St. Louis and the bayous and marsh areas that flow into it, surround where we live. We lived in Long Beach, the town over, for over 30 years. We were involved in the BP oil spill cleanup activities through the Vessels of Opportunity Program (VoO) program, which BP created to employ private boat owners and workers to clean up the offshore oil. During that time we were sprayed by what we believe to be the dispersant Corexit. We have since been coping with chronic health problems. Also during the time of the cleanup, we witnessed a lot of unusual activity, some contrary to cleaning up the oil. However, we did not receive cooperation from government officials when we tried to report these concerns. If in sharing our knowledge it would help one person get medical attention that suffered from the oil spill, that's what this is about. We give permission for this statement to be used.

Donald Tillman (DT): I'm a contractor for a company that builds waterfront properties. However, after the oil spill the jobs that we had lined up fell through, because no one wants to build waterfront property when you have an oil spill. In order to subsidize my income, my brother, who became ill, asked me to run his boat in the VoO program. Before I become a contractor I was a licensed tugboat captain for 35 years. I have worked in the water all my life. I had an unlimited OUTV (Operator of Uninspected Passenger Vessels) license, which is a Captain's License, for boats up to 1600 tons. My brother was under contract by BP, and I went on there as a captain to run his boat from June 13, 2010 through August 13, 2010. I was a captain for most of the time, however. In late July I got HAZWOPER training, and then cleaned up the oil directly for two months.

Shirley Tillman (ST): I would go out on the boat with my husband and work as a deckhand when one of the other deckhands needed a day off. In the beginning when the oil and dispersed oil would get on the boat, I would try to clean it but I could not; it would just smear so I stopped trying to clean it.

1 .DAILY ROUTINE

DT: My brother had already been working a month or so straight when he started having health problems in June 2010. He had to work every day. That's just like when I took over; at one point I worked 60 days straight, every day for 12 hours a day. I was getting up at 5:00 in the morning to get to work at Pass Christian Harbor. Parsons was the company running the cleanup site for BP that I worked at, and they would hold you at the site until 8:00 am or 9:00 am before you went out. We had morning briefings, where a safety guy would come. But all he talked about

SD DJT

SJ DJT

was drinking plenty of water and dehydrating. Then an official from the Coast Guard provided the weather forecast, and eventually he would tell you when to leave. Sometimes it might be weather related, but for the majority of the time it was to wait for these other boats to clear. They were from 17 to 24 foot skiff style boats. Most were Carolina Skiffs. We didn't ask questions, we thought we're here to clean up the oil and you do what you're told to do.

ST: I would occasionally go out with him on the boat, and in August we began noticing these other boats Donald mentioned. They looked like Carolina Skiffs, which are small motor powered boats with tanks on them that were supposed to be skimmers, according to the Coast Guard. A skimmer essentially is used to vacuum oil from the surface water. But if you'd looked at the tanks you would know that they had never skimmed oil, because you could see in the tanks. It was a clear white plastic. You could tell they didn't have oil in them, because once you got the oil on something you could hardly get it off. Also, these spray boats were zigzagging, and in one of the pictures that I took on August 8, 2010 you can see a helicopter directly above one of the boats. That photo is included in this affidavit as Exhibit 1. In the VoO program they would have helicopters go out and spot where oil was collecting, so that they could supposedly have crews go to that area to clean it up. So to me it appeared that the spray boats were just touching up oil areas with dispersant before they came in and we went out. Tanks were located toward the front of the boats. They were nearly clear plastic containers; if a tank had oil in it we would notice.

DT: BP would make changes to the rules and procedures daily. We didn't know why or ask why. For example, early in the VoO program we were required to have one HAZWOPER (Hazardous Waste Operations and Emergency Response) certified worker on every five boats, to pick up the contaminated oil. Then it changed to one HAZWOPER certified worker on each boat. Randomly safety representatives would join our boat to make sure we were following procedure, but they were not available until August, 2010. An air quality specialist from a private environmental company took air samples on our boat. He would strap equipment to wires on our boat and check it throughout the day; however, he did not share his findings. August 7 was his last day with us. We got sprayed by dispersant on August 8 (detailed below).

Most captains didn't have HAZWOPPER certification, so Parsons bused people in who were certified. They would bus these people in and line them up and tell the captains, "Pick who you want on your boat today." We chose a young man named Eric, and he asked me, "Out of all those people, why did you pick me?" I responded, "Because you're the only one who looks like you didn't just get out of prison." He started laughing and I asked him what was so funny and he said, "Most of those people did; even my supervisor just got out of prison."

We would go out in a task force with a group of 25, and then we would be broken into five groups, with one lead boat in it. You had to have at least one Coast Guard member in your group of at least five boats. Sometimes you would have a national guardsman on the boats too. But the Coast Guard told you when to leave the harbor, where to go, and how fast to go. Often which way they wanted to get you to go depended on which way these other boats were coming, so you

SJ DJT

wouldn't come in contact with them. That's what we determined later on, after we got sprayed and determined the boats were in a local holding location. We also concluded that they were likely spraying Corexit, because we could smell it as we went out. The dispersant was very pungent; it gave off a strong chemical smell. Before the spill, sometimes at Pass Christian Harbor there would be an oil sheen due to boat motors running and so forth, but we have never smelled anything like this.

2. INADEQUATE SAFETY EQUIPMENT

DT: When we went out in the boats, we had little to no safety gear. In the beginning they told us we had to wear hardhats, and you would move and the hardhat would fall off. If you go to grab your hardhat, were you going to fall overboard with it? Some of the things I could understand, but others were just totally ridiculous. Nobody had respirators; I wouldn't know a respirator if I saw it. We had to wear our life preservers at all time.

I got the HAZWOPER training in late July for three full days. After I received the training I was able to clean up the oil and pull boom. The boom used to clean up the oil before it hits shore is a large absorbent material tied together in sections, with mesh on the outside to keep the oil compacted. Some of the trainings, such as Hazmat, required safety equipment. Parsons should have given you big respirators, we learned subsequently, but they didn't even though we were out in the open and exposed. I brought a couple of paper respirators for myself, but they furnished none, not that I was given. When I was doing the boom, I used the ones I brought. We put on the little rubber gloves, a little suit, and we would tape them - all the stuff you're supposed to do when you're working with hazardous materials.

Parsons rarely had what you needed or were required to have on your boat, such as the boom. In the first week of August, when the air quality safety man was on the boat, there was so much oil that we had to bring boom from Pass Christian Harbor to Long Beach so that they could block areas off; oil mousse was floating into the Long Beach Harbor. However, all five boats had to stay together as a group. In effect, it took an hour for five boats to stay in a group and deliver boom, even though our boat was the only one in the group actually delivering the boom; we loaded 15 bags of boom to take to the harbor. It was a complete waste of time and resources, because the other boats could have been laying and pulling boom and actually cleaning the oil. It was a dog and pony show.

Once the well was sealed it was evident that BP was trying to finish the VoO program. The equipment supplier informed me that the contractors were supposed to furnish all of the equipment, but BP was cutting them back; they couldn't give it to you, such as the boom or duct tape. In effect, we couldn't clean the oil. Following procedure, when we pulled the boom up and placed the contaminated oil in a regular clear garbage bags we put duct tape around the bags and put coordinates on them. There was a supply instructor that had a tractor trailer that would distribute supplies each morning before we went out. However, we had to fight for garbage bags

SO

to put the contaminated oil in. We had to fight for suits, rolls of tape, rope. In the line at the supply station, they would have too many people waiting. When you got up there you'd tell the guy what you needed and he'd say, "Well I don't have that, you're not getting that, this is all you're going to get." It often happened with Hazmat suits. And sometimes if they had a suit, it wasn't the right size. You can't take and put a 300 pound guy in a medium or small suit. And we had some pretty good sized guys down there.

We even had trouble getting boom. If you go out and use six sets of boom and go back to replace it, they didn't even want to do that half the time. There would be times when they wouldn't even let you pull boom, and you'd ride around with boom on your boat for a week. But you always had to have boom available on your boat. One of the supply guy's positions was, "Well you don't need all that boom on your boat, you're not pulling it." But what if we came across oil we needed to cleanup? How are you going to pull boom if you don't have it? His response would be, "Well, you don't need that."

When we'd have our briefings in the morning workers would ask, "How come there's so much trouble getting supplies?" and Parsons would respond, "Don't worry, we're going to take care of it." But they never did. It was just, "Hurry up and get your stuff, get out of here. The Coast Guard is going to call you when it's time to leave the Harbor."

3. VOO INSTRUCTIONS: "DON'T CLEAN THE OIL'

DT: When I first started in the VoO program in June 2010 it wasn't quite as bad, because the oil hadn't reached us yet. About the end of June oil started showing up on a regular basis. The water started getting more sheen. It was not big heavy patches of what crude oil normally looks like. Rather, it was like lumped up stuff that already had been dispersed and everything. It looked like patties or tar balls. They call these tar patties, because some would be anywhere from two inches to eight feet wide.

However, the majority of the time throughout the cleanup we were told to just to call in the coordinates from where we identified the oil and keep up surveillance. In total, they probably allowed us to collect about four to five bags of oil, which each weighed thirty to forty pounds. We were told, "Don't touch anything." These instructions came from the head coast guard operation Seahorse. Every time we would call something in, Seahorse would tell us to go the other way.

ST: In the beginning in late June and July 2010 when we would go out working and see the oil in the water, it was called either oil moose or oil sheen because it had been dispersed so it wasn't the long strains of oil. Rather, oil would be in clumps and almost looked like rubbery like stuff. People would say, "I found oil, come here" and it would show up on the news; you know, the media would go and try to take it. The Coast Guard and the Mississippi Department of Marine Resources (DMR) would say, "Oh, that's just algae."

SJ DJT

ED_001324_00007754-00283

SJ DJT

After the oil first reached Pass Christian, around late June and early July, its official identity changed from algae to fish oil, instead of oil mousse and oil sheen. Later, on August 1, 2010 we went out to the Gulf Port area and saw oil. Our Coast Guard contact on another boat in our group said, "Don't contain the oil, it is just fish oil." Two photos that I took that day are included in this affidavit as Exhibit 2. After he provided those instructions we were immediately sent back to Pass Christian Harbor. By living here all of our life, we know what we have seen in the past. We've had shrimp boats, we've had oyster boats, and from what you know, through experience, and then all of sudden to see what's washing up and what's floating by the boat, we had never seen anything like that before, stretches of oil the size of football fields. The government's response was insulting because we knew that it was not algae or fish oil, it was dispersed oil.

On more than one occasion my husband just begged to drop boom, but they wouldn't let him. We could smell it - football fields long of oil sheen with clumps of the oil in it. The following day we would be sent to a different location. One day in late July when we went out oil and sheen was everywhere. There was a man close by fishing for pleasure, and he asked us why we weren't cleaning the oil. This is what was so concerning: As happened previously, that day the Coast Guard directed us not to drop boom and instead sent us in the opposite direction of the oil. The following day Coast Guard Admiral Thad Allen stated that there was no more recoverable oil in the Gulf.

DT: I think I've got experience enough to know it was dispersed oil, because before I became a contractor I was a licensed tugboat captain for 35 years. I worked in the water all my life; I know what water looks like and what it's not supposed to look like. Boats leak, and sometimes when your engines run it might drip into the water. If you don't have a proper containment on your boat to catch the run off oil, it gets mixed up in the bilge water. Pumps automatically come on and pump the bilge water into the ocean, which can cause an oil sheen. You might be putting a quart of oil or diesel fuel into the water and the Coast Guard, DMR and the Mississippi Department of Environmental Quality will fine you heavily - hundreds or even thousands of dollars. All of the agencies are waiting to get their hands on the fine money. For instance, after the spill a young boy was working on his boat and the bilge pump kicked on and got some oil into the harbor. He had to pay thousands of dollars. So if they are going to fine me for pumping my bilge out, how come they didn't properly identify the oil sheen and dispersed oil and allow us to clean it up?

I spoke with a young man who worked on a skimmer boat and would vacuum the oil by the islands. After he stopped working, he shared with me that in August 2010 they would go out to Cat Island, but if it was too big of an oiled area, they boomed it off as best as they could, they put a bowie in the middle of the oiled location and the next day they would be dispatched out there to pick up the boom and the bowie, and all of the oil would be gone; it would just be foamy stuff.

There were instances when the Coast Guard would tell us, "Put the boom out," and five minutes later they were making us pick it up. What was that all about? Why wouldn't you let us mop up

SJ DJT

SJ

what we had here? They would not let us clean up the oil. There were several times when we identified oil in the water, and a lot of the fisherman down there made remarks, "Well, what are we doing down here if they're not going to let us clean up?" Often the Coast Guard would not let you drop boom; they would send you in another direction from the oil that we located.

We always thought when we were working that it was just a very unorganized project. But when you start taking it and adding everything up after the fact, they knew what they were doing. They were keeping us in that harbor for a reason. They were making us go at a certain speed to a certain place for a reason – to not come in contact with the unmarked boats that sprayed dispersant (detailed below). All these things started to add up. And all we wanted to do was clean up the oil. But we were not allowed to do very much of that. I put boom over board and just started to spread it and pull it and they'd say, "abort." Now, why would I put boom out on all this stuff and have to pick it up without collecting oil.

On August 13, 2010 we were one of the last groups to be laid off. I don't know how many hundreds of boats got laid off before we did, but they kept phasing it out until there were no more boats. It wasn't like they just laid us off because we did something wrong or anything like that. When they capped that well they started taking and cutting back on everything and winding it down.

4. SPRAYED BY DISPERSANT

ST: Before getting laid off, on August 8, 2010 somebody must have got their connections crossed. As our boat was going out into the Gulf, these spray boats were coming in. But after they passed us I'd been taking pictures of the wildlife and the water, and I happened to zoom in on them and I saw them spraying something on the water. It was coming from a garden type hose but stronger. We were probably two football fields away, so I did not think about it coming back. However, these boats were up wind from us; as we were going west the stuff they were spraying came back on us.

A National Guardsman was on our boat that day. When my husband realized we were getting sprayed he ran into the cabin and closed the windows. Most of the people on the boat, including the National Guardsman, followed my husband into the cabin. I stayed on the deck to try and take pictures. The skiff photos were taken south of the Bay of St. Louis Bridge. The bridge is west of the Pass Christian Harbor. Three photos are included in this affidavit as Exhibit 3. I never would have stood out there to take pictures had I known what I do now about the effects of Corexit and the fact that it has never been tested on humans or animals. I did not think it was a public health threat, because it has been approved for use. I went into the cabin after I sprayed and tried to wash my face and hands but it was already in my eyes, nose and probably lungs by then. My husband immediately contacted the Coast Guard official who was in the group with us that day, but on a separate boat. Within minutes, the Coast Guard supposedly dispatched helicopters and a boat to investigate these boats. Most of the government representatives and

SJ PJT

safety people that rode on our boat were great people, doing their jobs like we tried to do ours. We didn't talk business, such as what the air quality specialist was finding or whether or why the Coast Guard wasn't monitoring the unmarked spray boats more closely. However, the next day after I was sprayed a Coast Guard official asked my husband for copies of the photos that I took. As soon as I handed him disk he told me that the unmarked boat I had identified was in the VoO program and was just rinsing its tank. This didn't add up, however, because the Coast Guard always told us when to leave the harbor, where to go and how fast to go. We had to have flags and transponders to identify us as part of the VoO program. I did not see a flag on the boats that were spraying, and even the Coast Guard officials did not seem to know anything about the boats when we reported them.

DT: The captain of that boat that was sent after these unmarked boats is dead now. All I know is that he passed in the summer of 2011. Within thirty minutes of trying to chase the boats he was called back; he couldn't catch up to them. We later discovered that they were going back to their dock at Henderson Point (detailed below), which was located in the direction they were going. We don't know anything about his health or the cause of his death. He got us in touch with Matt Guttman from ABC news. One time I spoke with a supervisor at a staging site for the Carolina Skiffs. I asked him, who originally opened it as a staging site and he said that it was U.S. Environmental Services and an additional company. In August 2010 I saw what appeared to be empty Corexit tanks at the staging site. Two photos of the tanks are included in this affidavit as Exhibit 3. I didn't even know what Corexit tanks looked like until weeks later; I just kept seeing these semi-clear plastic empty tanks.

ST: We knew the captain well, we grew up with him. He was a commercial fisherman, and I believe in his 50's. The Coast Guard sent his boat to chase, to try to see where this boat that we reported was going. The boats were zigzagging back and forth by the bridge down here, and when they saw that the Coast Guard sent this captain to turn around and go follow them, they took off. Most of these boats had 150 horsepower on the back. There was no way we could catch them in our boats. When we returned that afternoon from the whole episode, the Parsons supervisor told me that before that event they identified the boats and were trying to catch them, but they could not catch up. He told me one day he would write a book about all he was aware of. He was speaking in general terms, because he too got his orders from the Coast Guard, and they changed orders without reason or rhyme on a daily basis. For example, we would change routes unexpectedly, or be authorized to lay boom one day but not another.

The day that we were sprayed, when the Coast Guard turned us back around to go east you could see the white foam in the water where the spray boats had been. A photo of the white foam is included in this affidavit as Exhibit 5. In fact, the Coast Guard official told us to drop boom over it, but it was useless because we were collecting foam at that point, not oil, so he then changed his orders to just collect the boom. By the time we got in that afternoon, it was all over the harbor that we got sprayed. We would not give interviews for a long time after that, because we felt the government was supposed to be taking care of this and we weren't getting into it. Oddly, our

supervisor at Parson's was unaware of the incident. We informed him of what happened and he shared that he had been trying to identify the unmarked boats as well, but they were too fast and would always get away. I told him I took photos and he asked for copies. About 30 minutes later, after I had returned home, Donald called to tell me that the Coast Guard wanted a disk of the pictures.

5. COAST GUARD "INVESTIGATION"

ST: I made the Coast Guard a disk of the photos and took it down the next morning, on August 9. As soon as I handed the disk to the Coast Guard official presiding over the staging site that day, before even looking at the pictures he proceeded to tell me that they had investigated the incident, that the unmarked boats we reported were in the VoO program, that it had just not been documented - although he also stated that it hadn't been verified - and if I had seen them spraying anything into the water they were just rinsing out their tanks.

Why would a supposed skimmer boat be rinsing out their tanks? Were they putting the oil back into the water, because what I saw was not oil coming out of the sprayer, it was just like clear stuff. During that exchange, the Coast Guard official also asked me, "Don't you think that if they would have been spraying dispersants into the water, they would have been wearing safety equipment?" I told him, "From what I've seen around here, no". All they had were box fans on their boat, which meant they had a power source to skim oil or pump Corexit; they didn't have any kind of respirators or anything. That's obvious in my pictures. You know, they were just guys on the boat.

I have spoken to some people since then who did not have safety equipment when they worked and sprayed dispersant. They were working out of Louisiana, and one gentleman in particular was the supervisor on a cleanup crew and firsthand witnessed a lot of things. But most people are afraid to get involved in anything because of repercussions, you know. People were desperate for work. Most of the spray boats and the people who worked in Mississippi on the cleanup were from Louisiana and Alabama. Almost all of the tags were out of state tags for boats at staging sites. My friends from Louisiana told me the same thing; Louisiana workers were from Mississippi and Alabama. Why didn't BP let workers work in their own state? A lot of the beach cleanup crews were from all over the country. I think now, looking back, that these people would go back home, and if they go sick from the oil clean up, how would they know and who would they tell?

My husband and I have not been contacted by the Coast Guard since I provided the photos. And the funny thing was that the Coast Guard official claimed that they conducted an investigation within less than a day. However, they never asked me for a statement or my husband or any of the other five boats working with us that day. I think it's kind of funny that as thorough the government is usually on paperwork, they would have at least had us sign our name to something. So, what kind of an investigation was that?

6. HEALTH PROBLEMS

ST: Immediately after I was sprayed I started feeling the effects of this stuff. My eyes started watering, my nose was running and I was coughing. My husband's problems began a few days later, and then escalated. To our knowledge there was no kind of medical person at all on site when we returned from the water that afternoon. Our supervisor was not informed by the Coast Guard that we had been sprayed; when we checked out he was unaware of what had happened. Prior to the exposure we didn't have any eye problems; my husband and I both always have been healthy people. Now his whole eye is messed up, completely irritated and red. It wouldn't clear up with eye drops. Finally we broke down and went to doctor and got medication. Usually my eye problems are contained to one side of my eye. We don't even wear glasses except to read.

Before the oil spill I saw the doctor because I was sick maybe one time in five or six years. We had to give up our insurance right before the spill took place, because the premiums went up and we just, you know, couldn't afford them. Since our exposure, both Donald and I have been to eye doctors, because it just doesn't get better sometimes. You have to get antibiotics. The headaches are relentless. Everyone has headaches, but when you go from maybe one, two, or three a year to maybe two or three a week since the oil spill, it's like you know what's normal for you and what's not. I used to have migraines. These weren't like migraines; they were just horrible headaches where you hurt bad and get nauseated.

Two or three days after I was sprayed I had nausea and diarrhea. I couldn't breathe or my nose would run like a faucet; it was continuous. A few days after I was sprayed I developed itchy batches of rashes on my skin. I would have itchy batches on my skin, but I still went to the beach to take pictures. I put topical cream on it, and it would go away. I didn't break out in a bad rash until January 2012. These little fine bumps were all over my face and body. I had to go to a medical clinic, and the doctor told me that it was either an allergic or chemical reaction. I was given steroids and a topical cream. After three days the rash went away. Donald had the rash, too, and my daughter in law had a similar experience in the summer of 2011.

Now I have good days and I have bad days, you never know what you're going to feel like the next day. Donald and I still have upper respiratory and sinus problems. Fog makes our sinuses worse. If we wake up and can hardly breathe, we can tell that it is foggy outside. I have thrown up more in the last year than I probably have in the last 20 years. Some days it's so bad that it happens in not just one or two episodes but goes on all day long. And then other days it's just, you have no energy, you're just completely drained for no reason at all. You wake up more tired than when you went to sleep. Just common, everyday symptoms, but they're not normal symptoms for me, and never have been.

DT: The only health problem I had before the spill was your common winter cold symptoms and headaches that you don't normally get in the summer time. And basically all this stuff here is common sense. You know, the doctors want to treat you with antibiotics for cold symptoms that

SO DJT

you don't have during the summer. We're still all congested now. We went up North Mississippi in the summer of 2011, and this stuff cleared up. We came home and the health problems immediately returned. Three weeks later we went to Arkansas for a week, and all the congestion and stuff went away. We come home, and two days later it was back. This pattern continues.

ST: In addition to going on the boat with Donald, I would take pictures on the beach to document the oil spill in June 2010. But I haven't been to the beach in awhile, because every time you go down there, for the next two or three days it's like you pay for it with bad headaches, nausea or respiratory problems. But I decided in early August 2011 that I was going to go down there to Pass Christian Harbor and take more pictures. And then the very next morning I woke up and a vessel in my eye burst again for the third time. And it's taken like three days to get over that.

In January 2011 my husband and I got Volatile Solvent Profiles. By then it was several months after we had been working on the cleanup, however, the test still found traces of chemicals in our body. We're we continuing to be exposed somehow? From what I've learned, our levels are low compared to a lot of people who have fallen ill from the spill but high compared to the average person. In both of us, the test detected chemicals found in the crude oil or Corexit, including ethylbenzene, m,p-Xylene, 2-methylpentane and 3-methylpentane. It's been really hard to get an accurate diagnosis or treatment, because none of the local doctors will even admit there is a problem. So we have not been able to consult with a doctor candidly about the prospect of our illnesses being connected to the chemicals from the oil spill. Our grandson also got really sick after the oil spill, and the doctors ran us in circles trying to determine what the problem was. When his mother brought up concerns about it being related to the oil spill, they would not even consider that possibility. There's one friend of mine who happens to be a doctor, and he's very well aware of what's going on but is afraid to take a hard stand on it. He is an emergency room doctor.

We didn't become mad about how the spill has been handled and our health problems, until our two year old grandson's blood test came back positive for four chemicals found in the oil and Corexit: hexane, 2-methylpentane, 3-methylpentane and isooctane. His exposure surprised us, because since the spill he did not go to the beach or eat any seafood. However, when he began getting sick in September 2010 his life force left him. He went from running all over the place with high energy, to just lying on the floor some days, just so sick. His symptoms included frequent vomiting and ongoing respiratory and sinus problems. We felt like "Damn you BP," because we knew by then that BP had done this to our grandson. Prior to seeing how he was affected, we wouldn't conduct radio interviews or go on film. We wouldn't do any of that, until his test came back. Then our mentality shifted to, "We'll do whatever is needed to raise awareness around the public health impact from the oil spill."

Some people still don't know why they're sick. I mean, even neighbors, you'll be talking to them and they'll go, "I've been sick for months now, it goes away and comes back." And I'll go, "Did you smell a lot of the burning oil during the spill?" and they'll go, "Oh yeah, I smelled that every

SO DJT

day for weeks" and I'll go, "Well guess what, you probably have that in your body." The smell was so bad around here when they were burning the oil for weeks in May and June. We would go outside and turn around and come right back in. I'd think, "Is that smell going to get into our home and in our clothes? How are we ever going to get rid of that?"

DT: It got in our bodies instead.

ST: Coast Guard Admiral Thad Allen said that the dispersants were only sprayed after July 15, 2010, on a case by case basis. Dahr Jamail of Al Jazeera was down here in October 2010 when we took water samples. The samples came back positive for dispersant and crude oil. [1] If the dispersants only last for 28 days, why was it still showing up in October?

7. UNMARKED BOATS AND SURVEILLANCE

DT: We didn't realize odd patterns with these Carolina Skiffs until August 8, 2010, the day we got sprayed. Then, once the Coast Guard told us that we didn't see what we saw, the very next day we located a staging site about two miles from our house that a VoO captain had told us about. We ultimately found three compounds – or staging sites – that sheriffs of the county would be monitoring heavily. The location close to our house was at Henderson Point. The second location was in Hancock County and the third staging site was located off the interstate in Gulfport, at corner of Canal Road and I-10. At least in Pass Christian Harbor, prior to the spill there was not security watching these boats, much less the sheriff's department. We started documenting the sheriff's department and their unusual behavior at these compounds after we got sprayed. From what we observed, the behavior of the boats and sheriffs continued at least from August 8, 2010 beyond September and October 2010.

At all of the locations there were one or more guards by the entrance and a sheriff's department vehicle from the respective country situated next to the boats. I did not understand why they had this additional security, especially because some of the staging sites were already fenced in. The location on I-10 had an eight foot fence all the way around it. There was a guard at the gate and other guards all over the place, in addition to the sheriff's department vehicle. What is so unique about these sites that you have to have law enforcement watching the inside of a compound that is already secured?

Throughout the cleanup, these boats were coming back in as we were going out at eight or nine in the morning. It didn't make a lot of sense until it started occurring all the time. We believe that during the daytime you'd have other boats and helicopters locate oil plumes by stopping bowies and providing locations for them to go back and spray at nighttime. Then planes would touch up with dispersant at nighttime. Then the Carolina Skiffs would go out there and touch up in areas as well with dispersant. One worker who skimmed surface oil explained to me that when an oil

[1] Dahr Jamail & Erika Blumenfeld, *The Tragic State of the Gulf of Mexico: Sampling Reveals Oil and Dispersants on Mississippi Coast*, Truthout, Jan. 12, 2011, http://archive.truthout.org/the-tragic-state-gulf-mexico-sampling-reveals-oil-and-dispersants-mississippi-coast66726.

SD DST

patch was too large to skim, he and the other workers would be instructed to boom the area and leave a bowie. The following day when they would collect the boom, they would see nothing but white foam, which is a sure tale sign of dispersant. This happened repeatedly. C-130's were spraying Corexit for months out there.

ST: You couldn't see anything at night when they'd spray. We tried videotaping them going back and forth in August or September 2010. Before the well was capped, the news reported that they only sprayed by the wellhead through subsurface spraying, which is not the case. They still have C130s at Stennis International Airport in Hancock County, Mississippi and Marine Spill Response Consortium (MSRC) planes, which are strictly for spraying dispersant. We would watch them at night out by the islands, which are about 10 nautical miles from the beach. We would watch them go back and forth and back and forth, flying at low altitudes between islands. On videotape all you could see was this little ball moving around on the tape. Before the spill I had never seen planes flying that low or directly over our heads. They would fly over our home or at the Pass Christian beach. We have pictures of them so low that we could see the people in the planes. A photo of a low flying helicopter is included in this affidavit as Exhibit 6. We are surrounded by water on three sides and we have an airport 15 miles east and another airport 15 miles west. Even now C130s, Coast Guard planes and helicopters continue to make loops repeatedly. It wasn't like this before the spill. To this day there is sheen on the water.

After a tropical storm in August 2010 BP took all of the recognizable spray boats out and moved them to a big staging site in Gulfport. You could recognize the boats, because in front of the consul of the boat there was a big white tank in a little cage structure. It was probably a two hundred gallon tank at least. I do have pictures of tanks at the same staging site with the sheriff's department car sitting right there by the boats. A photo of the sheriff's department car at the staging site is included in this affidavit as Exhibit 7. I've seen the same tanks and they are dispersant tanks. They are the 330 gallon white tanks from Snyder Industries that basically have pictures a friend of mine sent me indicating that's what the Corexit came in - tanks from Snyder's Industry's. Al Jazeera reporter Erica Bloomfield also came in October 2010 and got barcode numbers off of the tanks at the Gulfport staging site. However, when BP started relocating back to the Henderson Point staging site, it was a different type of boat - like pleasure boats and metal oil mop boats.

8. GOVERNMENT INVESTIGATIONS

ST: In October 2010 representatives from the National Oceanic Atmospheric Administration (NOAA) and the Department of Fishing and Wildlife (DFW) showed up at our door. They had been by earlier in the day and left a card at my door with a message to contact them. Their cards read special agents, and they said they were here investigating the use of Corexit in inland waters. They were very nice, but I believe they were overworked; they are just two agents responsible for three states. They told us that they had recently received complaints of Corexit being sprayed in inland waters. I had been working with other people collecting water samples

SD DST

SD DJT

the day before, and there were two identical samples taken from the same spot at the same time. I said to NOAA, "Well here, if you're investigating the use of Corexit, you take this sample with you, and we'll see if your test results come back the same as the other test results." I had to do the chain of custody, and I've got the receipt. They also contacted me about the dead turtles. In April 2011 I documented 39 dead turtles, and from January through April 2011 I documented 57 dead turtles.

After speaking with them for several hours it became clear that they were most interested in the photos I had taken. They were investigating the use of Corexit, and they wanted to see the photos of the spray boats and Corexit tanks and planes. At that time I probably had 5,000 to 10,000 pictures. They were all mixed up because I had no idea this is what they were interested in. I have pictures of the dead birds, marine life and wildlife that are usually only found in the marshes. Six photos that I took of oiled animals are included in this affidavit as Exhibit 8. In the spring of 2011 I found a dead armadillo on Long Beach. In May 2011 I found a dead raccoon in two to three inches of water, muskrats, possums and one wild pig in Hancock County. In September 2011 after tropical Storm Lee there were places on Pass Christian beach where I couldn't walk within 10 feet without witnessing a dead bird. I heard from friends that it was that way everywhere along the coast. Maybe we would see an occasional dead bird before storm, but after the storm the tide washed up their bodies and they lined the beach. Rescue people were swarmed with calls. What was peculiar is that all these animals lived in the marshes. It was unusual to see these dead out there. I am concerned that the spill has also affected the wildlife that lives around the bayous in the marshes.

The special agents and I were talking as I scrolled through the photos for them. They kept saying things like, "We just found out about reports of spraying inland" and so forth. I asked them, "Wouldn't it be easy for you all to get the records from the Corexit manufacturer Nalco for how many gallons BP has bought from them to use to spray down here? Wouldn't that be a lot easier, since they've admitted to spraying 1.8 million gallons?" They responded, "Oh no, we can't do that, it's way too early in the investigation."

From that point on I felt they were just here to see what pictures I had. I would show them a picture of a Corexit sprayer or the skimmer boats, piles of foam from when we were working on the VoO program, which was what the water looked like the day when were sprayed by the unmarked boats. After three hours they had another appointment, so they asked for a copy of some key photos that I agreed to provide them, specifically the Corexit tanks and the boats that contained the tanks. The following day, a friend of mine called me from Ocean Springs and said, "There are big piles of white foam washing up here that look like dispersed oil." I said that I knew just who to call. I called the special agents with NOAA and Fishing and Wildlife a few times and neither contact answered. I called again a little while later to tell them about the fresh samples that they could obtain, but they never called me back. They never followed up to obtain their photos or return my call.

SD DJT

SO DST

9. FACEBOOK RETALIATION

ST: I didn't know a BP America (BPA) Facebook site existed, until a friend told me that lies were being spread about me on the BPA Facebook page. She told me that people were posting comments that the photos I had documented of dead turtles were not authentic, and that I was taking dead turtles to beach and photographing them and trying to make money off of the photos. I went on the BPA Facebook page and confronted the people making these false statements about me, and I also responded that I post my photos for the public for free. In addition to monitoring comments about the spill's devastation on the marine life, the attackers all comment that no one is sick from the spill and Corexit is harmless.

If someone gets on the BPA Facebook page and says "I am sick from the spill," a handful of people attack the individual that person. They have made comments that the people who claim they are sick or who take the Volatile Solvent Profile blood test are trying to make money off of the spill. I have a friend with a young son who has fallen sick since the spill. He got on the BPA Facebook page and wrote that he and other people are sick, and he was attacked. One attacker looked at his profile, identified his friends and family and sent them nasty messages. Based on other people I have compared experiences with, anyone who takes a stand against BPA Facebook page is attacked. The people making these unfounded attacks have Facebook pages but they do not have profiles, so it is unclear whether or not they are real people.

At one point the BPA Facebook page was promoting Gulf seafood. I made a comment that I choose not to eat it. One of the trolls replied that the Food and Drug Administration (FDA) has tested the seafood and found that it is safe for consumption. I responded that the last time I saw that FDA had only tested for 16 out of 60 compounds, and I choose not to eat the seafood. The next day I was blocked form the BPA Facebook page. According to Facebook's own guidelines, someone can be blocked for personal attacks and foul language, but it doesn't list anything about stating one's opinion on seafood safety as grounds for being blocked. When I was removed from the page, all of my posts were deleted as well.

10. CONCLUSION

DT: In addition to the resistance surrounding medical problems resulting from the spill, we still have oil washing up. To this day, there is oil out by Cat Island, Ship Island and Hound Island. In Bay St. Louis you can go on one of the bridges right now. When the tide is running in and out you can still see the oil slick. Where are the people who are supposed to be protecting us from all of this?

SO DST

ED_001324_00007754-00293

SJ

I have read the foregoing 14 page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on June 14, 2012.

Donald J Tillman Sr.

Shirley W. Tillman

Subscribed and sworn to before me
this 23rd day of August, 2012

Notary Public

STATE OF MISSISSIPPI
LESLIE ANN HARVEY
ID No 100696
Comm Expires
Nov. 16, 2015
NOTARY PUBLIC
HARRISON COUNTY

My Commission expires on: _____

SJ

ED_001324_00007754-00294

SK

AFFIDAVIT

My name is Steve Kolian. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am the founder of EcoRigs, a nonprofit group that's mission is to assess the environmental damage resulting from the Deepwater Horizon spill. EcoRigs is composed of a team of divers. We were asked by NOAA to collect water biological samples close to the spill site, in exchange for test results and presumable compensation. NOAA assured me that it was safe for us to dive into the dispersed oil, which we quickly discovered was false. NOAA did not follow through on its end of the bargain, and cut off communication without providing any test results or funds for the sampling trips we had conducted at their request. Once I realized the health threats associated with Corexit, I alerted the diving community, so that other divers would not have to endure what my team and I have been through.

1. BACKGROUND

I earned a Bachelor of Arts from Augsburg College in Minneapolis and a Master of Science at Tulane University in environmental science. I was an AAUS (American Academy of Underwater Sciences) diver with scientific diving certification between the years 2004 through 2007. I have been PADI (Professional Association of Diving Instructors) diving certified for 10 years. However, before that I snorkeled frequently for the last 30 years on oil rigs. I grew up in Minnesota, and would come down and shrimp in the Gulf of Mexico during the summers. I grew up as a commercial fisherman; I was a shrimper for seven years off and on, and then I practiced longline fishing for tuna and shark. I have been working as an environmental scientist since 1997 providing environmental and natural resource consulting to the government and private sector. My day to day work focuses on National Environmental Policy Act (NEPA) documentation and modeling environmental events. I am also a water quality and fishery specialist.

I founded EcoRigs.org ("EcoRigs") in 1999. We are composed of a team of scientists and divers whose mission is to save retired platforms from removal for use in sustainable fisheries and renewable energy. However, since the spill we have been collecting and analyzing water samples from the Gulf of Mexico to be "fingerprinted" for biomarkers of BP MC 252 oil. A biomarker is an organic compound used to identify the source of crude oil. Fingerprinting crude oil was necessary to validate the source of crude oil. Crude oil is composed of a diverse mix of organic compounds and the composition of the crude varies from field to field which allows the fugitive oil to be fingerprinted and its source identified.

After the Deepwater Horizon explosion, we were one of the first groups to go offshore and sample the subsurface plume from the MC 252 field. We collected surface and subsurface water samples and marine life that live on offshore oil and gas platforms. The reason that we're interested in those organisms is that they occupy a vertical profile; by analyzing the organisms,

SK

SK

we can determine the distribution of the oil in the water column from the surface through the subsurface.

From EcoRigs, I dive the most with Scott Porter and Michael Boatright. Scott has over 6,000 dives, and Michael has forensic and safety licensees. Dr. Paul Sammarco from the Louisiana Universities Marine Consortium (LUMCON) is another diver and scientist with EcoRigs whom I work closely with. I have authored or coauthored 15 to 20 publications, some of which are peer reviewed.[1] The self-published EcoRigs reports are doing very well, and often get more exposure than peer review journals do.

2. ECORIGS

EcoRigs is a small, self-funded nonprofit. Our main charter is to save some of the 4,000 oil and gas platforms after they retire. There are 4,000 platforms in the Gulf, and 1,200 are going to be removed in the next five years. The government wants to remove the platforms, because they can pose navigational liabilities. However, 20 years ago we started advocating saving platforms and before the spill we were whistleblowers; our position is that when a platform is removed the oil and gas companies are violating the National Environmental Policy Act (NEPA), because protected corals live on the platform pilings. The removal of platforms violates the Magnusson Stevens Act, which protects coral and fish; and the Endangered Species Act, because endangered sea turtles sleep and feed on the platforms.

The platforms' benefits are twofold; they benefit marine life by providing sustainable fisheries, and they offer a platform for renewable energy through wind, solar, waves, and currents.[2] They also make great places to sequester greenhouse gases; Massachusetts Institute of Technology (MIT) identified offshore platforms as the safest place on the planet to store greenhouse gases.[3] To sequester greenhouse gases you would inject them into the vacant geological formations that the well had just produced, and then seal off the well.

We are advocating rebuilding populations of fish in the Gulf of Mexico with the retired platforms because they are excellent nursery habitats. This is especially important now because there will be mass mortalities resulting from the spill. We could help rebuild the habitats by collecting larvae offshore, put them in a tank, grow them until they are large enough to fend for themselves and then release them. Organisms are floating by a platform all the time. We could grow the fish that are very difficult to grow, like the highly protected Blue Fin Tuna. We have not performed any surveys but we have observed lower populations of their prey species and know that their larvae are bound to be affected. All this takes a lot of research we need money.

---

[1] Press, Media and Publications – EcoRigs, http://www.ecorigs.org/Press.htm.
[2] Alternate Uses of Offshore Oil and Gas Platforms – EcoRigs, http://ecorigs.org.
[3] Howard Herzog and Dan Golomb, *Carbon Capture and Storage from Fossil Fuel Use*, Encyclopedia of Energy 277-87 (2004).

SK

We have accomplished a lot and have published numerous articles without receiving government funding or donations from oil companies.

3. DIVING IN OIL PLUMES

Our first dive was May 7, 2010. We wanted to see how the oil was impacting the marine life, the corals and other invertebrates such as sponge, tunicates, and hydroids that inhabit the pilings of the offshore platforms. I anticipated that the splash zone (upper 15 feet of the water column) would all be black and the attached organisms would be dead due to exposure from surface oil. We went offshore to Mississippi Canyon Block 194 to look at organisms on the Cognac platform, 26 miles northeast of the spill. On our way we didn't see as much wildlife as we normally do on our offshore trips. We saw a lot of patches of the rusty red floating oil.

The Cognac platform was located in 1,110 feet of water, and we went down to 90 feet below the surface under the platform for 30 minutes. When we arrived we only saw sheen on the water, which is un-emulsified oil. The oil evaporates and the heavier compounds start clumping together, which is pre-tar ball, pre-sinking oil. When we dove into the water we saw a subsurface plume and took video footage.[4] The subsurface plume is composed of small droplets of oil that sink. Their density is slightly greater than seawater. The objective of dispersants is to create small droplets of oil that sink.

The organisms that were on the splash zone of the pilings were not affected, because they were excreting some mucus and preventing the oil from sloshing up and attaching to them and killing them. They were in defense mode. That occurred for the top 15 to 20 feet, so they did not look impaired on our first visit.

CBS News saw our video and asked us to go back out to the same location on May 9, 2010. During the second dive, there was a lot of water with sheen. During that dive, 40% to 50% of the organic compounds had evaporated and the oil was still on the surface, starting to mix with water. We saw a lot of organic materials falling from the surface and subsurface plume, and the subsurface plume was 15 to 20 feet thick.[5]

During those dives we wore standard equipment; air tanks fins, snorkel, gloves, a 2mm wetsuit, and a hood. Even though we had our bodies completely covered, it didn't help protect us from the oil at all because we were diving with a wetsuits going down to 90 feet below the surface. However, we were not concerned about the exposure at the time, because the EPA said publicly that it was ok to dive. After those first two trips I wrote reports and put them on the EcoRigs website and submitted them to NOAA coral listserv and they got a lot of attention.[6]

---

[4] Video Data: Surface Oil Slick on May 7th – EcoRigs, http://www.ecorigs.org/EcoRigsOilSpill.html.

[5] Video Data: Marine Life on May 9th MC 194 – EcoRigs, http://www.ecorigs.org/EcoRigsOilSpill.html.

[6] Report May 7th and 9th, 2010 – EcoRigs, http://www.ecorigs.org/EcoRigsOilSpill.html.

SK

Approximately two weeks later the NOAA Natural Resources Damage Assessment (NRDA) contacted us.

4. NOAA: "DIVE IN; ITS SAFE"

I started commercial fishing in the Gulf of Mexico 30 years ago, but I have never seen anything like the conditions we were diving in. Occasionally, I've seen small patches of oil and sheen on the surface water, but not the red stuff. They were spraying Corexit around the time we started diving. After those first two dives, I asked NRDA staff specifically if the Corexit was toxic, and they said "Corexit only has a 90 minute half life." This was reassuring to hear because that meant that the water would not be toxic; as long as we were not seeing any planes flying around we thought we would be ok. On top of that, NOAA told us later in August 2010 Corexit would not be sprayed in the areas where we were conducting our research because the well was capped (July 15, 2010).

I don't like pointing fingers at NRDA staff. I think management endorsed a policy to deny the toxicity of Corexit, because they didn't say anything to anybody about the associated risks. In fact, they purposely misled people. NOAA, EPA, FDA and NRDA knew that Corexit and oil was a very toxic combination. There are numerous publications on the subject and there is historical data from the Alaskan Valdez spill. Why they chose to adopt this policy is really confusing. In late July 2010 BP announced that it stopped spraying dispersant for the cleanup. However, we have a video of fresh Corexit in the water from August 21, 2010 and August 18, 2011 (detailed below).[7],[8]

I was first contacted by NOAA through an email from a NRDA contact. He asked us to collect samples and submit a research proposal for surface water samples and subsurface water samples, and then a second proposal to collect the marine invertebrates and fish that inhabit oil and gas platforms. We conducted 36 dives for NOAA. During the time that we worked with NRDA we continued to post our material on the NOAA Coral Listserv. We were seeing things that other people were not documenting. Further, I have emails between several NOAA staff, their lab personnel and BP regarding the samples we provided. We collected samples for NRDA from mid-July to mid-September, 2010. After repeated requests, in April 2012 NOAA provided us the Chain of Custody for the samples that we provided them.[9]

Arkansas State University also tested our July 2010 samples for Total Petroleum Hydrocarbons (TPHs) and metals; they could not afford to test Total Aromatic Hydrocarbons (TAHs) or

---

[7] Video Data: Subsurface Oil and Dispersant South Pass August 21, 2010 – EcoRigs, http://www.ecorigs.org/EcoRigsOilSpill.html.

[8] Video Data: New EcoRigs Sampling Event 13 miles offshore of Long Beach MS on August 18, 2011 – EcoRigs, http://www.ecorigs.org/EcoRigsOilSpill.html. [Hereinafter Sampling Event 13 miles offshore].

[9] Documentation of federal government correspondence will be provided to responsible, authorized investigators with a need to know the contents.

SK

Polycyclic Aromatic Hydrocarbons PAHs. TPH is a term used for any mixture of hydrocarbons found in crude oil. NRDA told us they would give us the lab results from our samples. However, they never did.

5. NOAA RADIO SILENCE

At first everything seemed to be going fine with NRDA. We sent them two research proposals before we collected samples. They told us they looked good, and to proceed. We were speaking with four to six different scientists. However, when we started producing and sending samples in, the dynamic shifted. In August 2010, we brought about 15 samples from two sampling events to NRDA staff located at the Houma BP Command Center and delivered them by hand. In the beginning they would reply to my email regarding confirmation of the delivery. NRDA told us for several weeks that we were going to receive results. We had two more sampling events in the freezer that we were going to give them. When they stopped giving us results but continued to tell us to go out, we started to hold our samples.

I sent in a written request to NRDA several times for the certificate of analysis. They were testing for PAHs and TPHs and we wanted to know the results. I think they were going to fingerprint biomarkers as well. However, we only received a verbal response that some of the samples were positive for oil, and they did not identify it as BP's MC 252 oil. That was the extent of it. After they did not respond to our written requests, we started to figure that NRDA was going to screw us in some way. It was very very disappointing not to receive more information, after all of the conversations, preparation and dives that we invested in. EcoRigs later analyzed surface water samples from some of our NRDAs dive for PAHs and biomarkers specific to the MC 252 blowout crude oil. Concentrations of PAHs were found to be up to a thousand times greater than the U.S. EPA water quality benchmarks for human exposure. Some samples were fingerprinted and the critical difference analysis of biomarkers showed that the sample correlated with the crude oil from the MC 252 well.

There was one event that foreshadowed how NRDA planned to renege on its end of the deal. In the summer of 2010 they had a meeting in St. Petersburg, Florida to begin funding the main universities in Florida, Alabama, Mississippi, and Louisiana. At the time of the meeting we had conducted three to four sampling events for NRDA, and they did not even bother to tell us about the meeting. After that meeting, NRDA stopped communicating with us, and has not paid us to this day. For the NRDA samples, our invoice is for $113,000. That includes hazardous pay, such as diving in the oil.

Scott was diving more than me and his health problems began in July 2010; mine began in September 2010. I don't recall if we informed NRDA we were getting sick. At that time we didn't know it was from the Corexit and oil. We were in disbelief; NRDA had told us it was safe to dive. We were suffering symptoms like nausea, headaches, fatigue, memory loss, blood in the

SK

stool (detailed below). In October 2010 I started to formalize my understanding of the relationship between our health and diving.

6. DIVER SAFETY SOS

In November 2010, I began writing a paper on our health problems. On March 11 2011, I submitted it to offshorediver.com, because I wanted other divers to know what was going on in the Gulf of Mexico.[10] I also submitted it to the Louisiana Environmental Action Network (LEAN).[11] I had previously asked Marylee Orr, the Executive Director of LEAN, if I could reference her organization to assist divers that may be suffering from the same symptoms. After she read the paper, she asked if she could put it on her website. It focused on our symptoms and exposure. I provided a link to the videos of what we saw when diving, and explained "If you think you were in this, you better get your blood tested."[12]

LEAN paid for Volatile Solvent Profile tests through Metametrix Lab, to test the blood for compounds found in the oil and dispersant. My blood was tested January 21, 2011 and levels were extremely high. The Volatile Organic Compounds (VOCs) entered through our skin when we dove. In effect, we had dermal exposure to the VOCs. The test screens for the lighter organic compounds, such as benzene, toluene, ethylbenzene and a few others. . Research shows dermal exposure symptoms correlate with the symptoms I documented: the VOCs got into our liver, kidney and fat cells. Further analysis shows that they can affect DNA replication, and potentially lead to cancer ten to fifteen years from now, as the evidence from the Exxon Valdez spill confirms. Presently, I just found out my liver is partially damaged due to exposure to oil and I suffer from chronic dermatitis on my face. My face is the only part of my body that was exposed while I was diving.

Also, the exposure has affected my cognitive abilities. I describe the symptoms as "BP on the brain." I am the scientist. I have to think every day, and it really affects me. I have lost my memory, and it is very, very frustrating. I construct my sentences with the thought in mind that I will not know what I need to say by the time I get to the end of my sentences. If I am thinking about data and expressing references, and calculations in my head, now I prepare myself for my limitations. I noticed in November 2010, that my writing ability, ability to do calculations, and express complicated thoughts was noticeably impaired. I am not as prolific as I was before. I used to work every night and weekend and get a lot done but after being exposed, my

---

[10] Posting of BP Oil and Corexit Found in Science Diver's Blood to http://www.offshorediver.com/content/index.php?option=com_content&view=article&id=1381:bp-oil-and-corexit-found-in-scientific-divers-blood&catid=50:the-stack&Itemid=219 (Mar. 11, 2011, 7:50 CST).

[11] Steve Kolian, EcoRigs, Gulf Divers Experiencing Health Problems, Blood Contaminated with Petroleum Hyrdrocarbons (2011), http://leanweb.org/our-work/community/public-health/gulf-divers-experiencing-health-problems-blood-contaminated-with-petroleum-hydrocarbons.

[12] Video Data – EcoRigs, http://www.ecorigs.org/EcoRigsOilSpill.html.

SK

SK

productivity declined steadily. I have a difficult time concentrating for any amount of time in the evenings.

7. DETOXIFICATION PROGRAM, FRESH OIL

Fortunately in October and November 2011 I went through the Gulf Coast Detoxification Program, which is managed by Dr. Mike Robichaux, LEAN and Jim Woodworth, former director of the 9/11 detoxification program. It has helped clear some of my memory loss, and my writing and productivity is improving although these cognitive symptoms are resurfacing

October 10, 2010 was my last dive of 2010. However, Scott continued to dive throughout the winter. I dove three times in the spring and summer of 2011, and collected corals and surface water samples at the platforms on Grand Isle Block 93. In August 2011 there were several reports of oil slicks from the Macondo well. Regardless of the source, we knew there was a lot of fresh oil. On August 18, 2011 a captain took me to collect samples from Ship Island, Mississippi, 103 miles north of the Macondo well. We saw stretches of fresh oil.[13] I also saw what looked like dispersed oil. I was not diving, but I collected surface water samples; I had taken probably 70 surface water samples since the spill started, and this was one of the best sets. On September 12, 2011 I took samples at the end of the Houma Navigational Channel, 23 miles offshore of South Timbalier Island and about 130 miles from the Macondo well. That slick was seven miles wide, and I don't know how long it was.

Since September 2010, Scott and I have taken many samples and split them. If we had funding, I'd be analyzing those samples now. We went through the detoxification program and are giving our bodies a break. However, evidence shows that the Macondo well, MC 252, is still leaking. Pilot Bonny Shumaker with On Wings of Care is conducting flyovers and documenting large fresh oil plumes close to the Macondo well. I believe that there is a chronic leak that sometimes discharges at an even rate which changes periodically and the rate of discharge significantly increases. I fear that the leak could continue to flow for another 10 to 20 years.

8. PUBLICATIONS REJECTED

Six scientists, including myself and EcoRigs staff, including marine scientist Dr. Paul Sammarco, chemist Dr. Wilma Subra, environmental toxicologist Dr. Jennifer Bolin, analytical chemist Richard Warby, biologist Scott Porter, and I submitted a report on the impacts of the BP spill on human blood, seafood, biota, sediments, and water to Science, the Proceedings of the National Academy of Science (PNAS), and Environmental Science and Technology. It was turned down all three publications. The report concludes that the levels of contaminants in water, seafood, biota, and sediments are all higher than previously announced levels by NOAA and

[13] Sampling Event 13 miles offshore, *supra* note 8.

SK

SK

other federal agencies and universities. It took PNAS a long time to decide whether or not to publish it.

SK

I have read the foregoing eight page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on May 8, 2012.

Subscribed and sworn to before me
this 18 day of May, 2012

Pamela J. Brown

Notary Public

My Commission expires on: at my death

PAMELA J. BROWN
NOTARY PUBLIC
NOTARY ID # 59733
STATE OF LOUISIANA
PARISH OF EAST BATON ROUGE
My Commission is for Life.

ED_001324_00007754-00303

AFFIDAVIT

My name is Sydney Schwartz. I am giving this statement freely and voluntarily, without any threats, inducements or coercion to Tom Devine, who has identified himself to me as an investigator and the legal director of the Government Accountability Project (GAP).
I was hired through the Vessels of Opportunity (VoO) program out of Dog River, Alabama from May 12 to July 21, 2010. I was the Task Force leader at the time, and I had 25 boats under me. I am giving this statement to make a record of how British Petroleum's (BPs) response to the Deepwater Horizon spill skipped the usual ways to truly clean up oil spills. Despite contrary government reassurances that the oil was being cleaned up, the effort was based on chemical dispersants to make it seem like the oil had disappeared.

I live on the city limit of Mobile, Alabama, and I have worked on shrimp boats since I was three. I am now 51. As a boy, my father would tie me to the mast, the same as I have done with my son and grandson. By the 10th grade I was captaining boats. In 2000 I received my captain's license from the Coast Guard. During the past ten years I also have worked for the oil industry during the off season or when shrimp harvests were weak. I also run boats supplying offshore operations with fuel and feed.

1. LOCATE OIL, BUT DON'T CLEAN IT

As part of the VoO program, my boat was assigned to do surveillance and locate where there were oil slicks. In May I began as a one man boat with a team leader. It wasn't but a few days until my team leader talked me into being a team leader and then I had several boats under me. Toward the end of June the VoO program tried to create more structure, as opposed to running us out randomly, by adding Coast Guardsmen to the Task Force boats. At that point, we were not even given permission to clean the oil until the Coast Guard was on our boat. When the Coast Guard took over, they made me a Task Force leader. I was suddenly in charge of 25 boats; however, my pay did not increase. When I inquired with the Coast Guard why I did not receive a higher salary, they indicated that was just the way it was, and that I could take it or leave it. I didn't have the option of leaving it, because I was unable to make my livelihood shrimping due to the oil spill.

The VoO program had a morning group and evening group of boats, and each group had three Take Force leaders. I was part of the morning group. We were divided into three zones, and each zone was assigned a fleet of 25 boats. Each Task Force leader had five Strike Force boats, which were in charge of additional boats. If one of the boats under a Strike Force boat found oil, the captain would report it to the Strike Force leader who would then report it to me. I would report it to the Coast Guard and then we would have to report back to my home base leader. It was very frustrating for me to be in the position of Take Force leader, because I was regularly told by the Coast Guard officials that I could not direct the boats to clean up the oil that they spotted.

My zone went south from Dog River and mainly north of Dauphin Island in Mobile Bay. We stayed in state waters in the bay; we never went into the Gulf. To illustrate what I was finding, on June 13, 2010 there was an oil slick three miles long and a half mile wide. We were told not to clean up any oil we reported, however. We didn't have anything on the boat to clean it up. We

were just spotting oil. I was angry and protested. I knew BP had the equipment - such as boom - but they were not putting it on the boats, because I had seen it on the sites. I raised noise, got other fisherman involved and threatened to contact media if they would not provide us the tools to properly contain and clean the oil.

In response, BP put oil booms and rags on the boat to clean it, but when we went back to clean the stretch of oil that we had previously identified, all we could find were bubbles. The evening before, they had contacted me and wanted a GPS number of each end of the slick. I didn't put two and two together until the next day when we saw the bubbles and realized that they bombed it with the dispersants that night. The next morning I received permission to lay boom, but the oil was all gone despite there being almost no wind. All that could be seen were black bubbles and foam.

2. DISPERSED OIL

I almost always saw a lot of sheen and bubbles, but at least five times I saw slicks of heavy weathered oil. The weathered oil is a brownish dark color that puts off a lot of sheen, and it has a gooey peanut butter like substance like a heavy crude oil with water mixed in that makes it. They were different sizes, but the largest slick I saw was on June 13, when I was told not to clean it. Toward July, we began to see less weathered oil and more dispersed oil. I heard from several fishermen that the VoO boats were intentionally placed in the dispersed oil to ride over it and disperse it further. Just at Dog River, there were regularly 150 boats in the water throughout the cleanup, and 170 boats at its peak.

In mid July 2010 one of the Strike Force leaders in Mobile Bay and in my zone reported oil in shallow water. They could see it; it was black in the water but they couldn't get the sorbent boom to hold it or for it to stick. We don't have that problem with undispersed oil, so we figured it was oil that had been dispersed. They could only attain about a bag of sorbent boom from VoO to clean it up. We never did hear any explanation about what it was. Since all we saw were black bubbles, we assumed a plane and some large boats had been spraying a dispersant on the oil. That is why it could not be cleaned normally.

Toward the beginning of the VoO program there was a heavily-attended public meeting at the Mobile, Alabama Civic Center with the Coast Guard. There were people from the Coast Guard, as well as senators and a lot of environmental representatives who were concerned about the use of dispersant. The Coast Guard official said there would be only limited use of dispersants, in the hundreds of thousands of gallons, and only where there would be no human contact. That is not what happened. Other workers in my zone reported to me that they saw dispersant being applied regularly from boats in all areas, and public reports confirm there were millions of gallons used. When they witnessed spraying, I asked them to take pictures so that we could document it. They were never able to get close enough to take pictures, however, because the boats would leave.

BP hired a firm called Sea Tow out of New York to do a lot of the spraying from large aluminum boats. Normally the Sea Tow boats are used as response boats if you breakdown or have an emergency. They are big boats with a lot of horsepower and they have the capacity of carrying tanks and spraying dispersant. These boats were stationed at a compound in Deer River, located

I have read the foregoing four page statement, and it is true, accurate and complete to the best of my knowledge and belief.

Executed on July 6, 2012.

Sidney L Schwartz Sr

Sidney Lee Schwartz Sr

Subscribed and sworn to before me
this 7 day of 27, 2012

F. Vickers

Notary Public

F. Vickers
Notary Public
Alabama State At Large
My Commission Expires
March 21, 2016

My Commission expires on: _____

WS

AFFIDAVIT

My name is Wilma Subra. I am submitting this statement, without any threats, inducements or coercion, to Shanna Devine, who has identified herself to me as an investigator with the Government Accountability Project. I am president of Subra Company, a chemistry lab and environmental consulting firm located in New Iberia, Louisiana. Throughout the BP oil spill cleanup I have advocated for greater worker protections and sound science around the impact of the spill on the gulf ecosystem and public health.[1] I am providing this statement because of the health needs of the impacted communities all along the coastal areas. There are no limitations on the use of this statement.

I was born and raised in Morgan City, Louisiana. I have lived my adult life in New Iberia, Louisiana; however, I work all over the United States and in some foreign countries. I have a master's degree in chemistry and microbiology from the University of Southwestern Louisiana. After I finished graduate school in 1966 I worked for Gulf South Research Institute (GSRI) for 14 years. We conducted cancer studies, and developed toxicology programs and methodologies before they were available in universities. Our programs were eventually developed at the national level. From that aspect I have been practicing toxicology since it was in its infancy.

After working at GSRI I founded the Subra Company in 1981. I created it specifically to provide technical assistance to community groups dealing with environmental issues, and to help them understand what was going on with chemicals to which they were exposed. Since that time I have also worked as a chemist for the Louisiana Environmental Action Network (LEAN). Before the Subra Company was formed, specialists would come into communities and evaluate particular public health threats, and then the communities would be given summaries. But no one would ever be able to sit down with the community and explain, "This is what the data really showed, and this is what you need to be looking into in your community." For thirty years I have been providing that resource.

I received the MacArthur Genius Award in 1999, based on working with, educating and empowering communities with the information they need to address environmental issues. Then they are the ones who make the difference. Since that time I've continued that work night and day, often 7 days a week and sometimes up to 20 hours a day. I was selected in 2011 as one of the 'Lifetime Remarkable Woman,' and most recently I was awarded the 2011 Global Exchange, Human Rights Award for my ongoing work with the BP Oil Spill and the communities affected by it.

---

[1] *Local Impact of the Deepwater Horizon Oil Spill, Human Health and Environmental Impacts Associated with the Deepwater Horizon Crude Oil Spill Disaster: Hearing Before the Subcomm. on Oversight and Investigations of the H. Energy and Commerce Comm.*, 111th Cong. (2010) (statement of Dr. Wilma Subra, Chemist of Subra Company, Louisiana Environmental Action Network and the Lower Mississippi Riverkeeper), http://democrats.energycommerce.house.gov/documents/20100607/Subra.Testimony.06.07.2010.pdf

WS

I recently completed a seven year term as vice-chair of the EPA National Advisory Council for Environmental Policy and Technology, a five year term on the National Advisory Committee of the U.S. Representative to the Commission for Environmental Cooperation and a six year term on the EPA National Environmental Justice Advisory Council (NEJAC) where I served as a member of the Cumulative Risk and Impacts Working Group of the NEJAC Council, and chaired the NEJAC Gulf Coast Hurricanes Work Group.

1. LESSONS LEARNED FROM KATRINA

I have a local parish emergency response pass that I acquired as the chair of the Iberia Parish Emergency Response Committee. The pass is valid throughout Louisiana, and in 2005 after Hurricane Katrina I went into the community every day, even when the dead bodies were still floating in the waters, and did damage assessment and needs assessment. I would sample the sediment sludge that was washed in shore as part of the tidal surge from Katrina. I would come back at night and get in touch with LEAN director Marylee Orr and tell her, "This is the place and community and supplies that they desperately need." She would work on getting those supplies into the community. Then I would go into another community and do damage assessment and needs assessment, sampling the sediment and sludge, and repeat the process.

What I found were high levels of heavy metals, organics, Polycyclic Aromatic Hydrocarbons (PAHs), and gram positive and gram negative bacteria (detailed below). When residents were allowed to return they were coming into contact with these chemicals without protection. We had about three million people come into the gulf coast to volunteer after Katrina and Rita, to gut houses and to tear down structures. They were all getting severely contaminated, and then going home without the knowledge of what had happened to them. Then they were sick one year to five years later from the exposure. There was nobody in their community to trace patterns of exposure and identify the cause by asking, "Did you go down to the gulf and volunteer?" Some of the pregnant women who had exposure later had birth defects and there were high miscarriage rates. There were abnormal pre-cancer and cardiovascular impacts.[2]

Marylee and I were out there informing as many people as we could that these are the health impacts associated with your environmental exposure. But how do you protect the people when state and local health agencies said it was safe to go back in to their now toxic communities and homes? We felt that was a huge exposure that occurred and was going to go unrecorded. We were really putting pressure on the federal and state health agencies to monitor what the effects were through long term tracking of the health impacts from this exposure.

2. FAST FORWARD TO BP SPILL; EDUCATION AND RETALIATION

[2] Wilma Subra, Presentation to the Church World Service, Forum on Domestic Disasters Ministry, Princeton Theological Seminary: Environmental and Human Health Impacts of the 2005 Katrina and Rita Hurricane Season (Mar. 26, 2006), http://data.leanweb.org/katrina/wilmadata.html.

ED_001324_00007754-00308

The same thing occurred after the BP oil spill, regarding dangerous levels of exposure among workers, volunteers and residents. In late April 2010, before the crude made it to the Louisiana shore, which took nine days, the aerosol came on shore all the way across from Louisiana to Mississippi and Alabama to the Florida panhandle. The aerosol was dispersed crude oil. It came from the slick of the gulf and was dispersed into the air from the heavy winds of the high seas. It caused severe nausea, headaches and respiratory problems.

In May 2010 I went out and started conducting workshops for workers and their wives on health risks associated with exposure to the toxins and fumes. The people knew they were sick but they didn't know what it was from, and the media was reporting, "The oil hasn't hit the shore yet." At first the perception was that there were no health impacts. However, community groups would put the message out that I was providing the workshops, and people would quickly come out to learn what was going on. A lot of larger and national groups need a board to approve these actions, and it goes through a lengthy process which can delay our response time; I have been on boards and experienced this firsthand. Marylee and I get out there instantly. We don't worry about how we're going to pay for it until afterwards. We continue to offer these workshops.

There were two affected populations from very early on: those on the coastal area exposed to the aerosol and then to the crude as it moved in shore, and the worker population who were on the frontlines of the cleanup. The fishers couldn't go back out and fish, because the fishing grounds were closed. So quickly they wanted the jobs with BP, because they felt they knew the marshes and estuaries the best; that was their resource and they thought they could protect it the best. These workers were exposed every day, without proper training or proper protective gear.

Throughout the oil spill cleanup, worker safety trainings were insufficient to protect the health of the workers. The Occupational Safety and Health Administration (OSHA) and BP reduced the 40 hour HAZMAT trainings to four hour trainings for most of the workers. Some workers did not receive any training. Still, as part of the cleanup they came in contact with the oil and often dispersant and put out the booms. They would come home at night very sick, but desperate and needing the work. Then they would go back out in the morning and get sick all over again with headaches, nausea, respiratory problems and skin rashes; these are just some of the symptoms associated with exposure to the crude oil and dispersant. Health problems got worse from there (detailed below).

LEAN attorney Stuart Smith took BP to federal court in early May 2010, and the judge ruled that BP was not providing the cleanup workers with adequate protection and adequate training. BP signed the agreement that it would provide adequate training and adequate protection to the workers.[3] From that point forward the workers and their health should have been protected. BP and the government's ability and responsibility to protect these workers is not anything new. The

[3] *Fisherman Win Another Round: For The Second Time, Court Requires BP To Amend Its Responder Contract To Protect Responders In Oil Cleanup*, LEAN, May 10, 2010, http://leanweb.org/our-work/water/bp-oil-spill/fishermen-win-another-round.

ED_001324_00007754-00309

people in Louisiana deal with chemicals and chemical toxicity in a workplace environment all the time. To allow workers to be exposed and made sick in response to an oil spill is inexcusable. We have rules and regulation on the book. We have requirements, planning, and instructions for worker safety that need to be enforced. However, even after the court ruling to enforce worker safety, as discussed below BP did not comply with the regulations and allowed the workers to be made sick.

BP and BP contractors were not providing workers with respirators, or allowing them to wear additional safety equipment on their own accord. The workers would go out, and Marylee instantly ordered protective gear. She ordered Tyvek suits, gloves, respirators and goggles and started distributing them in May 2010. However, workers told us they were not allowed to use them. When the workers on BP's Vessels of Opportunity (VoO) Program would take them out on the boats, we were informed on several occasions by workers that BP officials would threaten, "You're fired if you wear the respirators." When I was doing the workshops all day long, the wives would come because their husbands were out on the boats, and suddenly they became very concerned because they realized why their husbands were getting sick. The wives started speaking out and the workers were told if their wives don't shut up, then they were going to be fired. This was shared with me repeatedly along the coast. LEAN did convey the information to state and federal government agencies. The agencies listened to the information, but did not provide responses.

On June 22, 2010 Maureen Lichtveld, Chair of Environmental Policy at Tulane University School of Public Health, held a meeting about the health impacts associated with the spill and invited me to give a presentation. The conference was very well attended from experts throughout the country who came to speak and listen. I spoke about the health impacts and the threats to the workers and their wives. I made the statement that it is totally inappropriate for workers in a workplace environment to be made sick in 2010.[4]

3. OSHA DIRECTIVES INADEQUATE

On June 22, 2010 before the conference began, I had lunch with Dr. David Michaels, Director of OSHA. I told him about what was happening with the workers, and what the response was from BP and BP contractors. He said, "We have a problem, we have to do something about it," and I said "Yeah, I know we have a problem, and OSHA is supposed to be in charge." He said, "Well Wilma, OSHA doesn't have jurisdiction in the outer-continental shelf, offshore in federal waters. We just have jurisdiction out three miles from the coast, because that is still state waters." In turn, he argued that OSHA was not able to take corrective action where many of the VoO

[4]Transcript of Presentation by Dr. Wilma Subra *at* 228-230, *Assessing the Human Health Effects of the Gulf of Mexico Oil Spill: An Institute of Medicine Workshop,* The National Academies, Jun. 22, 2010, *available at* http://www.iom.edu/~/media/Files/Activity%20Files/PublicHealth/OilSpillHealth/OilSpillHealth%20Day%201%20Transcripts.pdf.

workers were exposed to dangerous work environments without sufficient safety equipment. I responded that OSHA still should be protecting the health of the workers.

During our lunch, the main issue he pushed back on involved the use of respirators. He said, "If we make the workers wear respirators, then you, Wilma, will be causing them to have heat strokes." He framed it as if, by my advocating for their use of respirators, I'm causing the workers harm. I responded that the fishers participating in the VoO program said it was much harder on them not to wear the respirator and to breathe the fumes. They were the cleanup workers pulling in the booms loaded with oil that was running down their arms and their suits, and they were inhaling it. I have organized a lot of emergency response activities, and I know that if the wearing of a respirator induces heat stress then alternatively you put the body in a cool air system suit. This way the workers do not get overheated, and they do not breathe in the dangerous chemicals that are in their workplace environment.

A few positive things resulted from my conversation with Dr. Michaels. In July 2010 OSHA finally came out with a directive that the workers near the well site needed to wear respirators when they were spraying the dispersant Corexit. This did not apply to other workers, however. Additionally, in July 2010 the amount of time workers were allowed to work in the sun without a break was reduced. Prior to that directive, some of the workers on the beaches that were required to wear Tyvek suits would get so hot (due to the material, the suits retain heat) that they wore them tied around their waists and some workers didn't have them on at all. But after our conversation OSHA restricted their work time; they could only work 20 minutes out of a 60 minute period and the contractor was required to provide them shade and liquid during the 40 minutes. Sometimes the tents weren't adequate and they would still be exposed to the sun, but the break really helped them work.

OSHAs additional directives were better, but not appropriate for the exposure. Workers still weren't being provided with enough, or in some cases any, protective gear. The crude oil is in the environment, it's on the water, it's in the water column, it's in the sediment sludge, and it's on the beaches as a result. Any worker of BP or a BP contractor is going to come in direct contact with oil because they are out there to "clean up the oil." The routes of exposure of those workers are: inhalation by breathing in the fumes from the crude and/or dispersant if it was applied to the crude; ingestion because they spend their shift out there in contact with the crude and that is when they eat and they drink; and then dermal exposure, or skin contact, because a lot of them were not provided with adequate gloves or suits to cover their bodies, or when their gear ripped it would often not be replaced.

There are companies all along the Gulf coast that deal with oil spills all the time and they know the safety measures that must be taken. The whole process is already set up within these companies, and yet BP was allowed to hire cleanup workers without proper training or protective gear, and put them in harm's way through direct contact with the crude and the crude mixed with

ED_001324_00007754-00311

the dispersants. No matter how "emergency" it was, they knew how to protect those workers and they didn't.

4. HEALTH IMPACT, CANCER ALLEY FORSHADOWING

Often when you assess a health site there are a particular set of chemicals that you are dealing with and they have specific health impacts that you look at. We learned many lessons from "cancer alley," which is along the Mississippi River between Baton Rouge and New Orleans, Louisiana. It is important that we learn from cancer alley in our response to communities impacted by the oil spill, because the long term health impacts will be very similar. Cancer alley gained notoriety in the late 1980's due to abnormally high cancer rates along both sides of the river. The facilities on cancer alley are petrochemical bases, and in 1987 the EPA's Toxic Release Inventory came out and showed cancer causing agents being released from those facilities, including the PAH and volatile organic compounds, (VOC or volatiles).

A lot of the industrial facilities on cancer alley didn't have proper worker protections for decades. The petrochemical industry conducted blood and urine tests of workers on an ongoing basis, but never made that data available to the workers. However, someone with a workers union would get local data on urine and blood analysis. Through the union, I had access to the kinds of chemicals that workers were being exposed to. I could match that information with the results in their urine and their blood and it clearly would associate.

To this day, people who live in close proximity to the industrial facilities on cancer alley have increased levels of these chemicals in their blood and health impacts associated with the particular chemicals at those facilities. In Mossville, located in St. Charles, Louisiana they live in close proximity to 14 industrial facilities, the majority which release bino-chloride and dioxins and furans. Residents of Mossville have three times the blood levels of dioxin that the rest of the population in the United States has. This is due to their exposure from the air emissions, from the deposition and from the bioaccumulation, as well as the impact on the aquatic and terrestrial organisms and the fruits and vegetables.

The widespread and long lasting contamination results in long term exposure. The older people have much higher chemical concentrations in their blood. Even though the industrial facilities have reduced their emissions overtime, the bioaccumulation is continuing. It's not like you are exposed to something, get a cold, then go to the doctor, get an antibiotic and it goes away. These are longer term exposures that build up in the body and then debilitate the whole community – just destroy the quality of life of the community.

Unfortunately the impact on the community from cancer alley has not been sufficiently tracked, and it is important that the same mistake is not made with those impacted by the oil spill. The cancer registry puts the cancer rate data out based on parish. If you look at the industrial corridor along the Mississippi River, the parishes are large but the portion on the river is small. From cancer alley you have this severely impacted community along the river, and then you have a

large part of the parish that is not in close proximity. They combine all of that and give you a parish number instead of selecting the sections closest to the industrial facilities and coming up with those cancer rates.

In addition, most of the impacted communities are comprised of poor and minority populations, with a lack of access to health care. A lot of towns where cancer is prevalent don't get reported. You have to go to the doctor and the doctor has to take the initiative to report the incidents. And a lot of these people can't even go to the doctor because they don't have money for the gas to get to the doctor.

Marylee and I quickly employed the blood test method with the sick workers and residents in the aftermath of the BP spill (detailed below). I also developed two worksheets early in the oil spill cleanup process; a list of health impacts associated with Louisiana Sweet Crude, which is the type of oil that leaked during the spill, and a list of health impacts associated with the Corexit dispersants.[5] The combined short term health symptoms for include acute respiratory problems, skin rashes, cardiovascular impacts, gastrointestinal impacts, and short term loss of memory. Long term impacts include cancer, decreased lung function, liver damage, and kidney damage

When you combine the crude oil from the BP spill – Louisiana Sweet Crude - and the dispersant, the mixture toxicity is more than the additive amount; the more that they mix together, the greater the combined toxicity.[6] The issue is how well the dispersant was mixed with the crude in each specific location that these people were working. We compared the health impacts identified on the worksheets with the types of health impacts associated with the workers. From the beginning of the cleanup, the workers called Marylee and me on nights and weekends, and they were reporting all of the same health impacts; respiratory impacts, nauseas, severe headaches, cardiovascular problems, and huge skin lesions because of the skin contact with the oil and dispersed oil, and decreased memory. They began sharing these symptoms from the first day they went to work with BP, and by May 7 we had the court hearing with attorney Stuart Smith over the health impacts experienced by the workers.

Most of the cleanup workers were hired by a huge number of BP contractors. If any of the workers claimed they were sick, their employers would send them to a first aid station, or if they were severely ill they would send them to a hospital. However, after they became really sick and couldn't work anymore, they would be laid off. When they were still employed they would call us discreetly at night to report their health problems, but then they really started to speak out when they realized there no longer was anything to lose since they had been fired for being

---

[5] *Health Impacts Associated with Dispersants and Louisiana Sweet Crude*, LEAN, Jun. 14, 2010, http://leanweb.org/our-work/water/bp-oil-spill/health-impacts-associated-with-dispersants-and-louisiana-sweet-crude.

[6] Richard Denison, *EPA data show dispersants plus oil are more toxic than either alone*, Environmental Defense Fund, Jun. 14, 2010, *available at* http://blogs.edf.org/nanotechnology/2010/06/14/epa-data-show-dispersants-plus-oil-are-more-toxic-than-either-alone/.

victims. They were too sick to work, and had no medical or disability benefits. There are still thousands of workers employed by BP and BP contractors all along the gulf coast, and we continue to receive calls from them regarding health problems.

Since the oil spill, we also get calls from scores of sick residents that mirror the health problems reported by workers. Based on my experience with cancer alley, this was not surprising, and I am concerned about future cancer rates among gulf residents who have been impacted by the spill. The more vulnerable populations in any toxic environment are the elderly and the children. This is of greater concern in association with the BP spill than cancer alley, because a lot of the coastal community populations depend on fishing both for a livelihood and to feed their families.

Large Vietnamese, Native American and African American populations live along the coastal areas. Before the spill they had the ability to feed their families based on what they harvested. Now suddenly they don't. A lot of the organisms have been depleted and contaminated as a result of the spill. In a lot of cases these people are hungry because they can't eat the seafood or they don't want to poison their family by eating it and they have no other source of food. Fishermen have shared these concerns with me directly. In the marshy areas you can't plant a garden. All of a sudden their vulnerability has increased exponentially because they don't have access to food.

5. PAH, BLOOD TESTS

LEAN and I, working with Dr. Michael Robichaux, have taken excess of 100 whole blood samples on workers and residents who have reported health problems in the aftermath of the spill. The blood samples have analyzed for VOCs, the compounds found in the crude oil and dispersant. The results demonstrate an increase in the blood concentrations of those chemicals as a result of being exposed to the crude and dispersants. The findings have been consistent with the first six blood tests that we released on January 5, 2011.[7] When levels exceed the 95th percentile, it exceeds the level that the general population range is, so it clearly shows that exposure occurred. People who have not been exposed to the crude and dispersants have much lower levels in their bodies, way below the 95 percentile.

When you look at the overall data from the blood testing, the highest concentrations were in current workers and former workers who could not have had current exposure; they are in excess of the 95th percentile. The divers are just below that; they actually went out and dove through the slick when it was in the gulf, and in the marshy areas. The populations living and recreating along the coast are still in excess of the 95th percentile, because there is still ongoing exposure through their environment.

[7] Wilma Subra, *Evaluation of the Results of Whole Blood Solvents Testing*, LEAN, Jan. 5, 2011, http://leanweb.org/our-work/community/public-health/bp-spill-blood-test-results-louisiana-residents.

We started the blood testing in late December 2010, but we already had data from Mississippi and Alabama and Florida for blood tests which informed our initial analysis. We did a survey of what their occupation was or how they thought they were exposed. I have developed an instrument of surveying health impacts. In the case of the oil spill, it surveyed health symptoms specific to exposure from the crude oil and dispersant because after the spill a lot of the communities wanted it in order to have their symptoms reported. However, when they received it they were scared that BP would somehow get that survey result and it would hurt in their BP claims, so they were very reluctant to fill it out.

Based on our findings for approximately 100 surveys, in addition to approximately 800 interviews, individuals reported being ill often, on an ongoing basis, everyday and daily. Of the individuals surveyed, 45% of the individuals reported working in the BP oil spill cleanup efforts and being exposed to the crude oil and dispersants. In addition to the cleanup workers, the coastal residents completing the survey identified being exposed to crude oil and dispersants from the BP spill. The routes of exposure identified by all of the individuals surveyed consisted of contaminated air, contaminated water, contaminated wetlands and beaches and contaminated tissue. The description of the specific exposure pathways described by the cleanup workers that were surveyed consisted of: crude oil on surface of the water in the Gulf and Bay systems; crude oil offshore; oil soaked booms; crude oil and dispersants on beaches and wetlands; sprayed with dispersants while working on the oil spill cleanup; exposed to chemical solutions used to clean equipment in association with the oil spill cleanup; and smoke from burning of crude oil. The description of the specific exposure pathways described by the coastal community members consisted of: crude oil and dispersants on beaches and wetlands; smoke from burning of crude oil; washing contaminated clothing; and consuming contaminated oysters. [8]

Historically worker community groups don't have any money, so if we find a contaminated area we do a few samples, demonstrate what is happening, and usually the state or the federal agency comes in and does additional sampling or require the company to do additional sampling. That way the community has identified the issue, and the agencies then help us clearly define the issue. In this case, we're identifying the issues and yet the agencies aren't stepping in and taking a broader look. Exposure from the oil spill is affecting a huge portion of the population along the coastal areas. The federal agencies have claimed that they don't have the resources to come in and evaluate the chemicals in the blood of these sick populations. So we're evaluating it.

Each blood test costs approximately $500; $400 for the test and $100 to take it to the lab. We have to pay for the costs, because the people we are testing are mainly sick and unemployed and can't afford it. We're doing just a few at a time, and we're still looking for additional resources

[8] *Results of the Louisiana Environmental Action Network (LEAN) Survey of the Human Health Impacts Due to the BP Deepwater Horizon Disaster*, LEAN, Apr. 20, 2012, http://leanweb.org/our-work/water/bp-oil-spill/results-of-the-louisiana-environmental-action-network-lean-survey-of-the-human-health-impacts-due-to-the-bp-deepwater-horizon-disaster.

ED_001324_00007754-00315

so that we can do more testing. Even though it is expensive, the easiest approach was to test for the VOCs. Critics of this test, such as the Center for Disease Control (CDC), argue that the volatiles disappear quickly. If that is the case, there is real cause for alarm. Yet, the crude supposedly stopped flowing in the middle of July 2010, but exposure is continuing to this day. *Either they don't disappear quickly, or the oil is still contaminating the region.*

The government and BP also have taken the stance that we do not need to be concerned about exposure to Corexit, because it has a 90 minute half life, which means that after 90 minutes half of the components evaporate and the other half of the concentration remains, making it less dangerous. That is not fully accurate in this case, because the compounds from the dispersant come in contact with the crude and get interconnected. In effect, the degradation does not occur like that. The real half life and range depends on the environmental conditions. The BP oil spill is really a test case, since such a large amount of dispersant has not been used before in such quantities with the large amount of crude oil. When the remaining oil and dispersants are disrupted, the compounds rise to the surface. When divers went into plumes, they were exposed.

Every time I check, there is still oil on the beaches and in the estuary systems and in the wetlands and the marshes. People go to the beaches and swim in the gulf, and report to me that they still come up stained with a brownish tan color that they believe is oil. There are still tar balls and mats and strings washing on shore every single day all along Louisiana, Mississippi, Alabama and the panhandle in Florida. Grand Isle, Louisiana gets bowling ball size tar bars, and is still full of oiled birds that are dead and dying. If you open a tar bar that washed on shore, the volatiles are still being released. This exposure extends to anyone who took home tar balls in a Ziploc bag or on the airplane. From May 2010 through early 2011, I received a large number of complaints from the baggage screeners, or inspectors at the airports because passengers had to put the tar balls in their checked baggage when the inspectors found them in their carryon bags. The inspectors had to handle the tar balls and they were concerned that they were being exposed as well; they wear latex gloves, which would not protect them from exposure to the chemicals present in the tar balls.

Anyone who recreates, fishes, is in the marsh and hunts or traps in the gulf, is still coming in contact with the crude on an ongoing basis. I took samples from Mobile Bay, Alabama in July 2011, and the whole time we were out the fishermen on the various radios were calling in about the oil. The water there was like 85 and 88 degrees, so there was constantly oil coming up and making a sheen. There were constantly mats and tar balls and oil washing in to the barrier islands. But fishermen were really concerned about that sheen, because anything they harvested and picked up through it became contaminated with the oil. It's still very prevalent.

Many of the VOCs do go away quickly. However, the oil is still very prevalent in the environment. It's not over. The main VOCs are xylene, ethyl benzene and hexane. They were known to be in the crude, to move on shore, and to be off-gassing from the crude as it floats on the surface of the Gulf and as it is in the wetlands and the beach. These are known suspected

ED_001324_00007754-00316

cancer causing agents that also cause acute respiratory problems and gastrointestinal problems and decrease lung function type issues. The health impacts and the concentrations in the blood are to be expected from this level of exposure. For those who are living a normal life but not cleanup workers, the two ways that you can be most exposed to VOCs are from filling your car with gas and smoking, However, that exposure is much smaller than what we were finding in the blood tests. In fact, we have five and six year old children who had high levels of VOCs in their blood, and they don't go out and fill their car with gas, or smoke. Five to seven percent of the individuals we have sampled are children.

We tried to get the medical labs interested in doing analysis of the blood for the PAH, since it is a major component of the crude oil. To this day we have been unable to find a lab willing to provide the analysis, although PAHs are known and suspected cancer causing agents, and these are the components that last a long time in the environment. To demonstrate, I examine a lot of creosote facilities that primarily let off PAHs in the community. These facilities impregnate wood with creosote to preserve it. Some of these facilities have been shut down for thirty years, and the people in the communities around them still have high levels of PAHs in their blood that match the fingerprint of the PAHs from the facilities. The PAHs that form the dispersant and crude oil will be present for decades.

Because we are testing for VOCs, the government agencies are going to be constantly pushing back on us and saying bad things about our data based on the aforementioned reasons. Yet they are not coming in and taking over. Traditionally I help get testing off the ground in affected communities, and then the CDC and state's department of health services get involved to help implement the response on a larger scale. That was not the case in the aftermath of the BP oil spill. However, the National Institute for Environmental Health and Sciences (NIEHS) has $20 million – $10 million from the federal government and $10 million from BP - for its Gulf Study.

6. NIEHS GULF STUDY

From the beginning of the planning, mid-summer of 2010, I sat in on the conference calls that were developing the scope of the NIEHS Gulf Study to examine the health of people who helped clean up the oil spill. Because there was not a tracking system under Hurricanes Katrina and Rita, I was happy that they were going to create a health tracking system early on. But they said they were going to limit it to workers and volunteers. I replied, "There is this whole population on the coast that you just excluded – the residents." Then they came up with only 55,000 workers, and I replied, "But there's a whole population of workers and coastal communities that aren't included." They responded, "Well yes Wilma, but you know, we don't have the money."

As it developed, we talked about the different aspects of the Gulf Study. They were going to contact people and monitor their health symptoms. The first year they were going to track 55,000 people. The next year they were going to cut it down to 50,000. In actuality, during a conference call Dr. Dale Sandler, Chief of Epidemiology and Principal Investigator for the Gulf Study,

ED_001324_00007754-00317

stated that for the duration of the study they would only track 16,200 individuals. I responded to their proposal, "You were going to ask people what health symptoms they had but you weren't then going to say, 'we'll get you to the doctor and get you medical care.'" I said, "It's completely inappropriate to ask them what their health symptoms are, but then to not get them medical care." They replied, "Well, Wilma, you know we don't have the money."

Finally, about three months ago they changed the study terms to say, "And we'll refer you for medical care." I know that all of the agencies are not going to have the resources to make referrals. But then, four universities received these community involvement grants, one if which was University of Texas Medical Branch in Galveston (UTMB). [9] They have developed the analytical method, similar to the Metametrix blood test, used to look for the PAHs in the blood and the urine of the people that they're going to be covering in their study; the people who live in the coastal areas and consume seafood from the coastal areas. We are going to be assisting UTMB and sampling the seafood to be analyzed for the PAHs. We're going to be able to test for the PAHs in what they eat, and in their body and in their blood and their urine. These are going to be the PAHs that gulf coastal residents are bioaccumulating.

7. FDA ON SEAFOOD SAFETY

We have done a large amount of testing of the seafood.[10]. The minute we get our results, within three to four hours that information is available to the community through the LEAN website and provided to the federal and state agencies. The PAHS that we are finding in the seafood actually match the fingerprint of the BP crude, so it's clearly from the BP spill. Through EPA conference calls that I participated in on an ongoing basis, I knew that early in the spill the National Oceanic Atmospheric Administration (NOAA) took a few samples for Corexit. Shortly thereafter to my knowledge they dropped it. After the well was plugged they stated that the final Corexit application was July 19, and treated the testing of Corexit as a nonissue. They didn't establish criteria for the dispersants, only for PAHs in specific seafood (detailed below). Our data matches the data that the federal agencies have collected; however, when the FDA did its concentration calculation, it was based on flawed assumptions.[11] When we do those types of calculations, the concentrations in the seafood exceed the acceptable levels for safe consumption. We have gone around and around with the FDA on that issue.

The FDA developed criteria for specific PAHs in shrimp, crab and oysters. Their findings were based a 175 pound person. They ignored the vulnerable populations – the young, the elderly, the

---

[9] *Announcing GC-HARMS: UTMB's Study of PAH's in Seafood and People*, LEAN, Dec. 1, 2011, http://leanweb.org/our-work/water/bp-oil-spill/seafood-safety/lean-partnering-with-utmb-for-gc-harms-study-of-pah-s-in-people-and-seafood.

[10] *BP Oil Spill Seafood Sampling Projects Results Overview*, LEAN, Jan. 3, 2011, http://leanweb.org/our-work/water/bp-oil-spill/seafood-safety/bp-oil-spill-seafood-sampling-project-results-overview.

[11] Deepwater Horizon Oil Spill Reopening Samples: PAH and DOSS Results Summary From FDA Testing Labs, *available at* http://www.fda.gov/downloads/Food/FoodSafety/Product-SpecificInformation/Seafood/UCM231696.pdf.

ED_001324_00007754-00318

people on chemotherapy and HIV patients. They also based their conclusions on an average consumption rate of the United States, of four shrimp for one meal a week. No one along the coast only eats four shrimp. And they don't eat one meal a week of it; they eat it on a very frequent basis.

The other aspect is that the FDA and local and state wildlife and fisheries use that data to establish when they can reopen a fishing ground, and they work with the state agency to determine what kind of buffer zone from the marsh; how much of the water should be closed versus the rest of the lake estuaries open. In fall 2010 I was standing in this very oily marsh, and there was a shrimp boat right offshore trawling for shrimp. The shrimper didn't know what the buffer zone was; he was right up against shore. I knew that if I went off the bank 10 or 20 feet and took a sediment sample, it was visibly oil, and yet that is the area he was trawling in. To this day, if you talk to the fishermen they will talk to you about bringing up trawls and nets and cages full of oil. But they don't want to speak about it publicly, because the rest of the community is going to be screaming at them and saying that "you are destroying our livelihood" by raising concerns about the safety of Gulf seafood.

On top of the FDA's flawed safety assumptions, BP is giving huge monies to the seafood industry in each state to promote seafood. The federal government is a cheerleader for this false advertising. NOAA Administrator Dr. Jane Lubchenco stood at a press conference on September 15, 2010 in Kenner with all of the seafood bigwigs standing up behind her, and she said, over and over and over again, "The seafood is not contaminated, the seafood is not contaminated, the seafood is not contaminated."[12] That's what the industry and BP wanted the message to be.

After that event, I sent Dr. Lubchenco a message that stated "The seafood is contaminated with PAHs, and according to the FDA's calculations it is below the acceptable level you have established; your own data shows that 40% to 60% of the oysters are contaminated and the shrimp are contaminated." Shortly thereafter NOAA changed its message to "The seafood is contaminated but it is below the levels we have established as unsafe."[13] However, Dr. Lubchenco's first message was the message that BP and the seafood industry wanted to hear, and that was the message delivered in a public forum and that continued to be repeated publicly. She knew better.

It is a matter of finding the reality that is out there and the lack of transparency in the reality. We are trying to get the message out: "This is the real situation, now you make your own decision."

---

[12] Transcript: Press Briefing and Teleconference by National Incident Commander Admiral Thad Allen and NOAA Administrator Dr. Jane Lubchenco. RestoreTheGulf.gov, Sept. 15, 2010, *available at* http://www.restorethegulf.gov/release/2010/09/15/transcript-press-briefing-and-teleconference-national-incident-commander-admiral-.

[13] Press Release, NOAA, NOAA and FDA Announce Chemical Test for Dispersant in Gulf Seafood; All Samples Test Within Safety Threshold (Oct. 29, 2010), *available at* http://www.noaanews.noaa.gov/stories2010/20101029_seafood.html.

WS

8. EPA APPROVES COREXIT

When EPA administrator Lisa Jackson directed BP to come up with a less toxic alternative to Corexit, and the deadline hit on May 21, 2010, we asked for the response. BP said it needed to be confidential, so it took a number of more days for all the lawyers to release it. I got it on a Saturday afternoon and my colleagues wanted to know, "What does it say and mean?" It essentially said "Yes there were less toxic alternatives, but the supply was not available. Therefore, we, BP, will continue to use Corexit, because the supply is available for the quantity we need to apply."[14]

On May 26, 2010, Administrator Jackson responded that BP must reduce the amount of Corexit used by 75%.[15] Subsurface application of the dispersant continued and BP did not have to justify its use under the terms of the directive. Surface application was supposed to be eliminated, but BP could justify its use due to weather or if it identified an oil slick. On a daily basis BP received exemptions to apply the dispersant by plane. EPA would go in the spotter plane planes in the morning and look at all the slicks that BP was proposing to spray. By noon, they would tell BP which ones they were allowed to spray and then the spraying would occur. To me, the justification by EPA was that while they did not have a less toxic dispersant, BP was spraying less. Marylee and I worked extensively with the EPA throughout this process and would share community complaints about the use of dispersant, such as concerns of being sprayed, and EPA representatives informed us that they would try to verify the complaints.

I have worked with the coastal areas for my whole professional career, so the communities that reported to me during the spill are the same ones that I worked with before Hurricanes Katrina and Rita. I'm a known entity there. I know who is reliable within the community, and who is not. During the time that BP was spraying from the blowout through mid August 2010, I kept getting a lot of calls from workers offshore reporting that they were being sprayed; not the workers who were the BP contractors around the wellhead on boats and ships, but workers from other rigs that did not have protective gear. They reported respiratory problems and nausea. On an ongoing basis I would speak with EPA and share, "I've received information that these workers on the offshore rigs are being sprayed." They would look into it and come back and say, "No they are not Wilma. We are not spraying where there are workers, and we are not spraying where there are dolphins." Then I would get more complaints and I would tell the EPA again, the workers offshore are being sprayed. And they would respond, "No, they're not."

From early in the cleanup, residents inshore contacted me to report spraying as well. The last call I received was in July 2011. From the beginning, everybody ran to Venice, Louisiana, because

---

[14] Letter from Douglas J. Suttles, Chief Operating Officer, British Petroleum, to Mary Landry, Rear Admiral, Commander, Eight Coast Guard District, Samuel Coleman, P.E., Superfund Division, U.S. EPA Region 6, (May 20, 2010), *available at* http://www.epa.gov/bpspill/dispersants/5-21bp-response.pdf.

[15] Directive from EPA and the Coast Guard on Reducing the Use of Dispersants to BP (May 26, 2010), *available at* http://www.epa.gov/bpspill/dispersants/directive-addendum3.pdf.

WS

that was where the oil was going to come in. Residents and cleanup workers would repeatedly call me and report, "We are being sprayed on land in Venice." Venice is way inshore. I would tell them "It's mosquito control; I've been sprayed in Venice by the trucks and planes for mosquito control." In the first month it was primarily mosquito control. By law, dispersants cannot be applied closer than three miles to shore. But after the first month into the spill, BP started spraying inshore. A lot of people would send me photographs of Corexit in totes that were land based. EPA stated that Corexit was not being applied inshore, but went on to explain that through state exemptions it could be sprayed in shore.

From May 2010 through fall 2011, community members reported to me that they would go out and see a slick, that night hear the planes, and then the next day the slick was gone from the inshore and estuary areas. People inshore would continue to report how much they were being sprayed. Elderly would be sitting on their porches in their summers homes and get sprayed and wind up in the hospital for respiratory problems. I would call in the EPA and the feds to report that EPA was spraying people on shore, including the coastal estuary areas and beach area. They would respond "We have a federal criminal investigation and we can't talk to you about it, this is enforcement sensitive." I have had the kind of relationship with EPA where I can inform them about an environmental or health problem but the EPA cannot directly respond, therefore I understand if something is enforcement sensitive. I get the message to them and hope that they do the right thing.

EPA told me that there is a Louisiana state exemption that allows BP to spray inshore without keeping records of it, which is a historical problem that we have with pesticide use. In Louisiana we could never get a requirement for the state to record what pesticides are being sprayed, how much and when. In turn, farmers can go out and spray whatever they want, whenever they want, and I can't go back and find the file that says, "On that field across the street these chemicals were applied in these amounts on this date." That exemption applies inshore with Corexit use; because it is state waters, the company applying the dispersant does not have to report that they have sprayed dispersants. It doesn't make sense, but it is reality. Due to this loophole, you cannot find out who sprayed what, when, where, and yet I have all these people reporting that they have been sprayed.

We are a coastal parish and we have marsh and tons of mosquitoes, so mosquito control sprays by truck. When it gets really bad a federal plane comes in to spray. We worked with the Parish to the point where they now notify all of the sensitive populations before they spray, so that they can chose to leave the area. Further, they put it in the newspaper, so the broader population can know when they are going to spray from the planes. It's not dispersant but it's very toxic. Until this is implemented at the federal level, it is only a partial solution. If I'm not in every parish, I can't get the warning implemented everywhere. The problem is worse with dispersant use, because there is no requirement that BP has to record where it sprayed, and there was frequent denial by BP that they were spraying inshore.

WS

9. CONCLUSION

We knew that the BP spill was Louisiana Sweet Crude. We knew its major components, and that it toxicity level increased when mixed with Corexit. BP was spraying the more toxic Corexit 9527 and shortly into the spill they switched to a slightly less toxic 9500, which was still more toxic than alternative EPA approved dispersants. EPA and BP knew of the health impacts associated with it, even though BP wasn't forthcoming with all of the elements. The issue was responding to an oil spill of this magnitude, with unprecedented quantities of Corexit, including novel subsurface application. Gulf coastal communities, and individuals who consume gulf seafood or recreate in the gulf, are the guinea pigs left to deal with the consequences and will be feeling the full effect in years to come.

WS

I have read the foregoing 16 page statement, and declare that it is true, accurate and complete to the best of my knowledge and belief.

Executed on June 12, 2012.

Wilma O. Sielen

Subscribed and sworn to before me
this 18th day of June, 2012

Clint E Sulva #11630

Notary Public

My Commission expires on: 2-13

To: Wilson, Gregory[Wilson.Gregory@epa.gov]
From: Principe, Vanessa
Sent: Thur 4/2/2015 8:39:42 PM
Subject: FW: Marked up copies of final Subpart J rule and RIA
EO12866_Subpart_J_2050-AE87_NPRM_REDLINED_20141218.docx
EO12866_Subpart J_2050-AE87_NPRM_RIA_REDLINED_20141203.docx
EO12866_Subpart J_2050-AE87_NPRM_RIA_OMBRedlined_20141203.pdf
EO12866_Subpart_J_2050-AE87_NPRM_OMBRedlined_20141218.pdf

From: Gioffre, Patricia
Sent: Wednesday, April 01, 2015 4:17 PM
To: Jenkins, Robin; Hostage, Barbara
Cc: McGartland, Al; Bowen, Jennifer; Walsh, Patrick; Noggle, William; Principe, Vanessa; Matthiessen, Craig
Subject: RE: Marked up copies of final Subpart J rule and RIA

All- I found the word version of the redline documents in question (I just needed a few minutes at my desk to research the correct versions).

Note that the deleted text is shown in the margins of the pdf version (comment bubbles), whereas it is identified in the body of the document within the word version.

I am attaching both documents to this email (in both pdf and word). These match the versions in the docket.

I am also copying Bill Noggle who is the PARMS contact for this rule and Vanessa and Craig in OEM.

Take care!

Patty Gioffre

USEPA (OSWER/OEM)

1200 Pennsylvania Ave. NW (5104A)

Washington, DC 20460

202-564-1972

From: Jenkins, Robin
Sent: Wednesday, April 01, 2015 3:40 PM
To: Hostage, Barbara
Cc: Gioffre, Patricia; McGartland, Al; Bowen, Jennifer; Walsh, Patrick
Subject: Marked up copies of final Subpart J rule and RIA

Hi Barbara,

Just wanted to let you know that I spoke with Patty Gioffre just a little while ago. She assured me that she has tried to locate the documents but that she must wait until Vanessa Principe is back in the office tomorrow to get copies with the full comment bubbles.

Thank you,

Robin

566-2292

To: Conmy, Robyn[conmy.robyn@epa.gov]
Cc: Wilson, Gregory[Wilson.Gregory@epa.gov]
From: Principe, Vanessa
Sent: Mon 3/30/2015 3:03:10 PM
Subject: FW: Article I published in ES&T
ES&T Manuscript_es-2012-03881h_v3_clean_edited by est_all changes accepted.docx

Hey Robyn:

Wondering if you're familiar with this paper. Can't recall if this was included amongst the degradation papers for the "State of the Science" workshop. Seems to be consistent with Terry Hazen's observation from one of the calls that in some studies with cold water temperatures he was not seeing degradation at the same rates as others.

We'll be calling in tomorrow to listen.

Hope all is well and that you are having a nice time with your girls. V

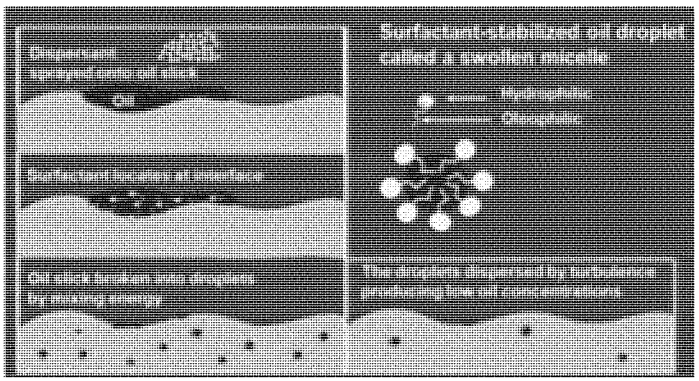
From: Al Venosa [mailto:advenosa@cinci.rr.com]
Sent: Sunday, March 29, 2015 3:53 PM
To: Wilson, Gregory; Principe, Vanessa
Subject: Article I published in ES&T

V and G,

Pursuant to our discussion on the phone last week, have you ever read my article in ES&T about the biodegradation of SLC with and without C9500 in our lab microcosms (attached)? If not, or even if you have but forgot the Discussion, open the article and read lines 327 to 483, especially lines 397 to 429. Even though Pablo was lead author, I was the one who contributed the interpretation of much of our results, and I don't know if anyone has ever referred to it in post-publication articles as I've been away too long. Greg, since you are a gearhead, I'm sure you know all about Fick's Law of Diffusion. Check it out and lemme know your thoughts. I will be paraphrasing this text in the Royal Society of Canada (RSC, similar to our own NAS) panel that is writing a book on the effects of oil spills in different environments.

AV

TOC/Abstract Art



ED_001324_00007761-00001

Biodegradability of Corexit 9500 and Dispersed South Louisiana Crude Oil at 5 and 25 °C

Authors: Pablo Campo[†], Albert D. Venosa[‡*], Makram T. Suidan[§]

Affiliations: [†]University of Cincinnati, School of Energy, Environmental, Biological and Medical Engineering, Cincinnati, OH, 45221-0012, United States.

[‡]U.S. Environmental Protection Agency, National Risk Management Research Laboratory, 26 W. Martin Luther King Drive, Cincinnati, OH, 45268 United States.

[§]American University of Beirut, Faculty of Engineering and Architecture, Office of the Dean, Bechtel Engineering Bldg., Beirut, Lebanon.

*Tel: 513-569-7668, fax: 513-569-7620, email: venosa.albert@epa.gov

Abstract: The reported persistence of the dioctyl sodium sulfosuccinate (DOSS) surfactant in Corexit 9500 in the oil plumes formed during the Deepwater Horizon oil spill has contributed to concerns regarding the biodegradability and bioavailability of dispersed oil and dispersants used as an oil spill countermeasure in the Gulf of Mexico. We studied the biodegradation of DOSS and dispersed South Louisiana crude oil (SLC) in laboratory microcosms. Two oil-degrading cultures from the Gulf of Mexico were isolated, one from the surface (meso) and one from close to the area of the Macondo well (cryo). Each was enriched on SLC, the former at 25 °C, the latter at 5 °C. Results indicated that the meso culture rapidly and completely degraded DOSS, alkanes, and aromatics. The cryo culture metabolized the same compounds but with a lag of 28 d and a

ED_001324_00007761-00002

remaining residual of *iso*-alkanes, *n*-C_{30-35}, and the 4-ring PAHs.

Introduction

In the aftermath of the April 20, 2010 Deepwater Horizon (DWH) oil blowout in the Gulf of Mexico (GOM), stopping the flow of oil from the well initially dominated the response effort but environmental and human health protection issues contributed to the decision to use dispersants as the primary mitigation action. To aid in accomplishing the response objectives, responders sprayed dispersants onto the growing slick on the surface and injected them directly into the gushing oil at the wellhead. Almost 7 million liters of dispersants [mostly Corexit 9500 (C9500)] were used in the spill, of which approximately 42% was applied at the wellhead.[1] The intended effect of this countermeasure was to disperse the surging oil into tiny, neutrally buoyant droplets that would not easily recoalesce and rise to the surface. A further objective was to accelerate the oil biodegradation rate in the water column due to the higher surface area of the dispersed oil droplets.[2] Injection of dispersant at the wellhead may have contributed to the formation of continuous and some discontinuous plumes of dispersed oil at approximately 1000 to 1250 m depth that persisted for months.[3] Lingering concentrations of sodium 1,4-bis(2-ethylhexoxy)-1,4-dioxobutane-2-sulfonate (common name, dioctyl sulfosuccinate or DOSS), an anionic surfactant present in C9500, were found at the same depth horizons where that oil plume appeared.[4]

Such findings have raised questions about the use of C9500 in deep water, specifically in

ED_001324_00007761-00003

regards to its inherent biodegradability.[5] With the exception of one recent article,[6] no information has been published about the fate of the active surfactant in C9500 or any other dispersant when subjected to microbial activity in the presence or absence of oil.[7] Data are available in regard to the potential enhancement effect of surfactants and dispersants on oil biodegradation,[8-14], but only one[6] reported the fate of the surfactant during the course of the experiments (although the authors did not report the method they used to measure DOSS). The objective of our work was to determine biodegradation rates of C9500 alone (as represented by DOSS), South Louisiana crude oil (SLC) alone, and SLC dispersed by C9500 under temperature conditions representative of those of the DWH discharge. Experiments were performed in microcosms at 25 and 5 °C, which correspond to average temperatures at depths of approximately 0-5 and 1000-1250 m respectively in the GOM. Two microbial inocula were used in this study after enrichment on SLC, one isolated from near the surface (meso), the other close to the location of the plume above the wellhead (cryo) (about 1240 m deep). Our experimental setup differed substantially from Baelum et al.[6] These researchers enriched their cultures with a mixture of Macondo oil and C9500 at a very high dispersant-to-oil ratio (DOR) of 1:1.67, whereas we initially enriched our cultures on SLC alone in the absence of C9500 and used a substantially lower DOR of 1:25 in the actual dispersed oil treatments.

Materials and methods

Chemicals and Reagents. EPA provided the South Louisiana reference crude oil (SLC) (note, this was not exactly the same oil from the Macondo well but similar in properties

ED_001324_00007761-00004

and hydrocarbon constituents) and the dispersant Corexit 9500 (Nalco, Naperville, IL) used in this study. DOSS and its deuterated surrogate (D_{17}-DOSS) were purchased from Aldrich (St. Louis, MO) and Isotec (Miamisburg, OH), respectively. Acetonitrile (ACN), deionized ultrafiltered water, and mineral salts were obtained from Fisher Scientific (Pittsburgh, PA). Dichloromethane (DCM) was acquired from Tedia (Fairfield, OH).

Silylation of Glassware. Glassware was deactivated with Sylon CT (Sigma-Aldrich, St. Louis, MO. In this procedure, dimethyldichlorosilane reacts with silanol groups (Si-OH) present on the glass surface so that the formation of hydrogen bonds with both polar molecules or functional groups is averted. The treatment increases the hydrophobicity of the glass and minimizes solute, oil, and biomass adsorption onto the container walls,[15] which occurred in the Baelum et al. article[6] where 30% of the initial oil added was lost to the sides of the glass flasks.

Artificial Seawater. Sterile GP2 medium was prepared by dissolving the required amounts of mineral salts in distilled water[16]. This solution was autoclaved at 120 °C for 30 min in batches of 1 L. The concentrations of each salt (expressed in g/L) were NaCl (21.03), $MgCl_2$ $6H_2O$ (9.5), Na_2SO_4 (3.52), $CaCl_2.2H_2O$ (1.32), KCl (0.61), KBr (0.088), $NaB_4O_7.10H_2O$ (0.034), $SrCl_2.6H_2O$ (0.02), $NaHCO_3$ (0.17) $FeCl_3.6H_2O$ (0.05), $Na_5P_3O_{10}$ (0.297), and KNO_3 (2.89). The GP2 pH was ~7.5.

ED_001324_00007761-00005

Microbial Cultures. The cryo culture was isolated from water close to the plume location at a depth of 1240 m near the Macondo wellhead (Lat 28.73834° W, Long -88.386975° N). The meso culture came from water within the top 5 m from the water surface in the vicinity of the wellhead (Lat 28.345667° W, Long -88.777833° N). Both cultures were collected on July 31, 2010. After collection, the water samples were shipped on ice to EPA's Gulf Ecology Division laboratory in Florida for culture enrichment. Both cultures were enriched in 2 L shake flasks containing 500 mL of the original unfiltered GOM seawater supplemented with 2.8 g/L KNO_3, 0.55 g/L NaP_3O_{10}, and 2.5 mL SLC. They were shaken at 400 rpm at 5 °C (cryo culture) and 25 °C (meso culture). After achieving adequate growth (7 days for the meso culture and 17 days for the cryo culture), the cells were harvested by centrifugation at 6000 × g for 30 min at 4 °C. The overlying liquid was decanted, oil removed with sterile swabs, and two consecutive harvesting steps were repeated. The pellets were preserved in 10% glycerol, dispensed in 2 mL aliquots, and frozen at -70 °C. Prior to shipping the cultures to EPA-Cincinnati for use in the biodegradation experiments, the inocula were prepared in shake flasks by adding 1 mL of each thawed culture to 500 mL GP2 medium supplemented with 2.5 mL SLC. The meso culture was harvested after 6 days of growth and the cryo culture after 29 days

Dispersed oil Treatment. The preparation procedure involved making 700 mL batches of dispersed oil in baffled beakers and, subsequently, compositing them in a 20 L glass carboy under continuous mixing to prevent recoalescence of the dispersed droplets. A

ED_001324_00007761-00006

given batch was prepared by transferring 700 mL of GP2 into a baffled 1 L beaker followed by 600 μL SLC pipetted onto the water surface and then 24 μl of C9500 onto the oil slick. These volumes yielded a volumetric DOR of 1:25. The mixture was initially shaken at a slow speed to minimize splashing onto the walls of the beaker and ramped up gradually to approximately 150 rpm. After 10 min of shaking at 150 rpm, the beaker was removed from the shaker and held stationary for 10 min to allow undispersed oil to rise to the surface. The dispersed oil seawater suspension was drained through a stopcock placed at the bottom of the flask into the carboy being careful not to disturb the top layer of undispersed oil. Once the volume of dispersed oil suspension reached 14 L, 100 mL aliquots of the composited dispersed oil suspension were dispensed into a series of 120 silanized shake flasks, half of which served as the dispersed oil killed controls (KCs). All flasks were placed on the orbital shakers in corresponding constant temperature rooms set at 5 or 25 °C and maintained at those temperatures for the duration of the experiment.

Non-dispersed oil Treatment. In this treatment, the biodegradation of SLC alone was studied. The final concentration of oil in these samples was approximately the same as in the dispersed oil treatment (i.e., 0.7 g/L).

Dispersant alone Treatment. To evaluate the biodegradation of C9500 alone at 5 and 25 °C, tests were conducted where the only substrate was the dispersant. A single batch of sterile GP2 (14 L) was spiked with approximately 476 μL of C9500 corresponding to the

ED_001324_00007761-00007

same concentration as in the dispersed oil treatment. This batch was also kept well mixed. From this stock, which was prepared immediately before the experiment to minimize abiotic loss, the samples for both temperatures were prepared by transferring 100 mL of the mix into each flask.

Experimental Setup and Sampling of Flasks. Table S1 of the Supporting Information summarizes the experimental design layout. In the case of the 5 °C experiment, 11 sampling events took place at 0, 2, 4, 8, 11, 14, 17, 21, 28, 35, and 42 days. For the 25 °C experiment, 9 sampling events were used at 0, 2, 4, 8, 11, 14, 17, 21, and 28 days. For both temperatures, 3 different treatments were studied in triplicate shake flask microcosms, namely, C9500 alone, SLC dispersed by C9500, and SLC alone. The sample volume in each of these treatments was 100 mL. In addition, KCs were necessary for each treatment to account for abiotic losses, if any. For these controls, the sterilant was sodium azide at a final concentration of 500 mg/L. All experimental units were spiked with 0.5 mL of the appropriate culture, which were kept at 4 °C until inoculation. The orbital shakers were set to rotate at 200 rpm (Innova 2300 series digital platforms, New Brunswick, Edison, NJ). At a given sampling event, triplicate flasks of each treatment were sacrificed. In addition, for the treatments with dispersed oil and C9500, KCs were also included. In the case of the KCs of the oil alone treatments, triplicates of the controls were sampled only at the initial and final events.

ED_001324_00007761-00008

Oil Components and C9500 Analysis.

In tests where C9500 alone was present, a 20-mL subsample was collected for the analysis of its main active component, DOSS, by liquid chromatography tandem mass spectrometry (LC/MS/MS). In the flasks containing nondispersed SLC, the 100 mL of seawater was extracted with DCM and the extracts analyzed for alkanes and aromatics by GC/MS. Alkanes included normal and branched aliphatics ranging in carbon number from 10 to 35 as well as pristane and phytane. Aromatics included 2-, 3-, and 4-ring PAH compounds and their alkylated homologues (i.e. C_{0-4} -naphthalenes, C_{0-3} -fluorenes, C_{0-3} -dibenzothiophenes, C_{0-4} -phenanthrenes/anthracenes, C_{0-4} -napthbenzothiophenes, C_{0-2} -pyrenes, C_{0-4} -chrysenes). Finally, in the dispersed oil flasks, after withdrawing the 20 mL subsample for DOSS analysis, the remaining seawater was extracted with DCM and analyzed for oil components. This procedure was repeated at each subsequent sampling event.

Hydrocarbon Analysis. We determined that the SLC aromatic fraction comprises napthalenes (72%), phenanthrenes (12%), fluorenes (8%), dibenzothiophenes (6%), and 4-ring compounds napthobenzothiophenes, pyrenes, and chrysenes (2%). After liquid-liquid extraction, oil extracts were filtered through sodium sulfate to dewater the extracts, concentrated under nitrogen gas, and then solvent-exchanged into hexane to a final volume of 10 mL. The GC/MS analysis was performed in a Model 6890 gas chromatograph coupled with a Model 5973 mass spectrometer from Agilent (Palo Alto,

ED_001324_00007761-00009

CA). A DB-5 MS column [30 m × 0.25 mm I.D., 0.25 μm particle size (J&W, Palo Alto, CA)] was used to achieve chromatographic separation of the alkanes and aromatics. Analyte detection was conducted in the selected ion monitoring mode.[17]

Dioctyl Sulfosuccinate Analysis. DOSS was analyzed in GP2 seawater as described in the ASTM D7730 Standard Method.[18] For this purpose, 20 mL subsamples were collected from those flasks containing C9500 alone or dispersed SLC. These aliquots were spiked with both the surrogate D_{17}-DOSS and an ammonium formate buffer solution, brought to a volume of 40 mL with ACN, and vigorously shaken for 1 min. Finally, portions of these subsamples were withdrawn with a 1 mL syringe and then filtered (0.2 μm) before analysis. DOSS was quantified using a Model 1200 series liquid chromatograph (LC) connected to a Model 6410 tandem Triple Quadrupole Mass Spectrometer (MS/MS) by Agilent (Palo Alto, CA). An analytical column Zorbax Eclipse XBD C_{18}, 2.1 × 50 mm with a particle size of 3.5 μm was used for analyte separation. The binary pump was operated at 0.4 mL/min with two eluents: (A) 99% water + 0.9% ACN + 0.1% of formic acid and (B) 99% ACN + 0.9% water + 0.1% of formic acid. At the beginning of the run (12.1 min), the mobile-phase composition was maintained at 98% A and 2% B during the first min. After that, the gradient's strength was sequentially increased to 38, 80, and 98% B at 4, 7, and 12 min, respectively. DOSS and its deuterated surrogate were detected by tandem mass spectrometry. With the electrospray operated in negative mode, these compounds generated precursor ions (PI) at *m/z* 421

ED_001324_00007761-00010

(DOSS) and 445 (D_{17}-DOSS). Upon fragmentation, both PIs yielded the same product ion *m/z* 81. For this reason the analytes were monitored and quantified with the selected reactions *m/z* 421 → *m/z* 81 and *m/z* 445 → *m/z* 81. The electrospray parameters were gas temperature, 350 °C; gas flow, 6 L/min; nebulizer, 15 psi; and capillary voltage, 4 kV. For identification of DOSS byproducts, samples were also injected in scan mode from *m/z* 50 to *m/z* 500.

Results and Discussion

DOSS Degradation. At 25 °C, DOSS biodegradation rates in the absence and presence of SLC were high, and the extent of removal exceeded 99% by days 8 and 14, respectively (open symbols, parts A and B of Figure 1). For these treatments, we calculated the biodegradation rate coefficients by fitting the DOSS data to a first-order model. The first-order rate coefficients were -0.30 ± 0.02/d (C9500 alone) and -0.46 ± 0.03/d (C9500 + SLC). Hence, in the presence of SLC, the DOSS biodegradation rate was enhanced by a factor of 1.5, because our culture, which had been enriched previously on SLC and thus preacclimated to hydrocarbons but not DOSS, likely grew to higher numbers faster and thus metabolized DOSS faster by virtue of the greater population density. This is in stark contrast to the findings of others[6] whose initial enrichments were conducted on mixtures of oil and C9500 at a very high DOR (1:1.67), whereas we enriched our cultures on oil alone. In the Gulf of Mexico waters, oil seeps have been occurring continuously for eons, giving rise to microbial cultures highly adapted to growth on hydrocarbons. Because

ED_001324_00007761-00011

DOSS is a xenobiotic compound in that environment, one would not expect to find cultures able to degrade DOSS rapidly at 5 °C except after a long adaptation period. Thus, results from our cultures are more representative of the DWH spill conditions because in the GOM dispersant was injected in the deep sea where no previous microbial exposure to DOSS had ever occurred.

KCs run in parallel also revealed a significant DOSS disappearance. At the end of the experiment (28 d), only 10% of the initial DOSS concentration remained in the dispersed SLC controls (open symbols in part D of Figure 1), whereas 33% remained in those for the C9500 alone treatment (open symbols in part C of Figure 1). The linear rates of surfactant loss in the KCs were -185 ± 14 μg/(L d) in the presence of SLC (part D of Figure 1) and -140 ± 12 μg/(L d) in its absence (part C of Figure 1). The abiotic loss can be explained on solvolysis grounds: sulphosuccinates contain ester bonds that are susceptible to hydrolysis.[19] This hydrolysis reaction consists of a staged, acid-catalyzed, nucleophilic attack on the ester bond by water that results in the cleavage of the DOSS molecule to 2-ethylhexoxy-1,4-dioxobutane-2-sulfonate (common name, monooctyl sulfosuccinate or MOSS) and 2-ethylhexanol (2-EH) (Scheme 1 of the Supporting Information).

LC/MS/MS analysis of the KCs in scan mode confirmed the presence of MOSS as a peak eluted at 5.5 min with *m/z* 309 (part A of Figure S1 of the Supporting Information). The

ED_001324_00007761-00012

acidic hydrolysis of esters is a reversible process, and the formation of products requires a shift in the reaction to the right.[19] Water displaces the equilibrium toward 2-EH and MOSS. With 2-EH being highly hydrophobic (log P = 2.71), this fatty alcohol strongly partitions to SLC, which forces the equilibrium further to the right, causing the higher disappearance rate achieved in the dispersed oil KCs. The observed zero-order kinetics corresponds either to a catalytic reaction with a multistep mechanism or to an experimental run that did not proceed long enough for the DOSS concentrations to follow the curvature typical of a first-order decay.[20] Clearly, DOSS metabolism takes place at a much faster rate than chemical hydrolysis. When both processes occur at the same time, microbial uptake is facilitated, since the two mechanisms create similar intermediates: DOSS biodegradation always involves a cleavage of the ester bond, and microbial enzymes preferentially and more rapidly attack the same bond as the first step in biodegradation.[21] In our live microcosms, apparent first-order biodegradation rates reflect the overall process for DOSS disappearance, regardless of chemical or biological contributions, with hydrolysis being negligible relative to the biological reaction.

Data obtained at 5 °C contrasted sharply with the 25 °C results, since a 28-d lag period occurred before DOSS biodegradation ensued. As part A of Figure 1 shows, in the absence of SLC, DOSS was depleted by 98% in 1 replicate on day 35 and 2 replicates on day 42, whereas in its presence (part B of Figure 1), the triplicates averaged 61% removal but with a slow, steady decline. These results suggest that the cryo culture needed an

ED_001324_00007761-00013

acclimation stage to synthesize the enzymes that facilitate DOSS uptake and breakdown. The slow disappearance of DOSS observed with the cryo culture may help explain the results reported in the subsea.[4] DOSS was detected at the same depth horizons as the dispersed oil plumes with concentrations ranging between 0.4 to 12 μg/L within a 300 km distance from the discharge source. Modeling the concentration profiles suggested that DOSS underwater attenuation was due to transport and dilution within the oil plumes and not biodegradation.[4] Again DOSS is a xenobiotic compound in this environment, and its metabolism requires a constant presence and sufficient exposure time to become a microbial substrate.[22] In our experiments with the cryo culture, these requirements were met because of the batch nature of the setup (no continuous dilution possible in a closed system). As parts C and D of Figure 1 show, DOSS also remained unaltered in the KCs run at 5 °C. In general, as temperature declines, so do chemical reaction rates.[20] It is possible that at 5 °C DOSS hydrolysis progressed at such a slow rate that it did not occur within our 42-d experiment, and MOSS was not detected in the LC-MS scans (part B of Figure S1 of Supporting Information).

Hydrocarbon Degradation.

Alkanes. Parts A and B of Figure 2present the hopane-normalized biodegradation results for the total alkanes. Regardless of the presence of dispersant, the effect of temperature was clearly evident. Alkanes disappeared much faster at 25 °C than at 5 °C, and the variability among the 3 replicates at 5 °C (oil alone, part A of Figure 2) was much higher

ED_001324_00007761-00014

than at 25 °C. We did not model the low temperature data because the data approached a nonzero asymptote regardless of the absence (part A of Figure 2) or presence (part B of Figure 2) of C9500 (discussed later). Also, a 2 day lag period occurred before biodegradation ensued.

At 25 °C, the biodegradation patterns were markedly different for both dispersant treatments. The alkanes approached nondetectable by day 11 (part A of Figure 2) in the absence of C9500 and by day 4 in its presence (part B of Figure 2). In both cases, no aliphatics were detected at the end of the experiment except for hopane, which remained unchanged (Figure S2 of the Supporting Information) (the reason why hopane was lower at day-0 in the dispersed treatment was that not all of the oil was dispersed in our preparations; thus, this treatment had less oil to begin with). The oil KCs are shown in Figure S3 of the Supporting Information, which shows that no loss in either alkanes or PAHs took place at either temperature.

The first-order biodegradation rate constants for the individual hopane-normalized alkanes at 25 °C were calculated by nonlinear regression. The data are presented in part A of Figure S4 of the Supporting Information for oil without dispersant and part B of Figure S4 for oil in the presence of dispersant. In the dispersed oil treatment (part B of Figure S4 of the Supporting Information), the presence of C9500 enhanced biodegradation to such an extent that all the *n*-alkanes were degraded before the second

ED_001324_00007761-00015

sampling event at day 4; thus, we could not collect enough data to estimate their rate constants. For PR and PH, the degradation rates were 6.8- to 5-fold higher respectively over those obtained for the same analytes with the nondispersed oil.

Upon completion of the 5 °C experiment (42 d), 7% of the initial alkane load remained regardless of the presence or absence of C9500 (parts A and B of Figure 2). This residual amount was due to the persistence of PR and PH (parts A and B of Figure 3) and the high molecular weight *n*-alkanes (n-C_{30-35}) (parts C and D of Figure). However, in the presence of C9500, the n-C_{30-35} alkanes were fully degraded by day 42. As for the nondispersed oil treatment at 5 °C, part A of Figure 2 shows that the total alkane fraction degraded much more slowly than in the presence of C9500 (part B of Figure 2). In the latter case, the extent of biodegradation at day 42 was 93% with a residual fraction comprised exclusively of PR and PH. In the former case, the extent of biodegradation was 87% with the residual fraction comprising PR, PH, and *n*-alkanes over 29 carbons. The persistence of *iso*- and *n*-alkanes at chain lengths >29 carbons in the absence of dispersant suggests that the microorganisms were less able to metabolize branched and higher molecular weight hydrocarbons at this low temperature. The presence of dispersant mitigated this somewhat since only PR and PH were still present at day 42. This indicates that either the microorganisms were less able to hydroxylate the terminal carbon in such structures or that the higher molecular weight *n*-alkanes and *iso*-alkanes were less bioavailable to the degrading communities. The above findings also contrast

ED_001324_00007761-00016

with those of Baelum et al.,[6] who reported only 25 to 60% degradation of oil at 5 °C in the absence or presence respectively of C9500.

As seen in parts A and B of Figure S4 of the Supporting Information, at 5 °C, alkane biodegradation rates were inversely proportional to hydrocarbon chain length for both the dispersed and nondispersed treatments. The comparison of the individual rate coefficients showed that C9500 enhanced by more than 3-fold the biodegradation of the individual alkanes.

Aromatics (PAHs). We were unable to fit a first-order model to the time series data for the biodegradation of the total aromatics (PAHs) (parts C and D of Figure 2). Hence, we used inferential statistics to help explain the observed results. For a given treatment and temperature, we compared the concentration of total PAHs measured at each sampling event by a one-way analysis of the variance (ANOVA) followed by a Newman-Keuls Test (NK).[23, 24] This analysis allowed us to detect significant differences among sampling events and identify the data causing such differences. The null hypothesis tested was that the total PAH concentration did not vary with time. We also evaluated the effect of dispersant on total PAH biodegradation by comparing the concentrations measured for the nondispersed and dispersed SLC treatments for the same temperature and sampling day. The null hypothesis for these tests was that the dispersant did not affect PAH degradation. Finally, we also identified outliers, marked with arrows in parts C and D of

ED_001324_00007761-00017

Figure 2, with the Grubb's test.[25] All the statistical analyses were performed with *Prism 5* (GraphPad Software, CA).

At 25 °C, total PAH concentrations in the dispersed oil treatment declined in all 3 replicates only in the final sampling event (day 28) (open symbols of part D of Figure 2). This decrease was the only significant difference among sampling events confirmed by the ANOVA ($p < 0.005$). Moreover, based on statistical analysis, the final concentrations for both treatments were not significantly different ($p = 0.078$). These results suggest that the meso culture required a long adaptation period (18-21 d) for enzyme induction, possibly due to DOSS having been completely mineralized long before activation of the PAH degraders, thereby delaying the onset of PAH biodegradation. Also, the method originally used to enrich the two GOM oil degrading cultures, which involved two transfers to fresh medium with each transfer occurring at 6-7 d for the meso culture and 17-29 d for the cryo culture, may have discriminated in favor of alkane degraders. This could help explain why PAH biodegradation did not start until close to the end of the experiment.

Similar to the total alkanes, we also observed a 2-day lag period for total PAH degradation at 5 °C (parts C and D of Figure 2). However, the rate of degradation was greater than at 25 °C, as the cryo culture began degrading PAHs after 14 d for dispersed SLC (part D of Figure 2) and 17 d (part C of Figure 2) for nonchemically dispersed SLC.

ED_001324_00007761-00018

Furthermore, the 10% residual PAH concentration remaining at day 28 for both treatments was lower than at 25 °C. Student's *t*-tests revealed differences between treatments at days 4 ($p = 0.0108$) and 14 ($p < 0.0001$) and, in both cases, the dispersed SLC oil produced lower PAH concentrations. This may possibly indicate an enhancement in substrate availability due to DOSS breaking up the oil into tiny droplets. However, despite the statistical differences noted, from a practical standpoint we see little difference in the PAH biodegradation patterns at both temperatures due to the dispersant treatment.

Both the cryo and the meso cultures were able to metabolize the 2- and 3-ring PAHs, but the 4-ring PAHs degraded only negligibly if at all, as depicted in parts C and D of Figure S4 of the Supporting Information. Nonlinear regression analysis was used to estimate first-order biodegradation coefficients for the individual PAHs at both temperatures. The presence of dispersant seemed to improve PAH depletion rates, since the rate constants for the dispersed oil treatment were mostly higher than those estimated with nondispersed SLC. However, the r^2 values in these regressions were relatively low because of the long lag period noted.

The observed biodegradation pattern of the PAHs was complex at both temperatures compared to the alkanes. The variability was considerably higher among the three replicates at the lower temperature. It is well-known that bacteria initiate PAH

ED_001324_00007761-00019

biodegradation using intracellular dioxygenases.[26, 27] Thus, the PAH must be transported into the cell before metabolism can begin. Because petroleum is a complex mixture of thousands of compounds, including the more easily degradable *n*-alkanes, the relatively high variability in PAH degradation is understandable especially in the presence of another metabolizable substrate in the form of an anionic surfactant such as DOSS.

As for the higher apparent rates of biodegradation of PAHs compared to alkanes at 5 °C, we offer a plausible explanation. Any process or environment that lowers or is near the freezing point of water may result in the formation of crystals. Because the melting point of *n*-alkanes of carbon number ≥14 is below 5.5 °C and increases with carbon number, all the *n*-alkanes above tridecane crystallize at 5 °C and below. Thus, the alkanes in this study may have been less available to the microbial communities at the lower temperature compared to the more soluble PAHs. This conclusion could also pertain to the deep water in the Gulf where the temperature is ≤5 °C, assuming that the extreme hydrostatic pressure at depth had no effect on biodegradation rates.

From an engineering standpoint, if one assumes that the aqueous solubility of PAHs limits their microbial degradation,[28-32] then it is important to take into consideration mass transfer effects when interpreting our results. Fick's First Law of Diffusion provides that diffusive mass transfer attempts to equalize concentration gradients:

$$Q/t = -DA(C_0-C_x)/x \qquad (1)$$

ED_001324_00007761-00020

where Q is the quantity (g/m^3) of substrate diffusing through area A (m^2) per unit of time t (d), and $(C_0 - C_x)/x$ is the PAH concentration gradient where C_0 is the concentration at the source (g/m^3), C_x is the concentration at the sink (g/m^3), x is the diffusion path length (m), and D is the diffusion coefficient, m^2/s. The oil degrading community represents the sink. On the basis of eq 1, several ways exist to optimize mass transfer.[32] First is the production of biosurfactants by the degrading microorganisms that facilitate transmembrane diffusion of PAH into the cell. Application of dispersants containing surfactants also accomplishes this same effect. This, in essence, increases the effective D in eq 1. Surfactants and emulsifiers also tend to increase the interfacial area A resulting in a higher flux of substrate. The rate at which microorganisms degrade a substrate at low

concentration depends on their specific a□nity toward the substrate,[30] defined as the ratio

of the maximal substrate uptake rate to the half saturation constant.[33] High specific a

ED_001324_00007761-00021

□nities lead to e□cient low-concentration PAH removal from the environment at the cell

surface, steeper concentration gradients, and higher substrate transfer rates.

In addition to surfactants affecting Fickian diffusion as discussed above, they also influence dissolution and subsequent uptake of PAHs into the cell by attaching to the oil-water interface where micelles facilitate PAH release from the interface.[28] Alkane degraders are known to produce biosurfactants to increase the bioavailability of the poorly soluble hydrocarbons. However, biosurfactant production is not as common among the PAH degraders,[32, 34, 35] which means that biosurfactants may not be as important for PAH metabolism as for alkanes. In fact, because surfactants are known to interact directly with cell membranes,[36, 37] surfactants such as those in dispersants may negatively affect uptake of PAHs into the cell and subsequent metabolism by disrupting the integrity of the membrane, and it is possible this may even be exacerbated at deep-sea hydrostatic pressures. All of these interactions point to the possible explanation for the observed variability in PAH biodegradation in our microcosms.

The findings from this study revealed that the active surfactant in C9500, DOSS, spontaneously hydrolyzes to MOSS and 2-EH at 25 °C but not 5 °C (at least within 42

ED_001324_00007761-00022

days). In the presence of dispersed SLC oil, its biodegradation at 25 °C was exceedingly fast, much more so than the hydrolytic mechanism, and moderately (approximately 53%) faster than in the absence of oil. The implication is that DOSS will not persist when a dispersant containing that surfactant is applied to the water surface and the temperature is warm. However, if the temperature is near freezing, either in Arctic spills or deep-sea blowouts, our data suggest it is possible for DOSS to persist for a long period of time (at least 42 days, the duration of our experiments) when DOSS-containing dispersants are used for spill response. This conclusion agrees the observations made by Kujawinski et al.,[4] although they concluded that the primary explanation for the lower DOSS concentrations downstream from the wellhead was dilution due to advection rather than biodegradation. Research should be pursued to understand the toxicity of DOSS and its hydrolysis products at cold temperatures.

Alkane biodegradation proceeded rapidly and virtually completely at warm temperature, and its first-order rate coefficient was about 5-fold greater in the presence of dispersed SLC oil than in its absence (1.69 vs 0.34/d). This agreed with previous findings[9] where the rate difference between dispersed and non-dispersed oil (PBC) was ~4-fold at 20 °C (0.66 vs 0.17/d). Although these biodegradation rates were somewhat similar in magnitude to experiments conducted during the DWH spill in the Gulf[38] where the half-lives of oil in the field samples ranged from 1.2 to 6.0 days, we believe the data reported in that study[38] were more consistent with dilution than biodegradation. This is especially true when one views our results showing residual PR, PH, and *n*-alkanes with carbon

ED_001324_00007761-00023

number >29 remaining after 42 days at 5 °C (Figure 3). Our results were not in agreement with those of Foght and Westlake,[12] who used a different crude oil and a different dispersant, Corexit 9527, which contains the solvent 2-butoxyethanol as an additional ingredient. The C9527 inhibited biodegradation in the first 2 weeks, but after 12 weeks, all alkanes were gone. In our study, PR and PH were still present after 12 weeks at 5 °C (parts A and B of Figure 3), but all other alkanes were nondetectable. It appears that different solvents and surfactants affect biodegradation differently at low temperatures, or the fact that alkanes exist in a semisolid state at near freezing temperature may play a more important role in alkane biodegradation at that temperature. Another study[11] exposed pure cultures of *Acinetobacter calcoaceticus* and *Rhodococcus* sp. to 5000 mg/L crude oil and either 100 or 50 mg/L individual surfactants or Corexit 9527 in a Warburg respirometer. They found that DOSS alone either inhibited respiration in both bacteria or enhanced respiration only slightly. Perhaps the concentrations of oil and surfactants used may have been partly responsible for such findings. In our study, the oil concentration was ~700 mg/L and the C9500 was 4% of that by volume, much lower than they reported. In yet another study[10] microcosms were set up to observe biodegradation of Alaska North Slope crude oil at 1400 or 4500 mg/L with C9500 at 1:10 or 1:100 v/v ratios at a temperature of 8 °C. Measurement of the crude oil was only qualitative, but essentially little difference was observed between dispersed and nondispersed oil.

With respect to the PAHs, the long lag period prior to actual biodegradation observed at 5

ED_001324_00007761-00024

°C can be explained by the fact that DOSS persisted or degraded slowly during this time period and could have affected PAH metabolism but not the more easily degraded alkanes. We could not fit a first-order model to the total PAH data for either temperature because of the apparent outliers and the shape of the time-series plots. However, at the warm temperature a large decrease in total PAHs occurred after approximately 11-12 days (60%). At the cold temperature, the PAHs declined about 80%. Declines in the nondispersed oil at days 11-12 were much less. Clearly, in our experiments, crude oil biodegradation in general was readily enhanced by the addition of dispersant, but PAH biodegradation at 5 °C may have been more a function of the inherent solubility of PAHs compared to alkanes rather than due to the influence of the dispersant.

Acknowledgments: We thank Jan Kurtz of EPA's Gulf Ecology Division (GED) at Gulf Breeze, FL, who collected the water samples in the GOM for culture enrichment, and Diane Yates and Richard Devereux, also of GED, who performed the enrichments and provided them for the experiments. We also acknowledge the able assistance of William Platten III, University of Cincinnati, who assisted in the conduct of the microcosm experiments. The research was a product of the U.S. Environmental Protection Agency's National Risk Management Research Laboratory (NRMRL) and was funded by EPA, NRMRL, Cincinnati, OH, under Pegasus Technical Services, Inc. Contract EP-C-11-006.

Supporting Information.

ED_001324_00007761-00025

Details of our experimental designgraphic displaying the hydrolysis of DOSS into MOSS and 2-EH figures summarize (1) the chromatograms of DOSS and MOSS in the killed controls, (2) the persistence of hopane for the duration of the experiment, (3) the persistence of total alkanes and PAHs in the killed controls at both temperatures, and (4) a summary of the first-order biodegradation rate coefficients computed for each individual alkane and PAH in all 4 treatments at both temperatures. This information is available free of charge via the Internet at http://pubs.acs.org. The authors declare no competing financial interest.

References

1. The Federal Integracy Solutions Group; Oil Budget Calculator Science and Engineering Team *Oil Budget Calculator Deepwater Horizon*; 2010.
2. National Research Council of the National Academies, *Oil Spill Dispersants: Efficacy and Effects* The National Academies Press: Washington, D.C., 2005.
3. National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling *Deep Water. The Gulf Oil Disaster and the Future of Offshore Dirlling. Report to the President*; January, 2011.
4. Kujawinski, E. B.; KidoSoule, M. C.; Valentine, D. L.; Boysen, A. K.; Longnecker, K.; Redmond, M. C., Fate of dispersants associated with the Deepwater Horizon Oil Spill *Environ. Sci. Technol.* **2011,** *45*, 1298-1306.
5. Quinlan, P., More questions than answers on dispersants a year after Gulf spill. *New York Times* Apr 22, 2011.
6. Baelum, J.; Borglin, S.; Chakraborty, R.; Fortney, J. L.; Lamendella, R.; Mason, O. U.; Auer, M.; Zemla, M.; Bill, M.; Conrad, M. E.; Malfatti, S. A.; Tringe, S. G.; Holman, H. Y.; Hazen, T. C.; Jansson, J. K., Deep-sea bacteria enriched by oil and dispersant from the Deepwater Horizon spill. *Environmental microbiology* **2012,** *14*, (9), 2405-16.
7. Place, B.; Anderson, B.; Mekebri, A.; Furlong, E. T.; Gray, J. L.; Tjeerdema, R.; Field, J., A role for the analytical chemistry in advancing our understanding of the ocurrence, fate, and effects of Corexit oil dispersants. *Environ. Sci. Technol.* **2010,** *44*, 6016-6018.
8. Zahed, M. A.; Aziz, H. A.; Isa, M. H.; Mohajeri, L., Effect of Initial Oil Concentration and Dispersant on Crude Oil Biodegradation in Contaminated Seawater. *B. Environ. Contam. Tox.* **2010,** *84*, 438-442.

ED_001324_00007761-00026

9. Venosa, A. D.; Holder, E. L., Biodegradability of dispersed crude oil at two different temperatures. *Mar. Pollut. Bull.* **2007,** *54*, (5), 545-553.
10. Lindstrom, J. E.; Braddock, J. F., Biodegradation of petroleum hydrocarbons at low temperature in the presence of the dispersant Corexit 9500. *Mar. Pollut. Bull.* **2002,** *44*, 739-747.
11. Bruheim, P.; Bredholt, H.; Eimhjellen, K., Effects of surfactant mixtures, including Corexit 9527, on bacterial oxidation of acetate and alkanes in crude oil. *Appl. Environ. Microb.* **1999,** *65*, (4), 1658-1661.
12. Foght, J. M.; Westlake, D. W. S., Effect of the dispersant Corexit 9527 on the microbial degradation of Prudhoe Bay crude oil. *Can. J. Microbiol.* **1982,** *28*, 117-122.
13. Tosmides, H. J.; Hughes, J. B.; Thomas, J. M.; Ward, C. H., Effect of surfactant addition on phenanthrene biodegradation in sediments. *Environ. Toxicol. Chem.* **1995,** *14*, (6), 953-959.
14. Bruheim, P.; Bredholt, H.; Eimhjellen, K., Bacterial degradation of emulsified crude oil and the effect of various surfactants. *Can. J. Microbiol.* **1997,** *43*, 17-22.
15. Armarego, W.; Chai, C., *Purification of Laboratory Chemicals*. 7th ed.; Butterworth-Heinemann: 2013.
16. Spotte, S.; Adams, G.; Bubucis, P. M., GP2 medium is an synthetic seawater for culture or maintenance of marine organisms. *Zoo Biol.* **1984,** *3*, (3), 229-240.
17. U.S. Environmental Protection Agency, *EPA 8270D Semivolatile organic compounds by gas chromatography/mass spectrometry (GC/MS)*. 3rd. ed.; Washington, D.C., 2007.
18. ASTM D7730-11, *Standard Test Method for Determination of Dioctyl Sulfosuccinate in Sea Water by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)*. ASTM International 2011.
19. Smith, M. B.; March, J., *March's Advanced Organic. Reactions, Mechanisms, and Structure* 6th ed.; John Wiley and Sons: Hoboken, NJ, 2007.
20. Brezonik, P. L.; Arnold, W. A., *Water Chemistry. An Introduction to the Chemistry of Natural and Engineered Aquatic System* Oxford University Press: New York, 2011.
21. White, G. F.; Russel, N. J., Biodegradation of anionic surfactants and related molecules. In *Biochemsitry of Microbial Degradation*, Ratledge, C., Ed. Kluwer Academic Publishers: Dordrecht, 1994.
22. Grady, C. P. L.; Daigger, G. T.; Love, N. G.; Filipe, C. D. M., *Biological Wastewater Treatment*. 3rd. ed.; CRC Press: Boca Raton, FL, 2011.
23. Newman, D., The distribution of range in samples from a normal population, expressed in terms of an independent estimate of standard deviation. *Biometrika* **1939,** *31*, (1), 20-30.
24. Keuls, M., The use of the "studentized range" in connection with an analysis of variance. *Euphytica* **1952,** *1*, 112-122.
25. Grubbs, F., Procedures for Detecting Outlying Observations in Samples. *Tecnometrics* **1969,** *11*, (1), 1-21.
26. Cerniglia, C. E., Microbial metabolism of polycyclic aromatic hydrocarbons. *Adv.*

ED_001324_00007761-00027

Appl. Microbiol **1984,** *30*, 31-37.
27. Smith, M. R., The biodegradation of aromatic hydrocarbon by bacteria. *Biodegradation* **1990,** *1*, 191-206.
28. Volkering, F.; Breure, A. M.; Rulkens, W. H., Microbiological aspects of surfactant use for biological soil remediation. *Biodegradation* **1998,** *8*, 401-417.
29. Volkering, F.; Breure, A. M.; Sterkenburg, A.; van Andel, J. G., Microbial degradation of polycyclic aromatic hydrocarbons: e□ect of substrate availability on bacterial growth kinetics. *Appl. Microbiol. Biotechnol.* **1992,** *36*, 548-522.
30. Harms, H.; Bosma, T. N. P., Mass transfer limitation of microbial growth and pollutant degradation. *J. Ind. Microbiol.* **1997,** *18*, 97-105.
31. Bosma, T. N. P.; Middeldorp, P. J. M.; Schraa, G.; Zender, A. J. B., Mass transfer limitation of biotransformation: quantifying bioavailability. *Environ. Sci. Technol.* **1997,** *31*, 248-252.
32. Johnsen, A. R.; Wick, L. Y.; Harms, H., Principles of microbial PAH-degradation in soil. *Environ. Pollut.* **2005,** *133*, 71-84.
33. Button, D. K., Kinetics of nutrient-limited transport and microbial-growth. *Microbiol. Rev.* **1985,** *49*, (3), 270-297.
34. Itoh, S.; Suzuki, T., Effect of rhamnolipids on growth of a Pseudomonas aeruginosa mutant deficient in n-paraffin-utilizing ability. *Agric. Biol. Chem.* **1972,** *36*, 2233-2235.
35. Oberbremer, A.; Muller-Hurtig, R., Aerobic stepwise hydrocarbon degradation and formation of biosurfactants by an original soil population in a stirred reactor. *Appl. Microbiol. Biotechnol.* **1989,** *31*, 582-586.
36. Noordman, W. H.; Janssen, D. B., Rhamnolipid stimulates uptake of hydrophobic compounds by Pseudomonas aeruginosa. *J. Appl. Microbiol.* **2002,** *68*, 4502-4508.
37. Beal, R.; Betts, W. B., Role of rhamnolipid biosurfactants in the uptake and mineralization of hexadecane in Pseudomonas aeruginosa. *J. Appl. Microbiol.* **2000,** *89*, 158-168.
38. Hazen, T. C.; Dubinsky, E. A.; DeSantis, T. Z.; Andersen, G. L.; Piceno, Y. M.; Singh, N.; Jansson, J. K.; Probst, A.; Borglin, S. E.; Fortney, J. L.; Stringfellow, W. T.; Bill, M.; Conrad, M. E.; Tom, L. M.; Chavarria, K. L.; Alusi, T. R.; Lamendella, R.; Joyner, D. C.; Spier, C.; Baelum, J.; Auer, M.; Zemla, M. L.; Chakraborty, R.; Sonnenthal, E. L.; D'haeseleer, P.; Holman, H.-Y. N.; Osman, S.; Lu, Z.; Van Nostrand, J. D.; Deng, Y.; Zhou, J.; Mason, O. U., Deep-sea oil plume enriches indigenous oil-degrading bacteria. *Science* **2010,** *330*, 204-208.

ED_001324_00007761-00028

FIGURE CAPTIONS

Figure 1. Disappearance of DOSS in the absence (A, C) and presence (B, D) of SLC at 5 °C and 25 °C. Live treatments are in panels A and B, while killed controls are in panels C and D.

Figure 2. Biodegradation of hopane-normalized total alkanes (A, B) and PAHs (C, D) at both temperatures without (A, C) and with (B, D) C9500 dispersant. The arrows in the figure panels represent statistical outliers as determined by the Grubb's outlier test[25].

Figure 3. Biodegradation of the branched alkanes (A, B) and n-alkanes > nC_{29} (C, D) in the absence (A, C) and presence (B, D) of C9500.

ED_001324_00007761-00029

Acquisition Directorate

Research & Development Center

Report No. CG-D-08-14

Modernization of Special Monitoring of Applied Response Technologies (SMART) Technology and Methods – 2014

Distribution Statement A: Approved for public release; distribution is unlimited.

October 2014

Homeland Security

ED_001324_00007763-00002

N O T I C E

This document is disseminated under the sponsorship of the Department of Homeland Security in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

This report does not constitute a standard, specification, or regulation.

James E. Fletcher
E&W Branch Chief
United States Coast Guard
Research & Development Center
1 Chelsea Street
New London, CT 06320

Technical Report Documentation Page

1. Report No. CG-D-08-14	2. Government Accession Number	3. Recipient's Catalog No.
4. Title and Subtitle Modernization of Special Monitoring of Applied Response Technologies (SMART) Technology and Methods – 2014		5. Report Date October 2014 6. Performing Organization Code Project No. 4703
7. Author(s) Brian Parscal, Robert Young, Richard Barone		8. Performing Organization Report No. RDC UDI No. 1478
9. Performing Organization Name and Address U.S. Coast Guard Research & Development Center 1 Chelsea Street New London, CT 06320	SAIC 23 Clara Drive, Suite 206 Mystic, CT 06355-1959 Parscal Pacific, LLC 8938 Ortega Rd Atascadero, CA 93422-5901	10. Work Unit No. (TRAIS) 11. Contract or Grant No. Contract HSCG32-10-D-R00021/ Task Order HSCG32-14-J-300045 Deliverable No. 3
12. Sponsoring Organization Name and Address U.S. Department of Homeland Security Commandant (CG-MER) United States Coast Guard 2703 Martin Luther King Jr Ave SE Stop 7516 Washington, DC 20593-7516		13. Type of Report & Period Covered Final 14. Sponsoring Agency Code Commandant (CG-MER) U.S. Coast Guard Headquarters
15. Supplementary Notes The R&D Center's technical point of contact is Arden C. Turner, 860-271-2623, email: Arden.C.Turner@uscg.mil.		

16. Abstract (MAXIMUM 200 WORDS)

The Special Monitoring of Advanced Response Technologies (SMART) Protocol was developed to oversee oil dispersant application and in-situ burning during response incidents. The USCG Research and Development Center examined the use of the SMART Protocol at four major response incidents between 1999 and 2010 to identify future improvements in the areas of policy, training, and new technology. The review focused on four incidents:

- M/V *New Carissa* Grounding, 1999 (in-situ burning)
- Eugene Island Pipeline Spill, 2009 (dispersant)
- T/V *Krymsk* Oil Spill, 2009 (dispersant)
- Deep Water Horizon Blowout, 2010 (dispersant and in-situ burning)

We evaluated the effectiveness of the SMART Protocol through interviews with stakeholders and other subject matter experts. Where possible, we interviewed the Federal On-Scene Coordinators and NOAA Scientific Support Coordinators who led the responses, and other parties involved in the responses. We also reviewed agency reports, and discussed equipment use and performance with SMART team personnel and vendors. This review examines SMART team activities, incident commander assessments of the protocol's effectiveness, identifies SMART Protocol capability gaps, and identifies solutions for resolving those gaps. The report recommends modifications to USCG policies, training, and technology to improve the SMART Program's future performance.

17. Key Words SMART, *New Carissa*, Eugene Island, *Krymsk*, Deep Water Horizon, dispersant, in-situ burning, ISB, air monitoring, NOAA, Tier I, II and III, National Strike Force (NSF), Fluorometry, water parameter sampling, water sonde, particulate, PM10	18. Distribution Statement Distribution Statement A: Approved for Public Release; distribution is unlimited.		
19. Security Class (This Report) UNCLAS//Public	20. Security Class (This Page) UNCLAS//Public	21. No of Pages 126	22. Price

(This page intentionally left blank.)

ACKNOWLEDGEMENTS

This study was funded in part by the U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement through Interagency Agreement E13PG00040 with the United States Coast Guard Research and Development Center.

(This page intentionally left blank.)

EXECUTIVE SUMMARY

In 1997 a multi-agency working group, including the U.S. Coast Guard (USCG) and the National Oceanic and Atmospheric Administration (NOAA), was convened to establish guidelines for monitoring response technologies during oil spills, specifically, the use of dispersants and in-situ burning to reduce the spread of oil into the environment. The resulting guidance document is titled *Special Monitoring of Applied Response Technologies (SMART)*. The document also expresses the intent that SMART is not limited to oil spills, but can be adapted to other hazardous substance responses as well. The SMART methodologies and their continued refinement have undergone a number of reviews since around 2000, and the SMART Protocol has continued to evolve. The 2006 SMART Protocol remains in effect today, and has been employed in several major spill responses, most significantly the Deep Water Horizon blowout in 2010.

This project assesses current best practices, lessons learned from major incidents, and new technology since 2006, to develop recommendations for improving SMART program policies, guidance, technologies, and data products, in order to improve the program's effectiveness for the USCG. To conduct the research, the project team interviewed stakeholders and other subject matter experts (SMEs) (e.g., Strike Teams), reviewed agency reports, and conducted internet research. Some interviews were conducted at the International Oil Spill Conference 2014 in Savanna, GA, which also provided an opportunity to examine new technology with the vendors. The review focused on four incidents:

- M/V *New Carissa* Grounding, 1999.
- Eugene Island Pipeline Spill, 2009.
- T/V *Krymsk* Oil Spill, 2009.
- Deep Water Horizon Blowout, 2010.

The project concludes that the 2006 SMART Protocol meets its original purpose by providing general guidance. SMART lacks detailed guidance for operational data collection, processing, and data evaluation. This guidance should be developed and promulgated as job aids or appendices to the main body of the protocol. The SMART Protocol should be limited to "typical" responses that last a few days and cover a limited geographic area. Other more complex responses are better suited for events such as Deep Water Horizon, which is considered to be "atypical". The adequacy of training is another non-material gap. A routine curriculum of training on the equipment and procedures used by SMART that covers water sampling, water column profiling, and air monitoring is recommended for the Strike Teams. Also, the Strike Teams do not receive routine, comprehensive SMART Tier I training.

The procedures and division of responsibilities that were worked out between the USCG and NOAA during the Deep Water Horizon response effectively support the mission, and these developments should be incorporated into the Protocol. That methodology should be documented, along with more detailed guidance on executing the protocol. This additional guidance should be included in appendices to the basic protocol.

Inadequate communications was a common material gap for the four incidents we reviewed. Teams were unable to communicate with Incident Commanders, with other responders on the water, or with personnel in the air. This report recommends a combination of non-material measures: planning, preparation, and coordination, to partially address this problem; and recommends consideration of some interim solutions that may reduce the gap. The report also makes recommendations for material upgrades to the SMART Program's air monitoring instrument, multi-parameter water quality probes, and water sampling equipment.

(This page intentionally left blank.)

TABLE OF CONTENTS

ACKNOWLEDGEMENTS V
EXECUTIVE SUMMARY VII
LIST OF FIGURES XI
LIST OF TABLES XIII
LIST OF ACRONYMS XV
1 INTRODUCTION 1
1.1 Background 1
1.2 Summary of Existing Guidance 1
1.3 SMART Program Objectives 2
1.4 Objectives of this Study 3
2 METHODOLOGY 3
3 HISTORY OF SMART USE 4
3.1 M/V New Carissa Grounding, 1999 4
3.2 Eugene Island Pipeline Spill, 2009 5
3.3 T/V Krymsk Oil Spill, 2009 6
3.4 Deep Water Horizon Blowout, 2010 6
3.4.1 DWH In-Situ Burn Operations 7
3.4.2 DWH Dispersant Operations 7
4 PERFORMANCE GAPS AND SOLUTIONS 8
4.1 SMART Protocol 9
4.2 Subsurface Monitoring 9
4.3 SMART Guidance 10
4.4 SMART Roles and Responsibilities 10
4.4.1 SMART Data Collection 10
4.4.2 SMART Data Processing and Evaluation 11
4.5 SMART Response Timeline 11
4.5.1 Response Timeline for Typical Response Operations 11
4.5.2 Response Timeline for Atypical Response Operations 11
4.6 SMART Monitoring Procedures 12
4.6.1 SMART Methodology SOPs 12
4.6.2 SMART Equipment and Instrumentation SOPs 12
4.7 SMART Training 13
4.8 SMART Technology 13
4.8.1 Communications 13
4.8.2 Air Monitoring 15
4.8.3 Spill - Tracking Drifters 16
4.8.4 Water Parameter Measurement 17
4.8.5 Water Sampling 18

ED_001324_00007763-00010

TABLE OF CONTENTS (Continued)

5 RECOMMENDATIONS 19

5.1 SMART Protocol 19
5.2 Informational Needs 19
5.3 Response Timeline 20
5.4 Roles and Responsibilities 20
5.5 SMART Monitoring Procedures 20
5.5.1 USCG SMART Policies 20
5.5.2 USCG SMART Training 21
5.5.3 Technology, Urgent Needs 21
5.5.4 Technology, Optional Needs 22
5.6 Summary 22

6 REFERENCES 23

APPENDIX A. SMART, TECHNOLOGY, METHODS, AND OUTCOMES 2014 OPERATIONAL ISSUES A-1

APPENDIX B. GAP ANALYSIS OF SMART, TECHNOLOGY, METHODS, AND OUTCOMES 2014 ..... B-1

APPENDIX C. SURVEY OF TECHNOLOGY AND METHODS TO ADDRESS SMART PERFORMANCE GAPS C-1

LIST OF FIGURES

Figure A-1. Turner Designs C3™ fluorometer in specially constructed housing....A-3
Figure A-2. Hydrolab DataSonde portable water lab....A-4
Figure A-3. SCUFA fluorometer in weighted housing....A-4
Figure A-4. Panasonic CF-30 laptop computer with internal GPS receiver and SMART software....A-5
Figure A-5. Improvised water sampling pump for 5 m samples....A-6
Figure A-6. GO-FLO water sample bottle for 10 m samples....A-6
Figure A-7. SMART Tier II/III & III+ OSV *International Peace*....A-7
Figure A-8. SMART Tier II/III OSV *Warrior*....A-7
Figure A-9. Example of the DWH SMART Tier I final data product....A-8
Figure A-10. Example of a SMART Tier II/III final poster....A-9
Figure A-11. DWH SMART Tier I data processing flow chart....A-10
Figure A-12. Flow chart for the Tier II/III data processing procedure that evolved during the DWH response....A-11
Figure A-13. Flowchart summarizing the SMART data formatting procedure....A-12
Figure A-14. 28 April 2010 test burn monitored by NSF SMART team....A-17
Figure A-15. Thermo Scientific DataRAM 4™ Particulate Monitor....A-19
Figure A-16. Example of an EPA Air Particulate Matter Report from Venice, LA for 28 April 2010. ....A-20
Figure A-17. EPA data flow diagram for the DWH response (EPA, 2010c)....A-22
Figure A-18. T/V *Krymsk* with damaged hull....A-24
Figure A-19. SMART Tier I photo of a DC-3 aircraft applying dispersant to an oil sheen 40 miles off of Galveston, TX....A-25
Figure A-20. SMART Tier I photo taken during dispersant application....A-27
Figure A-21. SMART Tier I photo taken after dispersant application....A-28
Figure A-22. 27 July 2009 SMART Tier I photo taken after dispersant application....A-28
Figure A-23. Flight path for King Air dispersant spray aircraft sortie #4, 29 July 2009 (C. Henry, interview, 2014)....A-29
Figure A-24. Smoke plume from the burning of oil aboard the M/V *New Carissa*....A-31
Figure A-25. Five SMART Tier I monitoring locations on 11 February 1999 (Barnea, Holloway, Kim, & Orme, 2001)....A-33
Figure B-1. Example of a dispersant application observation reporting form....B-3
Figure C-1. ThermoScientific DataRAM 4....C-8
Figure C-2. ThermoScientific ADR 1500 Area Dust Monitor....C-8
Figure C-3. ThermoScientific ADR 1500 Area Dust Monitor field deployment....C-9
Figure C-4. TSI DustTrak DRX 8533 air monitor with weather proof enclosure....C-10
Figure C-5. TSI DustTrak DRX 8533 air monitor field deployment....C-10
Figure C-6. TSI DustTrak DRX 8533 air monitor touch screen showing a graphical view of instantaneous and TWA particle concentration values....C-10
Figure C-7. NovaTech RF-700C2 buoy....C-13
Figure C-8. NovaTech DF-500N Hand Held Direction Finder....C-14
Figure C-9. MetOcean iSphere Tracking Buoy....C-15
Figure C-10. MetOcean iSphere Tracking Buoy deployed....C-15
Figure C-11. Example of the iSphere data webpage....C-16

ED_001324_00007763-00012

Figure C-12. HydroLab DS5 multi-parameter sonde....C-18
Figure C-14. HydroLab HL4 multi-parameter sonde....C-19

LIST OF FIGURES (Continued)

Figure C-15. YSI EXO 2 Multi-parameter sonde (shown without sensor cover)....C-20
Figure C-16. CONBAR 7000 Series Telescopic Sampler....C-22
Figure C-17. GO-FLO sample bottle (USCG Gulf Strike Team package)....C-23
Figure C-18. Larger size GO-FLO sample bottle rigged for deployment....C-24
Figure C-19. Ground Control MCD-800....C-27
Figure C-20. Features of the MCD-800....C-27
Figure C-21. Sequoia Scientific LISST-100X....C-29
Figure C-22. Turner Designs C3 Fluorometer SMART response kit (USCG Gulf Strike Team)....C-31
Figure C-23. Turner Designs C3 Fluorometer with tow package ready for deployment....C-32
Figure C-24. USCG Atlantic Strike Team setting up the SMART software during the DWH response. The C3 SMART Operator's Guide is shown in the lower right corner.C-33
Figure C-25. SMART fluorometry user interface showing graphical and text displays along with live mapping application....C-33

ED_001324_00007763-00013

LIST OF TABLES

Table C-1. SMART ISB air monitoring performance criteria....C-7
Table C-2. ThermoScientific DataRAM 4....C-7
Table C-3. ThermoScientific ADR 1500....C-8
Table C-4. The TSI DustTrak DRX 8533....C-9
Table C-5. Air monitoring sensor table....C-11
Table C-6. Air monitoring instrumentation cost....C-12
Table C-7. NovaTech RF-700C2 buoy and DF-500N Direction Finder....C-13
Table C-8. MetOcean iSphere Tracking Buoy....C-14
Table C-9. Tracking buoy cost....C-16
Table C-10. HydroLab DS5....C-18
Table C-11. YSI Model 6600....C-18
Table C-12. HydroLab HL4....C-19
Table C-13. YSI EXO 2 (approx. $16k)....C-19
Table C-14. Water parameter sonde table....C-20
Table C-15. Water parameter sonde cost....C-21
Table C-16. CONBAR 7000 Series Telescopic Sampler....C-22
Table C-17. General Oceanics GO-FLO bottle model 108001.7T....C-23
Table C-18. Water sampling cost....C-24
Table C-19. Desirable attributes for Mobile Satellite Service (MSS) terminals....C-26
Table C-20. Ground Control MCD-800 cost information....C-27
Table C-21. Sequoia Scientific LISST-100X....C-29
Table C-22. Sequoia Scientific LISST-100X cost....C-29
Table C-23. SMART Fluorometer performance criteria....C-30
Table C-24. Turner Designs C3 Fluorometer....C-31
Table C-25. Turner Designs C3 cost....C-31

ED_001324_00007763-00014

(This page intentionally left blank.)

LIST OF ACRONYMS

API	American Petroleum Institute
BOEM	Bureau of Ocean Energy Management
BP	British Petroleum
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CDC	Centers for Disease Control and Prevention
CDOM	Colored Dissolved Organic Matter
CG	Coast Guard
CISB	Controlled In-Situ-Burn
COTS	Commercial Off the Shelf
DEQ	Department of Environmental Quality
DPnB	Dipropylene Glycol n Butyl Ether
DWH	Deepwater Horizon
EDD	Electronic Data Deliverable
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPAOSC	Environmental Protection Agency On-Scene Coordinator
ERMA	Environmental Response Management Application®
ERT	Environmental Response Team
FOSC	Federal On-Scene Coordinator
GIS	Geographic Information System
GPS	Global Positioning System
GST	Gulf Strike Team
GT	Gross Tons
HAZMAT	Hazardous Materials
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System
IOSC	International Oil Spill Conference
ISB	In-Situ Burn
ISPR	Incident Specific Preparedness Review
KML	Keyhole Markup Language
KMZ	KML Zip Archive
LED	Light Emitting Diode
LISST	Laser In-Situ Scattering and Transmissometry
LOC	Level of Concern
MC252	Mississippi Canyon 252
MDL	Minimum Detection limit
MSRC	Marine Spill Response Corporation
MSS	Mobile Satellite Service
MSU	Marine Safety Unit

ED_001324_00007763-00016

LIST OF ACRONYMS (Continued)

NARAC	National Atmospheric Release Advisory Center
NM	Nautical Miles
NOAA	National Oceanic and Atmospheric Administration
NRT	National Response Team
NSF	National Strike Force
ORR	Office of Response and Restoration
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organization
OSV	Off Shore Vessel
PAH	Polycyclic Aromatic Hydrocarbon
PM	Particulate Matter
PM10	Particulate Matter less than10 micrometers in diameter
PPM	Parts Per Million
RCP	Regional Contingency Plan
RDC	Research and Development Center
RRT	Regional Response Team
SCAP	Shared Corporate Allowance Plan
SCUFA	Self-Contained Underwater Fluorescence Apparatus
SMART	Special Monitoring of Applied Response Technologies
SME	Subject Matter Expert
SMU	Subsurface Monitoring Unit
SONS	Spill of National Significance
SOP	Standard Operating Procedure
SROMP	Special Response Operations Monitoring Program
SSC	Scientific Support Coordinator
START	Superfund Technical Assessment and Response Team
T/V	Tank Vessel
TAGA	Trace Atmospheric Gas Analyzer
TPAH	Total Polycyclic Aromatic Hydrocarbon
TPH	Total Petroleum Hydrocarbon
TS	Technical Specialist
TWA	Time Weighted Average
UC	Unified Command
U.S.	United States
USCG	United States Coast Guard
VOC	Volatile Organic Compound
$\mu g/m^3$	Micrograms Per Cubic Meter

1 INTRODUCTION

1.1 Background

The need for protocols to monitor response technologies during oil spills has been recognized since the early 1980s. In November 1997, a workgroup consisting of federal oil spill scientists and responders from the U.S. Coast Guard (USCG), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), and the Centers for Disease Control and Prevention (CDC), convened in Mobile, Alabama to draft guidelines for generating the SMART Protocol. The workgroup built upon currently available programs and procedures, mainly the Special Response Operations Monitoring Program (SROMP), developed in 1994, and lessons learned during spill responses and drills. The result of this collaboration is the Special Monitoring of Applied Response Technologies (SMART) program described in the guidance document (USCG, 2006, Special Monitoring of Applied Response Technologies Guidance Document).

The Coast Guard uses the SMART protocol to assess the use of dispersants, and in-situ burning (ISB) to mitigate the spread of oil into the environment. The SMART methodologies have undergone a number of reviews and refinements since around 2000, and the SMART Protocol has continued to evolve. SMART is not limited to oil spills, and can also be adapted to hazardous substance responses where particulate air emissions should be monitored, and to hydrocarbon-based chemical spills into fresh or marine water.

1.2 Summary of Existing Guidance

Existing USCG guidance for SMART consists of three elements:

SMART Protocol: The 2006 SMART Protocol remains the primary guidance document for SMART, and is described in more detail in Section 1.3 SMART Program Objectives. It is a consensus document developed by a host of federal agencies, including USCG and NOAA, the two primary agencies responsible for maritime spill response. It is prescriptive enough to indicate the situations in which it applies and which it does not, and provides a framework, in the form of a three-tiered monitoring regimen, for monitoring oil spill dispersant operations. The SMART Protocol is general enough to allow room for development of more detailed guidance without creating the need to update the protocol itself. It includes greater detail in a series of attachments that are designed to assist response personnel. The 2006 SMART Protocol lists the following attachments:

Monitoring Dispersant Operations:

- Roles and Responsibilities.
- Command, Control, and Data Flow.
- Dispersant Observation General Guidelines.
- Dispersant Observation Training Outline.
- Dispersant Observation Checklist.
- Dispersant Observation Pre-Flight List.
- Dispersant Observation Reporting Form.
- Fluorometry Monitoring Training Outline.
- Dispersant Monitoring Job Aid Checklist.
- Dispersant Monitoring Performance Guidelines.
- Dispersant Monitoring Field Guidelines.
- Dispersant Monitoring Water Sampling.

Monitoring In-Situ Burning Operations:

- Roles and Responsibilities.
- Command, Control, and Data Flow.
- ISB Monitoring Training Outline.
- ISB Monitoring Job Aid Checklist.
- ISB Monitoring Equipment List.
- Particulate Monitor Performance Requirements.
- ISB Monitoring Possible Locations.
- ISB Monitoring Recorder Sheet.
- ISB Monitoring Data Sample: Graph.

ED_001324_00007763-00018

Dispersant Monitoring Recorder Form.

COMMANDANT INSTRUCTION 16470.1: This guidance is titled "Use of Special Monitoring of Applied Response Technology (SMART) Protocols. The instruction: (1) mandates incorporation of the SMART Protocol into Regional Contingency Plans (RCPs), (2) directs the National Strike Force (NSF) to maintain the capability to deploy SMART monitoring groups, and (3) states that requirements in excess of those required by SMART are beyond the capability of the NSF.

SMART Training: In recent years, the NSF has obtained USCG specific SMART training through contractors. The training is designed to provide the USCG SMART field technician with the skills and operational overview necessary to perform SMART data collection. The NSF has also obtained equipment specific training from commercial vendors. In some cases, the equipment specific training is supplemented by additional information specific to SMART operations.

1.3 SMART Program Objectives

The SMART program objectives provide a context for reviewing SMART performance and identifying gaps, partly because they define what SMART is intended to do and not to do. These objectives can be found in the introductory material in the SMART Guidance Document. SMART is intended to change as experiences, improved operations, and implementation of new and upgraded technologies affect best practices. It establishes guidance to foster rapid collection and reporting of real-time, scientifically based information, to assist the Unified Command with decision-making during in-situ burning or dispersant operations. SMART recommends monitoring methods, equipment, personnel training, and command and control procedures that strike a balance between the operational demand for rapid response, and the Unified Command's need for feedback from the field to make informed decisions. The Guidance Document states the following about the content of the program:

- SMART is designed for use at oil spills both inland and in coastal zones, as described in the National Oil and Hazardous Substances Pollution Contingency Plan.
- SMART does not directly address the health and safety of spill responders or monitoring personnel, since this is covered by the general site safety plan for the incident (as required by 29 CFR 1910.120).
- SMART does not provide complete training on monitoring for a specific technology. Rather, the program assumes that monitoring personnel are fully trained and qualified to use the equipment and techniques mentioned and to follow the SMART guidelines.
- SMART guidelines are based on the roles and capabilities of available federal, state, and local teams, and NOAA's Scientific Support Coordinators (SSCs). The SSC most often fills the role of Technical Specialist (TS) for SMART. Users may adopt and modify the guides provided in the SMART Protocol to address specific needs.
- SMART attempts to balance feasible and operationally efficient monitoring with solid scientific principles.
- SMART uses the best available technology that is operationally practical. The SMART modules represent a living document and will be revised and improved based on lessons learned in the field, advances in technology, and developments in techniques.
- SMART should not be construed as a regulatory requirement. It is an option available for the Unified Command to assist in decision-making. While every effort should be made to implement SMART or parts of it in a timely manner, ISB or dispersant application should not be delayed to allow the deployment of the SMART teams.

ED_001324_00007763-00019

- SMART is not intended to supplant private efforts in monitoring response technologies, but is written for adoption and adaptation by any private organization or public agency. While currently addressing monitoring for ISB and dispersant operations, SMART may be expanded to include monitoring guidelines for other response technologies.
- The dispersant monitoring component of the SMART Protocol recommends three levels (or tiers) of monitoring.
    - Tier I involves visual observation and reporting by a trained observer.
    - Tier II builds on Tier I and adds real-time oil detection instrumentation and water sampling deployed at a single water depth (typically one meter).
    - Tier III follows Tier II procedures, but collects information on the transport and dispersion of the oil in the water column. Tier III is an expanded monitoring procedure that is intended to meet the needs of the Unified Command and may include:
        - Multiple oil detection instrumentation deployed at different water depths.
        - Water sampling from multiple water depths.
        - The use of a portable instrument to measure water temperature, conductivity, dissolved oxygen content, pH, and turbidity.
- SMART does not monitor the fate, effects, or impacts of dispersed oil.
- SMART does provide:
    - A general outline for dispersant and ISB monitoring procedures.
    - Guidance on mobilizing SMART monitoring resources.
    - Guidance on using and interpreting monitoring results.
    - Recommendations on locations for ISB monitoring.
    - Recommendations on a Level of Concern for ISB monitoring.
    - Definition on the performance requirements for SMART instrumentation.
    - Definition on where SMART fits into the Incident Command System (ICS) organization.
    - Guidance on SMART information flow and data handling.
    - Recommendations on the roles and responsibilities for the Monitoring Group.
    - Recommendations for SMART command, control, and data flow.
    - Recommendations for SMART field equipment, job aids, and training requirements.

1.4 Objectives of this Study

The purpose of this study is to develop recommendations for improving SMART program policies, guidance, technologies, and data products, to improve the program's effectiveness. The recommendations are based on an analysis of interviews of stakeholders and other SMEs (e.g., USCG Strike Teams), agency reports, and internet research involving four significant oil response events.

- M/V *New Carissa*, 1999 (atmospheric monitoring).
- Eugene Island Pipeline Spill, 2009 (dispersant).
- T/V *Krymsk* Oil Spill, 2009 (dispersant).
- Deep Water Horizon, 2010 (dispersant and atmospheric monitoring).

2 METHODOLOGY

ED_001324_00007763-00020

The project team followed three basic steps: (1) review the intent and scope of the SMART Protocol, (2) collect and review information on previous SMART deployments to identify capability and mission performance gaps, and (3) identify policy, personnel, and technological solutions to address those gaps. The first step began with a thorough review of the SMART Protocol to familiarize the team with the intent and scope of the SMART program. The project team interviewed personnel from the various SMART stakeholder agencies (primarily USCG, NOAA, & EPA) to collect input on how well the 2006 SMART Protocol addresses the operational and informational needs of their respective agencies.

Following the interviews, the project team reviewed information on oil spill response operations where SMART was used, focusing on four relatively recent significant incidents. For each incident, the project team reviewed published literature, incident briefings, and After Action Reports from participating agencies. In addition, the project team interviewed personnel associated with SMART operations for each event. From this information the project team identified performance gaps and in the process, identified components of the SMART process that were not fully developed or well understood by stakeholder agencies.

After identifying the gaps, the project team reviewed published literature, interviewed SMART participants and stakeholders, and investigated technologies that might enhance the SMART process. The team then generated recommendations to assist the project sponsor in developing an improved data collection program to satisfy the requirements of the SMART Protocol.

3 HISTORY OF SMART USE

The project team evaluated the deployment of the SMART Protocol during the four incidents. For the M/V *New Carissa* grounding, SMART was used to monitor oil burn operations while for the Deepwater Horizon (DWH), T/V *Krymsk*, and Eugene Island Pipeline incidents, SMART was used to monitor oil dispersant operations. With the exception of the Deepwater Horizon incident, information specific to SMART operations was scarce, and the project team pieced together information from many different sources to create an overview of how SMART was utilized and how it satisfied the mission objectives.

3.1 M/V New Carissa Grounding, 1999

On 4 February 1999, the freighter *New Carissa* ran aground off the Oregon coast in gale force winds. Bad weather and logistics ruled out pumping the oil from the ship, and on 10 February, the Federal On Scene Coordinator (FOSC), the Responsible Party, and the Oregon State Incident Command documented their decision to attempt a controlled burn onboard the stricken vessel. The burn was aimed at removing as much of the 425,000 gallons of heavy fuel oil and diesel fuel as possible. Realizing a burn of this magnitude could generate a large volume of black smoke, and cause a public health concern, the FOSC requested SMART particulate air monitoring at nearby population centers. The USCG, EPA, and State of Oregon monitoring teams were notified when it became apparent that a burn would take place, and the first NSF SMART team arrived on-scene at 1400 on 10 February.

Working with the EPA and Oregon Department of Environmental Quality (DEQ), the NSF monitoring teams were deployed to five locations and were in place well before the sustained burn operation commenced on the evening of 11 February. The teams utilized a combination of DataRAM™, Personal DataRAM™, and Nephelometer instruments, calibrated and configured to monitor particulates smaller than 10 micrograms in size (PM10). The documentation is not clear on which of these specific air monitoring instruments was utilized by the NSF teams, but all the instruments work on the same principle of light

ED_001324_00007763-00021

scattering, with the readings converted to weight of particulates in micrograms per cubic meter of air ($\mu g/m^3$). The level of concern (LOC) adopted for this operation was 150 $\mu g/m^3$ of PM10 averaged over a one-hour period. This was based on the LOC value for ISB operations adopted by the Region 10 Regional Response Team (RRT 10), of which Oregon is a member. The monitoring teams were instructed to notify the SSC if they observed time weighted average (TWA) PM10 readings above the LOC.
The monitoring teams remained on location for the approximately thirty hours of sustained burn operations. During this period, the teams observed TWA PM10 readings typically in the 0-50 $\mu g/m^3$ range, with one team noting readings as high as 100 $\mu g/m^3$ for a brief period. The highest readings came from a team located a few miles north of the burn area after the winds turned slightly onshore. Throughout the burn, the monitoring teams did not observe any TWA particulate levels above the LOC and the FOSC was satisfied that the smoke dissipated before reaching population centers. At midnight on 13 February, the monitoring teams were placed on standby, and later de-mobilized.

In the end, approximately 200,000 gallons of fuel oil, half of the oil on board, were burned in the operation without reported adverse health effects to the local population or responders. After action review by NOAA noted that "SMART was deployed successfully for the New Carissa incident. No significant smoke impacts were detected by the monitoring teams at population centers near the burn. Good cooperation among team members and federal, state, and local entities greatly contributed to the success of the monitoring operations." More information on the New Carissa grounding is provided in Appendix A.

3.2 Eugene Island Pipeline Spill, 2009

On 26 July 2009, USCG Marine Safety Unit (MSU) Morgan City notified the NOAA Hazardous Materials (HAZMAT) Duty Officer of an oil spill 65 miles south of Atchafalaya Bay, LA. An alarm indicated a pressure drop in a pipeline, but the location of a leak was unknown. Later that day, a slick was observed in the Gulf of Mexico, 20 to 25 miles south of Lake Pelto, LA. The Responsible Party, Shell Pipeline, estimated 63,000 gallons of crude oil had leaked from the pipeline. That same day (no time available) MSU Morgan City requested USCG Gulf Strike Team (GST) support for possible dispersant monitoring operations.

On the morning of 27 July, the Responsible Party requested authority to use oil dispersants on the surface oil. Under the RRT 6 preauthorization plan, authority was granted by the FOSC and a request was made for the USCG to provide dispersant monitoring services. The extended forecast suggested that on-shore transport conditions were predicted for the next few days, but predicted landfall for the oil was still days away.

On 27 July, GST personnel were mobilized to Gibson, LA to meet the morning overflight and provide SMART Tier I visual observation for the dispersant application. At that point it was practically impossible to get the SMART Tier II/III Team offshore and in position before the planned morning spray application sortie. Therefore, GST personnel provided SMART Tier I support for two dispersant application sorties that morning. The GST SMART Tier II/III teams were also on scene for the 27 July afternoon dispersant sortie, but a last minute change in the target location prevented them from arriving at the new location in time.

The GST continued to provide Tier I support for one dispersant application sortie on 28 July and two dispersant application sorties on 29 July, the third day of dispersant spray operations. All GST Tier I flights were made from the same aircraft as the dispersant spray spotting team. The spotter aircraft did not have the communications capability to relay a real-time verbal report from the SMART team to the NOAA SSC (located at the Shell Command Post in downtown New Orleans, LA), so reports and documentation were

delivered to the SSC as soon as possible after each flight. The general assessment from the Tier I team indicated that the dispersant applications were effective. It is not clear, however, whether the spotter aircraft had the capability to communicate with the SMART Tier II/III team on the vessel. The project team was unable to locate information stating why SMART Tier II/III teams were not mobilized during the second and third days of spray operations.

The GST SMART teams were de-mobilized on 30 July when dispersant spray operations ended. The NOAA SSC involved with this incident later noted that he was satisfied with the SMART data for this incident, and felt the Tier I data were sufficient to support informed recommendations to the FOSC. The SSC also mentioned that if Tier II/III data been collected (as requested by the FOSC), it would probably not have changed his recommendation, as he considered the Tier I data very convincing. More information on the Eugene Island Pipeline spill is provided in Appendix A.

3.3 T/V Krymsk Oil Spill, 2009

On 20 October 2009, the Offshore Vessel AET Endeavor collided with the Tank Vessel (T/V) *Krymsk*, an 820 ft, 62,395 gross ton (GT) Liberian-flagged, double-hull crude oil carrier located approximately 40 NM off of Galveston, TX. The vessel reported a 1 m x 1 cm crack on the No. 2 port bunker (fuel) tank approximately 2-4 ft above the waterline. The crack did not impact the cargo area. The USCG estimated a loss of roughly 13,600 gallons of bunker oil to the sea. Internal fuel transfers on board the vessel prevented additional oil from being released. An oil dispersant plan was developed and a Regional Response Team 6 (RRT 6) conference call occurred the morning of 21 October. The RRT concurred with the FOSC to use dispersants if suitable oil was detected during an overflight.

On 21 October 2009, (0145 local time) Marine Safety Unit (MSU) Galveston requested dispersant monitoring assistance from the GST. By 0850, two GST SMART team members were airborne on a King Air twin engine aircraft providing Tier I SMART monitoring for the morning's dispersant spray sortie.

On 21 October 2009, an Airborne Support Inc. DC3 aircraft applied 1,000 gallons of COREXIT® 9500 dispersant, making several passes over the area of heaviest oiling off-shore, as well as over areas of fringe sheening. SMART Tier I observers reported that the dispersants appeared to have been somewhat effective (milky emulsion observed). Heavy weather prohibited a second dispersant sortie in the afternoon, and also prohibited the mobilization of SMART Tier II/III.

On 23 October 2009, a limited dispersant application was made to the residual slick to assess the potential for mitigation. The SMART team observed this application and deemed the application ineffective. As a result, a decision was made to discontinue dispersant applications.

Throughout the response, The SMART Tier I team members shared a King Air aircraft with the dispersant spotting personnel. The twin engine King Air was considered a safer air platform than the USCG HC144 for the SMART team, considering the long distance off-shore for the area of operation. The King Air aircraft did not have the communications capability to relay a real-time verbal report from the SMART team to the NOAA SSC during flight operations, so reports were filed after the aircraft landed.

The NOAA SSC later reported that he was satisfied with the SMART Tier I data for this incident, and considered it sufficient to make informed recommendations to the FOSC. More information on the T/V *Krymsk* spill is provided in Appendix A.

3.4 Deep Water Horizon Blowout, 2010

On 20 April 2010, the Macondo Prospect well, 45 miles off the coast of Louisiana, experienced a catastrophic blowout, causing a major explosion, fire, and subsequent sinking of the Mobile Offshore Drilling Unit Deepwater Horizon. The blowout resulted in a major oil spill one mile below the surface of the ocean, leading to the most challenging and complex oil spill response the United States has experienced.

3.4.1 DWH In-Situ Burn Operations

Due to the quantity of oil released, mechanical skimming assets were not sufficient to contain and collect all the surface oil that was released. On 26 April 2010, the use of ISB of the surface oil was proposed. Between 28 April and 19 July 2010, the Controlled In-Situ Burn (CISB) Group under the Offshore Operations Branch of Incident Command Post (ICP) Houma, LA conducted 411 burns, removing 5 percent of the 4.9 million barrels of discharged oil. Burn task forces conducted burns within the specified and approved CISB Burn Area, typically within 3 to 8 miles of the spill site.

In 1994, RRT 6 published an In-Situ Burn Operations Plan, which required monitoring for a potential threat to the general public by smoke generated from the burning of oil. To fulfill the criteria of the RRT 6 Pre-Authorization for ISB, the NOAA SSC helped implement the SMART ISB monitoring protocol designed to alert the FOSC of any potential impact of the smoke on a populated area for the first test burn on 28 April 2010.

USCG NSF personnel deployed SMART ISB monitoring equipment to an off-shore platform approximately 13 miles southwest of the planned test burn site. Two NSF SMART team members with two DataRAM 4™ particulate air monitoring instruments were deployed to the offshore platform and remained on scene throughout the burn operations. SMART air monitoring detected no particulates related to the test burn at this location. NOAA worked with the National Atmospheric Release Advisory Center (NARAC) to model potential plume releases from future ISBs. NOAA and NARAC determined that ISB would not pose a problem to the general population, given the off-shore location (a long distance from populated areas) and prevailing atmospheric conditions. Thus, SMART monitoring was not required for further burns, and the NSF burn monitoring effort was suspended.

The project team found very little documentation about the DWH SMART air monitoring effort. For example, no operations logs were located and interviews with both a USCG monitoring team member and a NOAA SSC involved in the monitoring operation did not lead to any data collected during the deployment. Despite the lack of documentation, a NOAA SSC involved with the 28 April 2010 test burn indicated he was satisfied with the deployment and performance of the NSF SMART air monitoring teams. More information on Deep Water Horizon ISB operations is provided in Appendix A.

3.4.2 DWH Dispersant Operations

During the Deepwater Horizon response, aerial dispersants were applied to minimize the potential for surface oil slicks to impact wildlife and environmentally sensitive shoreline ecosystems. The RRT Regional Contingency Plan requires that use of chemical dispersant in the region's waters be accompanied by the implementation of SMART Protocols. Accordingly, the protocols were implemented when aerial dispersant operations began on 22 April 2010, and continued through the final aerial dispersant application on 19 July.

ED_001324_00007763-00024

SMART monitoring was initially conducted by the NSF, and later augmented by industry contractors and other USCG personnel. All SMART monitoring operations were coordinated through the USCG SMART Supervisor, with monitoring results reported to the FOSC through the NOAA FSC, who provided technical guidance. This was the first time SMART monitoring was implemented as part of a large-scale prolonged response effort during a Spill of National Significance (SONS).

Aerial dispersant operations were coordinated through the Aerial Dispersant Operations Group located at the ICP Houma and occurred over a period of 90 days, 61 of which involved active spraying. Twelve aircraft participated in the spray operations with a total spray capability of approximately 100,000 gallons per day. The spray aircraft applied approximately 973,000 gallons of dispersant during 412 sorties within an operating area of 18,000 square miles, dispersing an estimated 12 to 18 million gallons of oil.

The SMART teams adhered to the three tiers described in the SMART Protocol and on several occasions, the Tier III effort was enhanced with additional oil detection instrumentation and water sampling procedures (Tier III+). Out of 118 SMART missions conducted during the response, 77 were Tier I, 30 were Tier II/III, and 11 were Tier III+.

Equipment utilized in the SMART effort included three crew boats (>100 ft length), two small boats (<30 ft length), three helicopters, two forward staging areas, 50 USCG personnel, 30 contractor personnel, six C-3 Fluorometer kits, two Self-Contained Underwater Fluorescence Apparatus (SCUFA) Fluorometer kits, one Laser In-Situ Scattering and Transmissometry (LISST) instrument, and three HydroLabs DataSonde portable water labs. The largest SMART vessel (142 ft length overall) was also fitted with an onboard, portable dispersant spray system for SMART Tier III+ operations.

USCG SMART teams were on scene when aerial dispersant operations began on 22 April 2010 and performed all Tier I data collection duties for the duration of dispersant operations, and all Tier II/III data collection activities for the first few weeks of dispersant operations. In early May 2010, recognizing the need for extended dispersant operations, SMART teams from Oil Spill Response Limited (OSRL), a worldwide oil spill response organization, augmented USCG Tier II/III SMART data collection efforts. USCG/OSRL joint SMART data collection operations began in mid-May and continued into early June 2010, at which time the USCG was relieved of SMART Tier II/III data collection duties, and the OSRL SMART team began moving into enhanced SMART Tier III+ operations. The OSRL SMART Tier III+ team utilized standard Tier II/III techniques with the addition of more sophisticated instrumentation, expanded water sampling, and the use of an on-board dispersant spray system. OSRL SMART Tier III+ operations continued until dispersant spray operations were discontinued in late July 2010.

The SMART field data, consisting of annotated digital photographs, fluorometer and profiling instrument data, etc., in digital form, were delivered by hand to ICP Houma, where it was processed and evaluated by either NOAA personnel or NOAA contract personnel. Earlier in the response, basic data processing and evaluation techniques were suitable to address the informational needs of the SSC. As SMART data collection capability expanded, and the interest in dispersant efficacy data increased, more sophisticated data processing, evaluation, and presentation techniques were developed. More information on the Deep Water Horizon dispersant operations is provided in Appendix A.

4 PERFORMANCE GAPS AND SOLUTIONS

The project team grouped SMART performance gaps into three broad categories: policy, training, and technology. In each category, the team identified solutions to assist the USCG in developing a viable and sustainable SMART monitoring program that would satisfy the informational needs of SMART stakeholders. Additional details on the gaps and solutions are provided in Appendices B and C respectively. This section summarizes a gap and solution together for each subject indicated by the below subheadings.

4.1 SMART Protocol

The project team interviewed personnel from SMART stakeholder agencies to determine the level of satisfaction with the intent and scope of the protocol, as well as the level of guidance provided. Most SMART stakeholders indicated that the current SMART Protocol is adequate for a *typical* dispersant or ISB operation. They noted that the protocol was originally written to address the type of dispersant or ISB responses expected at the time - one lasting a few days, covering a limited geographic area. All stakeholders agreed that the 2010 Deepwater Horizon dispersant monitoring requirements far exceeded what was originally conceived in the SMART Protocol.

Many of the performance gaps identified from the DWH SMART operations resulted from the scale and duration of the DWH dispersant operations, while others were more fundamental and would likely occur regardless of the scale of the response. Some stakeholders emphasized that the DWH blowout was a highly unusual event and the associated response was an *atypical* response. These stakeholders suggested we focus on how SMART will be implemented during a typical response, and indicated that atypical dispersant and ISB monitoring may require guidance beyond the SMART Protocol. Most stakeholders preferred an additional guidance document that addresses atypical response operations, rather than an expanded version of the current SMART Protocol. This report notes all the performance gaps discovered in our review of past SMART deployments, but focuses on *solutions* that are appropriate for typical SMART response operations.

4.2 Subsurface Monitoring

The stakeholders interviewed agreed that the subsurface dispersant injection monitoring performed during the DWH response is far beyond the scope of the SMART Protocol and the technical capability of the USCG SMART teams. The following overview of this monitoring effort illustrates the complexity of the effort.

During the DWH response, a separate Subsurface Monitoring Unit (SMU) was established at ICP Houma to address the uncertain applicability of existing plans and dispersant pre-authorizations, the lack of an existing monitoring protocol, and the absence of any single organization with the required monitoring capabilities. The SMU was a collaboration between NOAA, EPA, USCG, Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE, formerly Minerals Management Service), British Petroleum (BP), and various academic institutions. The subsurface monitoring effort utilized over 25 open water vessels, logging over 850 days at sea during more than 125 dedicated vessel sorties. These vessels deployed a variety of advanced instrumentation to depths up to 1500 meters to collect data on fluorescence, temperature, conductivity/salinity, dissolved oxygen, LISST particle sizing, and a suite of petroleum hydrocarbon measurements. The SMU also utilized advanced technologies such as subsurface ocean gliders, air-dropped water profilers, high frequency radar, drifting and moored buoys, and wave gliders. The combined effort collected over 31,000 physical samples in addition to data on chemistry, sediments, acoustics, and imagery from over 40,000 ocean observation sites (Walker, 2010).

ED_001324_00007763-00026

When comparing the above effort with the surface dispersant monitoring program (SMART) that was in use at the same time, the differences are significant. The subsurface dispersant monitoring program required sophisticated equipment and expertise to collect data and samples from up to 1500 meters in the case of the DWH. SMART, on the other hand, was designed to monitor the effectiveness of dispersants applied on the water's surface, impacting perhaps the upper 10 meters of the water column. The procedures, equipment, and training of the SMART teams are aimed specifically at collecting data within that shallow surface water layer. Monitoring beyond that depth would require greatly expanded SMART capabilities. Some recent reports, such as the NRT Environmental Monitoring for Atypical Dispersant Operations, (National Response Team [NRT], 2013) and the API Industry Recommended Subsea Dispersant Monitoring Plan (American Petroleum Institute [API], 2013), have begun to lay the groundwork for developing a subsurface dispersant monitoring program. SMART stakeholders, however, cautioned that such a monitoring program was not a good fit for the current SMART Protocol. Most stakeholders recommended a separate guidance document for subsurface dispersant injection monitoring.

4.3 SMART Guidance

Stakeholders involved with past SMART deployments noted the absence of detailed operational instructions for executing the SMART mission. The SMART data collection teams (USCG) reported the lack of detailed guidance for SMART data collection, and the SMART data evaluation team (NOAA) reported the lack of guidance for SMART data processing and data evaluation. This lack of guidance was particularly evident during the DWH dispersant monitoring effort. Without such detailed guidance the USCG SMART field teams developed their own field data collection techniques. These techniques evolved with time and generally became very effective, but data collection efforts early in the response suffered from a lack of operational guidance. For example, the lack of operational guidance for water sampling early in the response led the USCG SMART teams to improvise a sampling pump that (as they discovered later) had the potential to contaminate subsequent samples due to adhesion of oil to the inner hose surfaces. The pump was later replaced with more rigorous sampling equipment and procedures. The same can be said for the SMART data processing and evaluation techniques used during the DWH response. Early during DWH SMART operations, there was no established process for quality control, data processing, and data evaluation. This resulted in a lack of uniformity in the data product, as different individuals processed and evaluated the SMART data. Ultimately, standardized practices were developed, but it was many days into the response before SMART data was processed and evaluated in a rigorous, consistent manner. Both examples illustrate the need for more detailed operational guidance at the onset of operations.

Some SMART stakeholders suggested bringing this detailed guidance into the protocol, while others cautioned that such detail would require more frequent updates and modifications to the document as procedures and technology evolves. An original contributor to the SMART Protocol noted that detailed operational guidance was intentionally left out of the document to keep the protocol at a manageable size to avoid providing techniques and instrumentation that might become outdated (C. Henry, interview, February 18, 2014). The project team's assessment however, is that detailed operational guidance is necessary and should be promulgated as separate job aids or appendices to the protocol that could be updated outside of the main body of the protocol.

4.4 SMART Roles and Responsibilities

A review of past SMART deployments found that roles, responsibilities, and expectations have not been adequately defined in the past. This gap was particularly evident during the DWH SMART operations. From the start, there was no question that the USCG Strike Teams would take the lead in the SMART data

collection effort, but the type and form of data expected from the field teams by the SSC was not defined.

4.4.1 SMART Data Collection

SMART operations can be divided into two broad categories, data collection, and data processing/ evaluation. The NOAA and USCG personnel interviewed agreed that SMART field activities and data collection during a typical dispersant or ISB operation should be the responsibility of the NSF. NOAA will provide general SMART mission objectives, but the Strike Teams will be responsible for providing the personnel, equipment, and logistics necessary for SMART data collection. NOAA stakeholders indicated that they need a standardized SMART data package similar to what was developed during the Deepwater Horizon response. A detailed description of the recommended data packages for dispersant monitoring and ISB monitoring operations is provided in Appendix C.

4.4.2 SMART Data Processing and Evaluation

Both NOAA and USCG personnel agreed that NOAA should be responsible for SMART data processing and evaluation. NOAA indicated that they do not have a SMART data processing program in place, but are developing one.

4.5 SMART Response Timeline

4.5.1 Response Timeline for Typical Response Operations

Early in the study, the project team noted a lack of consensus by SMART stakeholders on a realistic response time for SMART operations. The project team felt it was important to weigh the response time expectation of the NOAA SSC, the primary SMART data user, against the realistic response capability of the USCG SMART teams. Experience indicates that USCG SMART response time relies on many factors outside the control of the Strike Teams. These factors include timely activation of SMART, the availability of transportation resources to travel to the incident location, and the availability of aircraft and vessels suitable for SMART operations.

With this in mind, the project team proposed a cascading approach to a SMART dispersant monitoring timeline. This timeline would provide SMART Tier I (aerial observation) coverage for the first day of dispersant spray operations, while building up to Tier II/III capability on the second day. A NOAA SSC agreed that Tier I coverage on Day 1 of dispersant operations should provide them with adequate monitoring information, with the assumption that SMART Tier II/III will be in place soon afterwards. For SMART ISB monitoring, the USCG data collection teams should be in place for the onset of burn operations.

4.5.2 Response Timeline for Atypical Response Operations

The project team asked the NOAA SSCs to consider the guidance of the NRT Environmental Monitoring for Atypical Dispersant Operations guide, a document that considers dispersant operations that continue for an extended period (beyond 96 hrs.) to be atypical, requiring resources and methods beyond the current capability of the NSF. After that time, the FOSC should consider replacing the NSF SMART teams with contracted personnel better equipped to satisfy the enhanced informational needs of an atypical response. The NOAA stakeholders interviewed felt this approach was reasonable, provided the NSF could remain engaged in SMART operations and provide federal oversight of SMART field activities. This most likely would involve

ED_001324_00007763-00028

placing NSF personnel as observers or advisors on board vessels engaged in SMART data collection activities.

The NSF stakeholders interviewed noted that although the Strike Teams will make every effort to provide full Tier I, II, and III SMART capability on day 1 of dispersant operations, they agreed that the cascading response timeline was more realistic. An NSF stakeholder also agreed with the NRT's recommendation that NSF personnel should be phased out of SMART data acquisition if dispersant operations were to continue for a prolonged period. The interviewee noted that the Strike Teams would be in high demand elsewhere in a prolonged response, but agreed that NSF oversight of SMART operations is important and should continue for as long as SMART is in operation.

4.6 SMART Monitoring Procedures

The project team identified a lack of detailed operational guidance for the SMART data collection process. The 2006 SMART Protocol provides general guidance, but very little detailed information on the deployment, operation, and maintenance of the equipment; and the data collection techniques necessary for successful SMART operations. In some cases, standard operating procedures (SOPs) do not exist, and in other cases they exist, but need to be updated with increased scope and/or detail as noted in the following subsections.

The USCG should consider engaging other SMART stakeholder agencies for assistance in developing these guidance documents. The EPA in particular has considerable experience with field data collection techniques and data quality management, and has offered assistance in developing SMART procedures and practices.

4.6.1 SMART Methodology SOPs

SMART is a compilation of several different components, each with a unique operational requirement. The project team concluded that each of the below components should have a detailed SOP that describes the mission goals for each component, guidance on how best to meet those goals, and the techniques and methodologies needed. The topics to include for each SOP are provided in Appendix C.

- Tier I Aerial Observation and Photo Documentation.
- SMART Aerial Spotting.
- Tier II/III Fluorometry Data Collection.
- Tier II/III Water Parameter Collection.
- Tier II/III Water Sampling.
- In-Situ Burn Air Monitoring.

In addition to the individual SOPs above, the project team recommends an overarching guidance document that describes how the components fit into the program. This document should be similar to the SMART Protocol but shortened to include only the information required for field operations.

4.6.2 SMART Equipment and Instrumentation SOPs

The project team also recognized the need for detailed guidance on the operation and maintenance of the SMART equipment and instrumentation. Though SOPs exist for some SMART equipment (e.g.,

ED_001324_00007763-00029

fluorometry) SOPs for all SMART equipment should be developed. The SOPs should include step-by-step operational, calibration, and maintenance instructions. The topics to include for each SOP are provided in Appendix C. Below is a list of the SMART equipment that is not currently addressed by an SOP.

- Radios and Satellite Communications Equipment.
- Photography Equipment.
- Fluorometers.
- Multi-Parameter Water Sondes.
- Water Sampling Equipment.
- Particulate Air Monitors.

4.7 SMART Training

The project team interviewed USCG personnel and SMART stakeholders to identify USCG training procedures that may be developed or improved upon in order to maintain proficiency in all aspects of SMART operations. The current NSF SMART training curriculum addresses most of the SMART operational components, but some additional coverage and detail is needed. As an example, SMART fluorometry operations are covered in depth, while other components of SMART, such as water sampling, water parameters, and air monitoring are covered in theory only - there is currently no hands-on equipment training. Another example is the absence of a SMART Tier I training program. Past deployments have repeatedly demonstrated the value of SMART Tier I observations during dispersant spray operations, yet there is no routine, comprehensive SMART Tier I training within the USCG.

Below is a summary of the training modules recommended for a comprehensive SMART training program. The topics for each SOP are provided in Appendix C. In most cases, annual training with an SME is needed, along with semi-annual in-house refresher training. Experience demonstrates that a large-scale response (such as the DWH) may require the deployment of multiple SMART field teams, separately monitoring both dispersant and burn operations simultaneously. This may also involve Strike Team personnel from different regions joining forces to form a single SMART field team, and standardizing the training curriculum and requirements across units is an important aspect.

- Overall SMART Mission.
- Tier I Aerial Observation.
- SMART Aerial Spotting.
- Tier II/III Fluorometry Data Collection.
- Tier II/III Water Sampling.
- Tier III Water Parameter Collection.
- ISB Air Monitoring.

4.8 SMART Technology

During each of the four incidents reviewed for this project, USCG SMART teams provided some level of monitoring information to help the NOAA SSC make informed operational recommendations to the FOSC. In all cases however, the SMART field teams faced operational and technological challenges. Some challenges were common to all four incidents while others were the result of the unique circumstances of each specific incident.

ED_001324_00007763-00030

4.8.1 Communications

Communications between the field teams and Command, and between the field teams and other response operations, is a key requirement, and the most significant technological challenge common to the four SMART deployments we reviewed. SMART establishes a monitoring system for the rapid collection and reporting of real-time, scientifically based information to assist the Unified Command with decision-making during ISB or dispersant operations. Communication of monitoring results should flow from the field to those persons in the Unified Command who can interpret the results and use the data.

M/V *New Carissa* Communication Gaps: During the *New Carissa* response, the available information suggests that the SMART field teams did an adequate job monitoring the in-situ burn operations, but had difficulty relaying this information to the Incident Commander (IC). An After Action Report (AAR) noted that radios did not always work due to distance and terrain, and though cellular phones worked well, not all teams had them.

T/V *Krymsk* and Eugene Island Communication Gaps: The USCG SMART Tier I teams deployed to the Eugene Island spill and the T/V *Krymsk* spill faced similar challenges. In both cases, the teams were operating in an aircraft of opportunity and did not have the capability to communicate directly with the ICP while in flight. The SSC associated with both incidents noted that the SMART Tier I data was valuable, but was not available until the end of the spray sortie. He noted that a real-time verbal report from the Tier I team would have increased the value of the data and facilitated more timely response decisions.

DWH Communication Gaps: Communications became a pressing issue from the first day of SMART operations. During the DWH response, SMART teams often operated many miles offshore and many miles from the ICP. The Tier I aerial teams lacked the capability to communicate with the NOAA SSC while in flight, so their reports and data were not available to the SSC until after the flight ended. Both the Tier I and Tier II/III SMART personnel on vessels were unable to communicate with SMART personnel in aircraft, because the radios on the SMART vessels were not compatible with the radios on the SMART aircraft. The Tier II/III teams on vessels also had difficulty communicating with aircraft involved in spray operations. This made coordination between spray and monitoring operations very difficult. It was several weeks into SMART operations before the SMART teams on vessels obtained the capability to transmit digital data to the ICP while at sea. Prior to that, the teams resorted to delivering the data to a Command Post on shore where the data could be emailed to ICP Houma. This meant that the day's data often was not available to the SSC until late in the evening or the next morning.

Aircraft: The project team was unable to identify an all-encompassing technological solution to the communication challenges faced by SMART teams operating in an aircraft of opportunity. However, good planning, preparation, and coordination can minimize the challenge. The Team Leader should assess the communications capability of the aircraft before departing on a mission. If the aircraft operator does not provide suitable communications equipment, the Team Leader should either arrange for suitable communications equipment or develop an alternate communications plan with the SMART Technical Specialist. At a minimum, the SMART team members should be supplied with headsets that permit two-way communication with the pilot, and preferably allow the team members to communicate directly over the aircraft's aviation radio. The use of cell phones can be an effective tool in fixed wing aircraft (with approval of the pilot) but can be difficult to use in a helicopter due to the high background noise. Another

ED_001324_00007763-00031

option is to provide the SMART Technical Specialist at the ICP with a handheld aviation radio so that two-way communication is possible when the aircraft is within radio range of the ICP.

Vessel: The SMART teams operating on vessels of opportunity have more options than those operating in aircraft, but the same philosophy of planning, preparation, and coordination applies. The Team Leader should assess the communication requirements of the mission against the communications capability of the vessel. If the vessel's communications capability does not meet the mission requirements, the Team Leader should either arrange for suitable communications equipment or develop an alternative communications plan with the SMART Technical Specialist. In the hectic environment of an oil spill response, the SMART team may find themselves on a vessel with less than ideal communications capability. The best way for a SMART team to assure reliable communication capability is to be as self-sufficient as possible. Over the course of the DWH response the SMART field teams adopted some technologies that greatly improved their communications capability. These technologies included handheld aviation VHF radios that facilitated the communication between the monitoring vessels and response aircraft as well as portable satellite communication terminals that provided voice and data communication between the vessels and the Command Post.

Vessel to Aircraft Solution: The simplest solution to addressing the challenges of SMART vessels communicating with aircraft is to provide SMART teams on vessels with hand-held aviation radios. These COTS radios are relatively inexpensive and widely available, a much better option than installing marine VHF radios in the aircraft. The hand-held aviation radios have shorter range than aircraft mounted radios, but they proved suitable for the mission.

Vessel to ICP Solution: During the latter portion of the DWH SMART operations the SMART Tier II/III team had very good success with a Broadband Global Area Network (BGAN) satellite communication system. This system provided good voice communication and adequate internet connectivity that allowed the team to relay verbal reports and digital data while at sea. The system performed well and eliminated many of the communication challenges associated with operating outside of cellular phone range. The project team identified only one COTS BGAN package that appears to meet the SMART mission requirements.

Ground Control MCD-800 Solution: The Ground Control MCD-800 is a self-contained portable BGAN package that utilizes auto-pointing antenna technology designed to maintain connectivity even on a moving vessel or vehicle. The unit is mounted in a weatherproof case, can be initiated in less than one minute and operate for up to 6 hours on an internal battery (or indefinitely with an external power supply). Based on our research and conversations with the manufacturer, the Ground Control MCD-800 should provide adequate voice and data communications capability to SMART teams operating outside cellular phone coverage. Details of the Ground Control MCD-800 can be found in Appendix C.

4.8.2 Air Monitoring

The SMART Protocol prescribes the deployment of air monitoring teams when there is a concern that the general public may be exposed to smoke from the burning of oil. Each team should utilize a real-time particulate monitor capable of detecting the small particulates (ten microns in diameter or smaller) generated by the burn. Each monitoring instrument should display and log the instantaneous particulate concentration, as well as a time weighted average (TWA) concentration. SMART recommends measuring TWA concentrations averaged over a one-hour period.

Of the four SMART deployments we reviewed, two involved SMART air monitoring of ISB operations. For both the *New Carissa* grounding and the Deepwater Horizon blowout, the SMART teams used the Thermoscientific DataRAM 4 air monitor to measure particulate material produced by the burning oil. Our research indicates that in both cases the DataRAM 4 performed well, satisfied the mission requirements, and continues to meet the minimum operating criteria for SMART. The DataRAM 4, however, is an older generation air monitoring instrument that has recently been discontinued by the manufacturer. Although the manufacturer plans to continue to provide technical support for the instrument through 2016, the project team took this opportunity to investigate newer COTS air monitoring instrumentation, in the event the USCG desires to update their SMART air monitoring capability. We identified two particulate air monitors that meet the minimum performance criteria required by the SMART Protocol. The major difference between the two units is how the monitoring information is displayed for the operator.

ThermoScientific ADR 1500: The ThermoScientific ADR 1500 is recommended by the manufacturer as a replacement for the discontinued DataRAM 4. The ADR 1500 is portable, self-powered (internal battery), and mounted in a weatherproof case. The unit can display real-time instantaneous and TWA concentration values on a small, built-in LED screen or in a text and graphical format to a connected laptop computer. The TWA display cannot, however, be configured to specifically display a one-hour TWA concentration. This is a potentially serious drawback because the SMART Protocol recommends a one-hour TWA. More details for the ThermoScientific ADR 1500 can be found in Appendix C.

TSI DustTrack DRX 8533: The TSI DustTrack DRX 8533 is portable, self-powered (internal battery), air monitoring instrument housed in a weatherproof case, and can be set up via the built in touchscreen or through a connected laptop computer. The touch screen display can show the instantaneous and time weighted average concentration values in either numerical or graphical form. Although the unit can display only a single, user-selected particle size concentration (PM1, PM2.5, or PM10), it simultaneously measures and logs the concentration for all three particle size categories. The project team had an opportunity to operate the TSI DustTrack DRX 8533 during an oil spill response training event, and found that the unit could not display real-time data through a connected laptop. The unit appears to have a high quality built-in display, which would compensate for the lack of laptop interface. More details for the TSI DustTrack DRX 8533 can be found in Appendix C.

Either the ThermoScientific ADR 1500 or the TSI DustTrack DRX 8533 would be a suitable upgrade when compared to the DataRAM 4 (which is currently in the USCG SMART inventory). A summary of the features for the DataRAM 4, ThermoScientific ADR 1500, and TSI DustTrack DRX 8533 can be found in Appendix C.

4.8.3 Spill - Tracking Drifters

As part of the SMART dispersant monitoring process, field teams attempt to sample the same portion of an oil slick at two different times. In between these two samples the field teams must move away from the area (sometimes up to two miles away) to remain safely clear of dispersant spray operations. Reestablishing the sampling locations for a subsequent sample following spray operations can be difficult. During the DWH response, USCG SMART teams improvised several different floating buoy systems that helped them mark and return to the sample location. These buoys were very simple (e.g., a weighted 5 gallon bucket), but they were effective as long as the field team could arrive within approximately 100 yards of the marker. Beyond 100 yards, the field teams had difficulty locating the marker. With a 2-mile safety standoff distance during spray operations, finding the marker proved quite challenging.

A better solution would be the use of a buoy system that would drift with the oil slick and transmit real time position information. The buoy can transmit position information either via a simple radio beacon (radio tracking system) or via a satellite communications network.

We identified two spill-tracking drifter packages that will satisfy the SMART operational requirements. The NovaTech RF-700C2 Buoy and DF-500N Direction Finder package utilizes radio beacon technology while the MetOcean iSphere is a GPS enabled package that transmits data via a satellite network. Both systems have been used successfully in the oil spill response industry. More details on spill tracking drifters can be found in Appendix C.

4.8.4 Water Parameter Measurement

In addition to fluorometry data, the SMART Protocol prescribes that water physical and chemical parameters be measured during Tier III operations. NOAA has requested that the Strike Teams develop the capability to measure and record sample depth, water temperature, conductivity, dissolved oxygen content, pH, and turbidity as part of their SMART Tier III capability. This use of a portable multi-parameter water quality sonde satisfies this capability.

The HydroLab DS 5 water quality sonde is currently in the USCG SMART inventory, but is an older instrument with a somewhat cumbersome user interface and difficult calibration and maintenance requirements. With the recent introduction of newer multi-parameter sondes with better performance and user interfaces, updating the NSF inventory to modernize the Strike Team SMART capability may be appropriate.

The SMART Protocol does not list specific performance criteria for multi-parameter water quality sondes, so the project team focused on instruments that are from well-established manufacturers and that are in common use by oceanographic and water quality professionals. All of the instruments evaluated are based on proven technologies, but two recently introduced instruments are notable in that they provide improved user interface and simplified calibration requirements.

Some researchers have suggested that a fluorometry based oil detection sensor would be a valuable addition to SMART water quality data. The project team considered this and identified only one instrument, the YSI Model 6600, which can be fitted with an optional crude oil fluorometry sensor.

HydroLab HL4: The HydroLab HL4 is the manufacturer's recommended upgrade to the HydroLab DS 5 that is currently in the USCG SMART inventory. The most notable improvement with the HL4 is in the user interface and calibration process. The HL4 utilizes a self-testing function that can alert the user when a sensor is out of calibrated range, and guide the user through the step-by-step re-calibration process. This allows the user to address only the sensors that are out of calibration and illuminates the steps associated with routinely calibrating all sensors, regardless of their condition. This self-testing function should streamline maintenance procedures and decrease the time required to prepare the instrument for deployment. More details for the HydroLab HL4 can be found in Appendix C.

YSI EXO 2: The YSI EXO 2 is another recently introduced water quality instrument that, like the HydroLab HL4, uses newer sampling technology such as a calibration self-testing feature with an assisted re-calibration guide. The YSI EXO 2 utilizes a handheld user interface that has a built-in GPS receiver that, according to the manufacturer, records the latitude and longitude of each sample location. The interface is tethered to the sonde so that GPS data can be received while the sonde is at depth. This feature could

ED_001324_00007763-00034

streamline the data collection process and improve the accuracy of the data. More details for the YSI EXO 2 can be found in Appendix C.

YSI Model 6600V2: The YSI Model 6600V2 multi-parameter sonde is an older instrument with one notable additional feature. The 6600V2 allows for the integration of a fluorometry-based oil detection sensor. The optional fluorometry-based oil detection sensor adds considerable cost ($7000) to the instrument package, but offers the advantage of providing a more accurate correlation between water parameter and fluorometric data. The project team noted, however, that the SMART data collection methodology for fluorometry data collection is different from the SMART data collection methodology for water parameters. SMART fluorometry data is collected at a constant depth across a lateral distance, whereas SMART water parameter data is collected through a range of depths at a single location. Although the fluorometry data collected by the 6600V2 may add value to the water parameter data, SMART data end-users have not requested fluorometry as part of water parameter measurement. Additionally, from an operational perspective, the 6600V2 fluorometry data would not satisfy the total fluorometry data collection requirements of the SMART Protocol. The manufacturer plans to discontinue the 6600V2 in 2015. More details for the YSI Model 6600V2 can be found in Appendix C.

Water Parameter Summary: Any of the multi-parameter water quality sondes described above will satisfy the minimum performance criteria for SMART. A comparison table for all four water parameter instruments can be found in Appendix C.

4.8.5 Water Sampling

The SMART Protocol prescribes the collection of water samples during Tier II/III dispersant monitoring operations to validate the relationship between instrument readings in the field and actual dispersed oil concentrations in the water column. NOAA has requested the Strike Teams develop the capability to collect, store, and transport discrete water samples collected at depths ranging from 1 to 10 meters.

Of the four SMART deployments reviewed for this report, discrete water sample collection was performed only for the DWH response. During that response the USCG SMART teams did not have adequate equipment for collecting water samples. The FOSC requested water samples collected from 1 and 10 meters during SMART Tier II/III monitoring operations, but without the proper water sampling equipment, USCG SMART teams improvised various pump and hose configurations. These improvised systems worked fine for collecting the water sample, but it was impractical to decontaminate the pump and hoses after each sample. This may have cross-contaminated the samples and degraded the integrity of the sampling program.

Water Sample Solution: Water samples are difficult to collect where surface oil slicks are present. When sampling in areas covered by a surface slick, care is needed to "knock" the surface slick aside so that the sampling device can be lowered into the water without becoming contaminated. This can often be accomplished by utilizing the vessel's prop wash to push away the surface oil. It is important that the sampling container be closed as it descends through the higher oil concentrations near the surface. When it reaches the desired depth, the container is opened, allowed to fill, and closed again before being brought to the surface. There are very few water sampling devices on the market that can meet these requirements. A thorough review of water sampling equipment and conversations with organizations involved in water sampling for oil spill response led the project team to two devices that should satisfy the SMART water sampling requirements.

CONBAR 7000 Sampler: For sampling from shallower depths (less than 5 m) a simple COTS "Pole Sampler" such as the CONBAR 7000 Series Telescopic Sampler should suffice. The CONBAR 7000 is a simple and reliable device for the retrieval of 1-liter water samples from a stationary vessel. With a telescopic handle capable of extending from 7 to 24 feet in length the device should be suitable for retrieving water samples from up to 5 meters below the surface. The CONBAR 7000 features a closed-open-closed sequence that minimizes the potential for contamination from near-surface water. The device also accepts standard sample size bottles (1000 ml wide mouth jar) so there is no need to transfer the water sample from the sampler to a separate storage container. More information on the CONBAR 7000 Series Telescopic Sampler can be found in Appendix C.

General Oceanics GO-FLO Sample Bottle: For deeper sample depths (up to 10 m) the project team located only one COTS device that satisfies the closed-open-closed requirement. That device, the GO-FLO Sample Bottle, has a proven history in the oil spill response and oceanographic research fields and should be adequate for the SMART water sampling requirements. The GO-FLO's unique closed-open-closed deployment sequence allows for the collection of sub-surface water samples without contaminating the collection bottle as it passes through the shallower water depths. This is a critical feature for a SMART water sampling device since there is a high likelihood that the near-surface water under an oil slick will contain more suspended oil than at deeper levels. The GO-FLO bottle is deployed in the closed position (to reduce potential contamination). A hydrostatic switch opens the bottle at both ends at approximately 10 m depth. The bottle is then brought to the desired sample depth and a weighted messenger is sent down the line to close and seal the bottle. Once back on deck, the contents can be transferred into the appropriate sample storage containers. More information on the Go-Flo Sample Bottle can be found in Appendix C.

5 RECOMMENDATIONS

As the project team considered how best to modernize the SMART dispersant and ISB monitoring program, some broad questions were posed:

- whether the 2006 SMART Protocol is still viable, given advances in technology and the lessons learned since the 2006 revision,
- whether the scope of protocol has changed as result of the unprecedented use of dispersants (surface and sub-surface applications) during the Deepwater Horizon blowout, and
- whether the informational needs and expectations of the SMART end user match up with the capacity of the USCG SMART data collection teams.

With a better understanding of these broad issues, the project team was able to review past SMART deployments to identify operational gaps and solutions that may guide future improvements to SMART responses.

5.1 SMART Protocol

As noted in Section 4, Performance Gaps and Solutions, most SMART stakeholders feel the 2006 SMART Protocol is adequate for "typical" dispersant or ISB operations. The stakeholders' comments do not suggest the need for a revision of the SMART Protocol. Most stakeholders also agreed there is a need to address the informational needs associated with an "atypical" response, but that guidance should be separate from SMART. For the purposes of this project, when we consider modernizing SMART we do so within the context of the current SMART Protocol and with typical response operations in mind.

ED_001324_00007763-00036

5.2 Informational Needs

Early in this project the project team sought better definition of the expectations, roles, and responsibilities associated with the SMART process. The SMART Protocol provides basic guidance in this area but lacks the detailed information necessary for effective SMART operations. Interviews with the NOAA SSC (the SMART end-user), provided a detailed list of the data they need from the SMART field teams. The SSCs expect the SMART field teams to follow rigorous data collection techniques and deliver the data in a timely manner. Based on recent events, the conclusion is expectations of the end-users are consistent with the guidelines of the SMART Protocol and are within the capabilities of the USCG Strike Teams.

5.3 Response Timeline

The project team sought better definition on what the SMART stakeholders consider a reasonable response time for SMART. The tiered structure of the dispersant monitoring component of SMART lends itself to the concept of cascading SMART resources during an oil spill response. Both the NOAA SSCs and the USCG SMART data collection teams agreed that deploying SMART Tier I (visual observation) on Day 1 of dispersant operations while building up to Tier II/III capability by Day 2 is a reasonable response timeline. For the ISB monitoring component of SMART, both the NOAA SSCs and USCG data collection teams agreed that full monitoring capability should be in place for the onset of burn operations.

For both dispersant and ISB monitoring operations, the USCG data collection teams should prepare for a deployment of up to 96 hours. If the response continues beyond that timeframe, contracted SMART teams should relieve the USCG data collection effort, and the USCG will continue to provide oversight for SMART field activities. Considering historic response times for past SMART deployments and current Strike Team capabilities, these response timelines appear to be realistic.

5.4 Roles and Responsibilities

The NOAA SSCs expect the USCG SMART teams to be responsible for all SMART data collection activities for the first 96 hours of a response. This includes providing the personnel, equipment, and logistics necessary to support SMART data collection activities. The USCG SMART teams should provide the communications capability necessary to coordinate field operations, deliver near real-time verbal reports to the Unified Command, and deliver digital data to Unified Command on the day the data is collected. NOAA will take responsibility for processing and evaluating the SMART data once it is received at Unified Command. With a clear understanding that the USCG will be responsible for SMART data collection for the first 96 hours of a response operation, we can consider how best to satisfy the operational requirements.

5.5 SMART Monitoring Procedures

Modernization of the USCG SMART capability is focused on the three broad categories mentioned earlier - Policy, Training, and Technology.

5.5.1 USCG SMART Policies

The most pressing policy issue is the lack of SOPs for USCG SMART activities. These SOPs can be placed into two categories, Methodology SOPs and Equipment SOPs. Methodology SOPs should describe the objective for each SMART data collection activity, and provide detailed operational information that

ED_001324_00007763-00037

includes mission planning, data collection techniques, and field reporting expectations. USCG SMART response activity documentation guidance should specify how data is captured, formatted, and archived at the Strike Team level, in such a way that allows post-operation reconstruction of activities. In the case of the DWH response, the project team was unable to find comprehensive information to reconstruct SMART activities after 4 years, because no requirements existed to document them. For this study, the project team relied largely on the recollection of the stakeholders involved to characterize the response. Appendix C lists the activities would benefit from SOPs and the topics that should be included.

The SMART Equipment SOPs should be specific to each piece of SMART equipment or instrument; and should provide detailed instructions on the maintenance, calibration, and deployment of the equipment. The equipment SOPs should be written specifically for SMART operational requirements and not overwhelm the operator with details on features not utilized in SMART data collection. The SOP should also cover proper documentation and archiving of SMART data and field activities. Recommendations on which SMART equipment would benefit from SOPs and what topics those SOPs should cover are listed in Appendix C (SMART Monitoring Procedures - Equipment and Instrumentation).

5.5.2 USCG SMART Training

SMART data collection requires specialized training and employs techniques and equipment that are unlike any other USCG response activities. Because SMART is rarely deployed, maintaining a cadre of trained responders can be a challenge. Considering the regular rotation of personnel in and out of the Strike Teams, its recommended annual SMART training that covers the overall SMART mission as well as hands-on SMART equipment operation, maintenance, and calibration training. USCG SMART training has improved over the last few years, and those persons interviewed indicated that SMART training adequately covers many aspects of SMART, however; the training curriculum has gaps, most notably water sampling, water parameter measurement, and air monitoring. This project recommends that SMART training be expanded to include all activities that would be required for a SMART response.

5.5.3 Technology, Urgent Needs

As noted in the protocol, SMART attempts to balance feasible and operationally efficient monitoring with sound scientific principles, and uses the best technology that is operationally practical. The challenge for the SMART field teams is to identify technology that satisfies the informational needs of the end-user, but is portable and user friendly enough for a small team to deploy in a rapid response operation. The project team reviewed the current inventory of USCG SMART equipment, evaluated each piece of technology on its suitability for SMART operations, and investigated newer technologies that may improve SMART operational effectiveness. Though the team investigated a range of different technologies, the focus was on those that specifically address the informational needs expressed by the NOAA SSCs or enhance the operational capabilities of the field teams.

The current inventory of USCG SMART technology includes some state of the art instrumentation that is well suited to SMART field operations, some older instrumentation that still meets the minimum SMART operational performance criteria, and some equipment that does not meet the minimum SMART operational performance criteria.

ED_001324_00007763-00038

5.5.3.1 Communications

As noted earlier, communication is the most pressing and persistent technology gap facing the USCG SMART field teams, and is considered an "urgent" need. Adequate communications were not available to the USCG SMART teams during the DWH response. The project team's investigation did not identify a one-size-fits-all technology that will solve all the SMART communications challenges. However, the combination of marine VHF radios, aviation VHF radios, and satellite communications packages described in Appendix C should address most SMART communications requirements.

5.5.3.2 Water Sampling

The water sampling equipment utilized by the Strike Teams during the DWH response did not meet the requirements of the FOSC and may have led to cross-contamination of samples. The water sampling equipment recommended in Appendix C is relatively inexpensive and has a proven history in the oil spill response industry. This should be a high priority for USCG SMART technology improvement.

5.5.4 Technology, Optional Needs

Some areas where the current USCG SMART inventory is outdated, but still meets minimum performance criteria, is particulate air monitoring and water parameter measurement.

5.5.4.1 Air Monitoring

The particulate air monitoring instrument currently in the USCG SMART inventory, the DataRAM 4, is an older generation instrument recently discontinued by the manufacturer. Although the DataRAM 4 has a proven history in the air monitoring field and will continue to be supported by the manufacturer until 2016, the technology is dated and does not provide the operator with the level of real-time information available with newer air monitoring instruments. If the USCG DataRAM 4 units are in good condition and are still within manufacturer recommended specifications, however, they should continue to satisfy the SMART mission requirements. As long as the DataRAM 4 units remain operational the project team does not consider upgrading an urgent need. Considering that the manufacturer will discontinue support for the instrument after 2016, an upgrade should be part of the USCG SMART planning process. The project team investigated newer particulate air monitoring instruments and identified two additional units that satisfy the SMART minimum performance criteria. Specifications for the ThermoScientific ADR 1500 and TSI DustTrak DRX 8533 can be found in Appendix C, along with a table comparing the attributes of all three instruments.

5.5.4.2 Water Parameter Monitoring

The HydroLab DS5 is the multi-parameter sonde currently in the USCG SMART inventory. It is an older generation with a proven history in the water resources field. The manufacturer that supports the DS5 gave no indication that support will end soon. As an older instrument, the user interface is not up to modern standards and the calibration procedures are somewhat complicated. Appendix C describes some multi-parameter instruments recently brought to market. These instruments promise to provide a better user interface with less complicated calibration and maintenance requirements. Either the HydroLab HL4 or the YSI EXO 2 described in Appendix C would be an improvement over the instruments currently in the USCG SMART inventory. As long as the DS5 units continue to perform up to manufacturer specifications, the project team does not consider upgrading to a newer generation instrument a high priority.

ED_001324_00007763-00039

5.6 Summary

The overarching conclusion from this project is that the 2006 SMART Protocol still satisfies its original intent: providing guidance for monitoring typical dispersant and ISB oil spill response operations. The primary SMART end-user, NOAA, expects the USCG SMART teams to be self-sufficient in SMART data collection activities, utilize rigorous field techniques, and deliver to the Scientific Support Coordinator scientifically based monitoring data in a timely manner USCG SMART teams are well on the way to meeting those expectations. These enhancements to Coast Guard policies, training, and technologies will improve the effectiveness of the SMART Program.

6 REFERENCES

1. American Petroleum Institute. (2013). *Industry Recommended Subsea Dispersant Monitoring Plan, Version 1.0* [PDF Document]. Retrieved from http://www.oilspillprevention.org/~/media/Oil-Spill-Prevention/spillprevention/r-and-d/dispersants/api-1152-industry-recommended-subsea-dis.pdf.
2. Barnea, N., Holloway, C., Kirn, L., & Orme, P. (2001). Proceedings from International Oil Spill Conference 2001: *A Case Study in Public Health Risk Assessment and Communication During the M/V New Carissa In-Situ Burning.*
3. BenKinney, M., Brown, J., Mudge, S., Russel, M., Nevin, A., & Huber, C. (2011a). Proceedings from International Oil Spill Conference 2011: *Monitoring Effects of Aerial Dispersant Application during the MC252 Deepwater Horizon Incident.*
4. BenKinney, M., Parscal, B., Huber, C., Wood, B., Russell, M., Nevin, A., & Gass, M. (2011b). Getting SMARTer: Recommendations for Improving SMART Monitoring Procedures Based on Experiences from the Deepwater Horizon Response Scientific Support for Deepwater Horizon (DWH) Aerial Dispersant Operations. *2011 International Oil Spill Conference.*
5. Congressional Research Service. (2010). *Deepwater Horizon Oil Spill: The Fate of the Oil.* (CRS Publication No. R41531) [PDF Document]. Retrieved from http://fas.org/sgp/crs/misc/R41531.pdf.
6. Daling, P., Holumsnes, A., Rasmussen, C., Brandvik, P., Leirvik, F. (2010). *Development and Testing of a Containerized Dispersant Spray System for Use in Cold and Ice Covered Areas.* Oil-in-Ice JIP Report No. 13/ARCTECH P4.
7. Environmental Protection Agency. (2010a). *EPA Technical Overview of Ongoing Air Monitoring Efforts in Response to the Gulf Oil Spill* [PDF Document]. Retrieved from http://www.epa.gov/bpspill/air/airtechoverview.pdf.
8. Environmental Protection Agency. (2010b). *Quality Assurance Sampling Plan Air Sampling and Monitoring For Deepwater Horizon Incident* [PDF Document]. Retrieved from http://www.epa.gov/bpspill/samplingplanjune1/EPA_Region_6_Air_Sampling_and_Monitoring_QASP_050510.pdf.
9. Environmental Protection Agency. (2010c). *Deepwater Horizon Rig Explosion Air Sampling & Monitoring Data Management Plan* [PDF Document]. Retrieved from http://www.epa.gov/bpspill/samplingplanjune1/AppendixE-Data_Management_Plan_5-30.pdf.
10. Gass, M., Albert, V., Huber, C., Landrum, R., & Rosenberg, E. (2011). Proceedings from International Oil Spill Conference 2011: Aerial Dispersant Operations in the Deepwater Horizon Spill Response - A Framework for Safely Mounting a Large Scale Complex Dispersant Operation.
11. Houma ICP Aerial Dispersant Group. (2010). After Action Report Deepwater Horizon MC252 Aerial Dispersant Response.

12. Hunt, A. (2012). U.S. Coast Guard National Strike Force The World's Best Responders – Any Time, Any Place, Any Hazard.
13. Joeckle, J., Walker, A. H., Scholz, D., & Huber, C. (2011). Dispersant Use Approval: Before, During and After Deepwater Horizon. 2011 International Oil Spill Conference.
14. Levine, E., Mearns, A., Shigenaka, G., Miles, S., Bejarano, A., Magdasy, B., & Bond, K. (2012). Review of SMART Data for Aerial Dispersant Operations. *Prepared for US Coast Guard Federal On-Scene Coordinator Deepwater Horizon MC252.*
15. Levine, E., Stout, B., Parscal, B., Walker, A., & Bond, K. (2011). Aerial Dispersant Monitoring Using SMART Protocols during the Deepwater Horizon Spill Response. *2011 International Oil Spill Conference.*

16. National Oceanic and Atmospheric Administration. (1999). *Situation Update - NOAA Evening Report.*
17. National Oceanic and Atmospheric Administration. (2009a). *NOAA Evening Report.*
18. National Oceanic and Atmospheric Administration. (2009b). *NOAA Brief Update.*
19. National Oceanic and Atmospheric Administration. (2012). *The Future of Dispersant Use in Oil Spill Response Initiative* [PDF Document]. Retrieved from http://www.crrc.unh.edu/sites/crrc.unh.edu/files/media/docs/Workshops/dispersant_future_11/Dispersant_Initiative_FINALREPORT.pdf.
20. National Oceanic and Atmospheric Administration. (2006). *SMART at the New Carissa Oil Spill.* Washington, DC: U.S. Government Printing Office.
21. National Response Team. (2013). *Environmental Monitoring for Atypical Dispersant Operations: Including Guidance for Subsea Application, Prolonged Surface Application* [PDF Document]. Retrieved from http://rrt6.org/Uploads/Files/Appendix%2034%20--%20NRT%20Atypical%20Dispersant%20Guidance_Final_5-30-2013.pdf)
22. Parscal, B. (2011). Recent Advances in the SMART Protocol and it's Application During the Deepwater Horizon Response. *OSPR/Chevron Oil Spill Response Technology Workshop.*
23. Parscal, B. (2013). 2013 SMART Progress Report. *OSPR/Chevron Oil Spill Response Technology Workshop.*
24. Regional Response Team 6. (1994). *RRT 6 In-Situ Burn Plan Part I (Operations Section).* [PDF Document]. Retrieved from http://www.losco.state.la.us/pdf_docs/isb_plan_part1_operations.pdf.
25. Regional Response Team 6. (2001). *RRT 6 FOSC Dispersant Pre-Approval Guidelines and Checklist* [PDF Document]. Retrieved from http://www.losco.state.la.us/pdf_docs/RRT6_Dispersant_Preapproval_2001.pdf.
26. Sørstrøm, S. (2009). *Full scale field experiment 2009 cruise report.* Oil in Ice – JIP Report No. 25.
27. United States Coast Guard. (1999). *"Crisis on the Coast" Federal On Scene Coordinator's Report and Assessment of M/V New Carissa Oil Spill Response - Volume II* [PDF Document]. Retrieved from http://www.akrrt.org/Archives/Response_Reports/AAR_NewCarissa_Vol-II_1999.pdf.
28. United States Coast Guard. (2011). *BP Deepwater Horizon Oil Spill Incident Specific Preparedness Review (ISPR) Final Report* [PDF Document]. Retrieved from http://www.hawaiioceanlaw.com/files/bpdwh.pdf.
29. United States Government Accountability Office. (2012). *Report to Congressional Requesters, OIL DISPERSANTS Additional Research Needed, Particularly on Subsurface and Arctic Applications* (GAO-12-585) [PDF Document]. Retrieved from http://www.gao.gov/assets/600/591232.pdf.
30. Walker, S. (2010). *Subsurface Monitoring Deepwater Horizon Response* [PDF Document].

Retrieved from http://www.oil-spill-info.com/Spill_photos/DeepWaterHorizon/Presentations/DWH_Sub-Sea_Dispersant_Monitoring-NOAA_Walker_12-02%200945.pdf.

APPENDIX A. SMART, TECHNOLOGY, METHODS, AND OUTCOMES 2014 OPERATIONAL ISSUES

APPENDIX A Deep Water Horizon, 2010 (Dispersant Operations)

APPENDIX B Deep Water Horizon, 2010 (Dispersant Operations): Incident Overview

On 20 April 2010, the Macondo Prospect well, 45 miles off the coast of Louisiana, experienced a catastrophic blowout, causing a major explosion, fire, and subsequent sinking of the Mobile Offshore Drilling Unit Deepwater Horizon. The blowout resulted in a major oil spill 1 mile below the surface of the ocean, leading to an unprecedented oil spill response, the most challenging and complex our nation has experienced.

During the Deepwater Horizon (DWH) response, aerial dispersants were applied as part of the operational response to minimize the potential for surface oil slicks to impact wildlife and environmentally sensitive shoreline ecosystems. The RRT 6 Regional Contingency Plan (Regional Response Team 6 [RRT6], 2001) requires that any use of chemical dispersant in the region's waters be accompanied by the implementation of Special Monitoring of Applied Response Technologies (SMART) protocols. Accordingly, the protocols were initially implemented when aerial dispersant operations began on 22 April 2010 and continued through the final aerial dispersant application on 19 July 2010.

SMART monitoring was initially conducted by the United States Coast Guard (USCG) National Strike Force (NSF), and later augmented by industry contractors and other USCG personnel. All SMART monitoring operations were coordinated through the USCG SMART Supervisor with monitoring results reported to the Federal On-Scene Coordinator (FOSC), through the National Oceanic and Atmospheric Administration (NOAA) Scientific Support Coordinator (SSC), who provided technical guidance. This was the first time SMART monitoring was implemented as part of a large-scale prolonged response effort during a Spill of National Significance (SONS).

Aerial dispersant operations were coordinated through the Aerial Dispersant Operations Group located at the Incident Command Post, Houma, LA (ICP Houma) and occurred over a period of 90 days, 61 of which involved active spraying. Twelve aircraft participated in the spray operations with a total spray capability of approximately 100,000 gallons per day. The spray aircraft applied approximately 973,000 gallons of dispersant during 412 sorties within an operating area of 18,000 square miles. It is estimated that the aerial spray effort dispersed approximately 12 to 18 million gallons of oil.

The SMART teams adhered to the three levels (or Tiers) of effort described in the SMART Protocol. On several occasions, the Tier III effort was enhanced as described later and labeled Tier III+ in this report.

APPENDIX C Deep Water Horizon, 2010 (Dispersant Operations): Level of Effort (Number of Personnel and Number and Timing of Sorties)

SMART teams employed in the DWH response included three crew boats (>100 ft length), two small boats (<30 ft length), three helicopters, two forward staging areas, 50 USCG personnel, 30 contractor personnel, six C-3 Fluorometer kits, two Self-Contained Underwater Fluorescence Apparatus (SCUFA) Fluorometer kits, one LISST (Laser In-Situ Scattering and Transmissometry), and 3 Hydro Labs DataSonde portable

ED_001324_00007763-00043

water labs. Out of 118 SMART missions conducted during the response, 77 were Tier I, 30 were Tier II/III, and 11 were Tier III+.

APPENDIX D Deep Water Horizon, 2010 (Dispersant Operations): Measurement Techniques

To monitor the efficacy of dispersant applications, the SMART teams used the following measurement techniques.

- **Tier I:**
  - SMART Tier I observations were conducted by USCG personnel in helicopters in close coordination with spray aircraft. A trained Tier I observer flew over the oil slick and visually assessed and documented the efficacy of the dispersant application. This information was then reported back to the SSC at ICP Houma.
- **Tier II:**
  - Vessel-based field teams deployed a fluorometer at a water depth of 1 meter to measure and record the amount of oil present in the sample area before and after dispersant application. Discrete water samples were also collected within the sample area before and after dispersant application. The water samples were collected coincident with significant fluorometry readings. The Tier II fluorometry data, consisting of Global Positioning System (GPS) tracking information, photography, and all associated documentation, was physically delivered to the SMART forward staging area where it was digitally transmitted to ICP Houma. The water samples were physically delivered to ICP Houma by courier.
- **Tier III:**
  - Field teams expanded on the Tier II procedures to include fluorometry and water sampling at multiple depths (either 1 m and 5 m, or 1 m and 10 m). In most cases, this was accomplished by the use of two fluorometers operating simultaneously at different depths, although occasionally a single fluorometer was used to sample one depth, then return to the same area to sample the second depth. When circumstances permitted, Tier III teams deployed a portable water lab (Hydrolab DataSonde) along with the fluorometers. The portable water lab recorded data on water temperature, pH, conductivity, dissolved oxygen, and turbidity.
- **Tier III+:**
  - Although not prescribed in the SMART Protocol, several missions were conducted at what was referred to as Tier III+. These missions followed all the parameters of the normal Tier III protocol, but included more advanced instrumentation such as LISST, and increased water sampling for laboratory analysis.
  - The Tier III+ vessel was also fitted with an on-board dispersant spray system which allowed the team to perform self-contained, tightly controlled dispersant efficacy tests on small patches of oil. This provided valuable insight into how well the oil dispersed at various states of weathering and under various sea states.

APPENDIX E Deep Water Horizon, 2010 (Dispersant Operations): Equipment and Technology Used

At the onset of the DWH response, the SMART teams deployed with the equipment and technology currently in their inventory. Some of that equipment was new (less than 1 year old) and of the latest technology, and some was more dated. As the response progressed, much of the older equipment was replaced with newer technology.

ED_001324_00007763-00044

- **Tier I:**
  - Aerial Tier I SMART operations utilized high-resolution digital cameras, portable GPS units, NOAA Job Aids, and various documentation forms. High-resolution digital cameras with built-in GPS capability were added later in the response.
- **Tier II/III:**
  - The USCG NSF SMART Tier II/III teams utilized C3™ fluorometers manufactured by Turner Designs (Figure A-1) for all Tier II/III SMART missions. The C3™ fluorometer was mounted in a specially constructed housing which allowed the instrument to be towed horizontally through the water. The C3™ fed data through a hard-wired connection to a laptop on the deck of the vessel where the fluorometry data were combined with GPS data and logged for later transmission to data processing personnel at ICP Houma. To supplement fluorometry for Tier III monitoring, a Hydrolab DataSonde portable water lab manufactured by Hach Hydromet (Figure A-2) was utilized which recorded water temperature, dissolved oxygen, pH, and turbidity. Collection of the portable water lab data was considered a lower priority compared to the collection of fluorometry data, so the Hydrolab DataSonde was deployed only when its use did not interfere with SMART fluorometry and water sampling procedures. When deployed, the DataSonde was suspended in the water very near the fluorometer, while both instruments recorded data separately. Since the DataSonde was not set up for towing, the vessel had to be stationary for accurate positioning. The DataSonde data was logged separately from the fluorometry, and did not include GPS position information.

Figure A-1. Turner Designs C3™ fluorometer in specially constructed housing.

Figure A-2. Hydrolab DataSonde portable water lab.

- The contracted SMART teams from Oil Spill Response Limited (OSRL) utilized SCUFA fluorometers manufactured by Turner Designs for their Tier II/III SMART missions. The SCUFA fluorometer was mounted in a specially constructed weighted housing (Figure A-3) which allowed the instrument to remain in a vertical orientation while being towed through the water. The SCUFA is an earlier generation fluorometer that lacks the depth recording capability of the C3™ and is a bit more difficult to tow through the water.

Figure A-3. SCUFA fluorometer in weighted housing.

- For both the USCG NSF and OSRL teams, the fluorometers fed data through a cable to a Panasonic CF-30 laptop computer with an internal GPS receiver (Figure A-4). The fluorometry and GPS data were displayed and logged by a suite of software specifically configured for SMART operations.

Figure A-4. Panasonic CF-30 laptop computer with internal GPS receiver and SMART software.

- Water sampling at the 1 m and 5 m depth was conducted using either an off-the-shelf pole-mounted water sampler or an improvised submersible pump on a long pole (Figure A-5). Sampling at 10 m depth proved more difficult, but later in the response, the USCG NSF team fashioned a small pneumatic pump that could successfully pull a water sample from a 10 m depth. A general purpose submersible pump/hose setup was used that was not designed for water sampling, and may have introduced some shortcomings, such as potentially adsorbing oil into the pump/hose surfaces (the manufacturer lists the hose material as "pvc/nitrile"). These issues are discussed in Appendix B.
    - The OSRL team utilized a GO-FLO sampling bottle (Figure A-6) that effectively retrieved water samples from the 10 meter depth. The GO-FLO bottle is deployed in the closed position (to reduce potential contamination from the surface oil) on a metered cable. A hydrostatic switch opens the bottle at both ends at a depth of approximately 10 m. A messenger is then sent down the line to close and seal the bottle before retrieval.

Figure A-5. Improvised water sampling pump for 5 m samples.

Figure A-6. GO-FLO water sample bottle for 10 m samples.

- Of the five vessels used by the SMART teams during the DWH response, all were vessels of opportunity and four of the five vessels remained available for the duration of the SMART operations. Three vessels were used for the off-shore operations. These vessels ranged from 110 ft to 150 ft in length, and all had a cruising speed of greater than 20 kts. See Figure A-7 and Figure A-8. Two small boats of less than 30 ft in length were used primarily to shuttle personnel and supplies.

Figure A-7. SMART Tier II/III & III+ OSV *International Peace*.

Figure A-8. SMART Tier II/III OSV *Warrior*.

APPENDIX F Deep Water Horizon, 2010 (Dispersant Operations): Data Products

Another challenge faced early in the DWH response was how best to present the results of the SMART monitoring effort, and again, the 2006 SMART Protocol provided little guidance. Over the course of the response the SMART data products evolved to meet the demands of the end-users and improved as the capabilities of the field teams improved.

- **Tier I:**
  - The final Tier I data product that evolved of the course of the response (Figure A-9) was in a Keyhole Markup Language (KML) or KML Zip archive (KMZ) file format and was

ED_001324_00007763-00049

available on the web-based NOAA ERMA situation map. The individual photos were geo-referenced on the map and each photo was annotated with observer comments and other pertinent information.

Spray on . More steamers of dark heavly oil wilth dull silver sheen.

Title	SMART Air Team 2
Sub Title	Tier I Documentation
Comment	Spray on . More steamers of dark heavly oil wilth dull silver sheen.
Location	N 28° 25.394' W 088° 30.667'
Datum	Lat / Lon WGS 84
Elevation	1886 ft
Direction	0.0°
Time	06/18/2010 11:22:47 AM
Time Zone	(GMT-05:00) Central Daylight Time
Camera Make	RICOH
Camera Model	Caplio 500SE
Camera Software	2.78 Rev A
Original File	RIMG0002.JPG

Figure A-9. Example of the DWH SMART Tier I final data product.

- **Tier II/III:**
  - The SMART Tier II/III data product also evolved and improved over the course of the DWH response. After consulting with the NOAA SSCs and other end-users, the processing team developed a one-page poster format (Figure A-10) that summarized the SMART Tier II/III monitoring results. The poster was accompanied by a more detailed written evaluation of the Tier II/III data.
  - The Tier II/III water sample analyses were in the form of written lab reports that summarized the analytical results.

ED_001324_00007763-00050

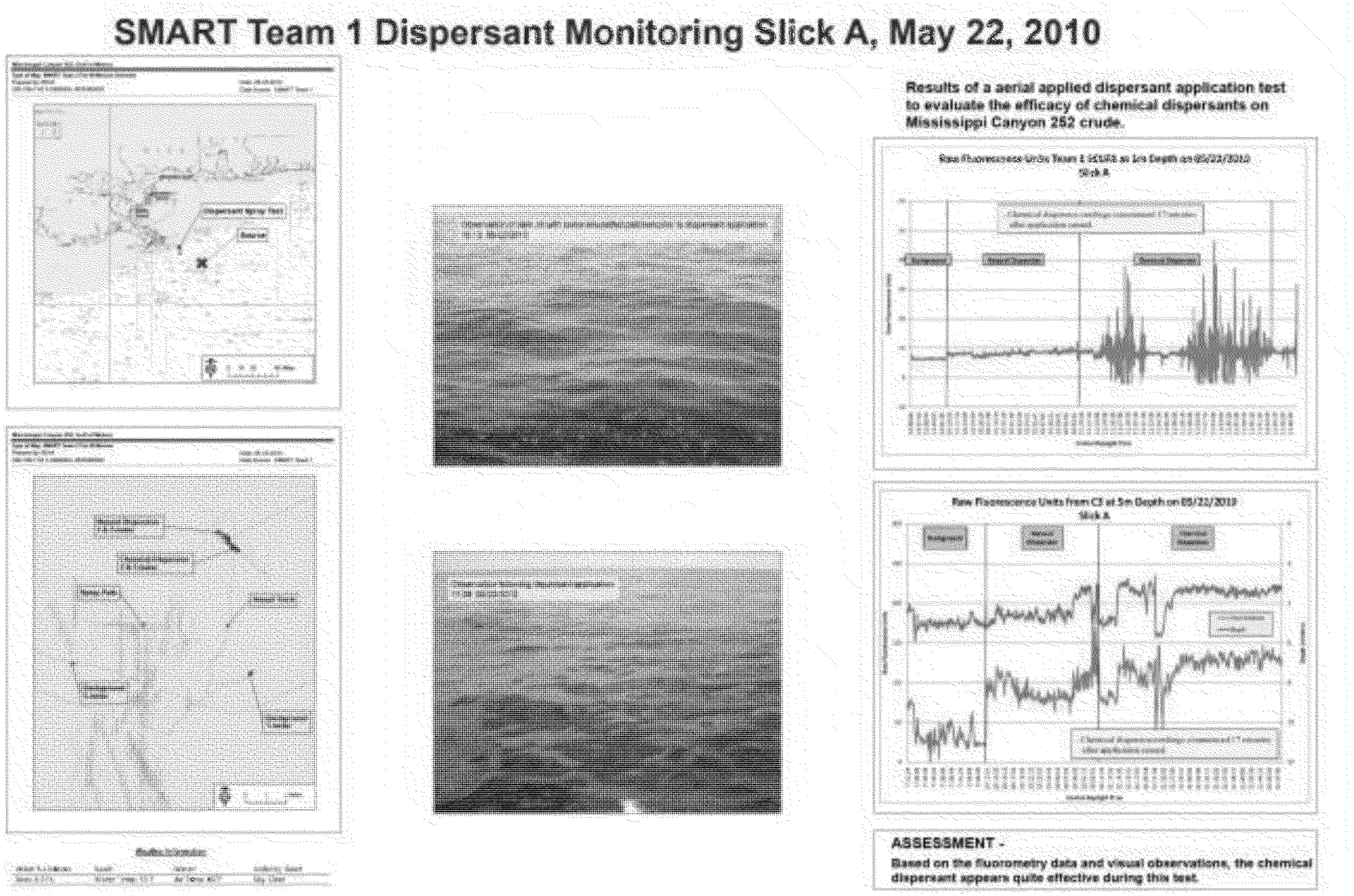
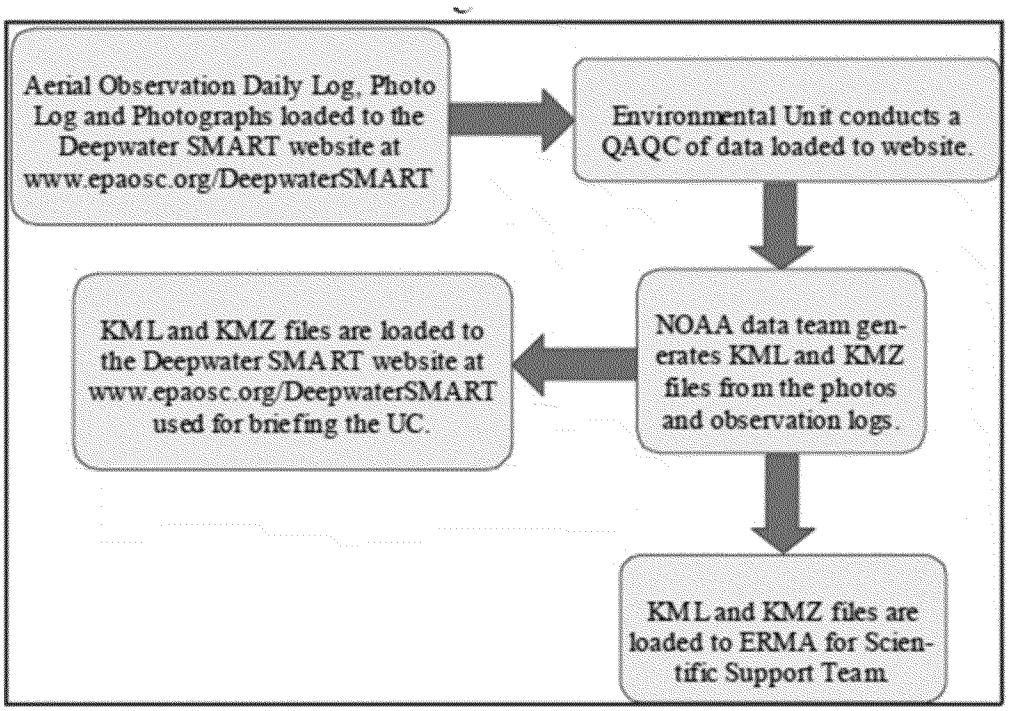


Figure A-10. Example of a SMART Tier II/III final poster.

APPENDIX G Deep Water Horizon, 2010 (Dispersant Operations): Data Processing and Analysis Practices

Data processing and analysis was a formidable challenge for the DWH Dispersant Monitoring Group, as neither the 2006 SMART Protocol nor previous SMART deployments provided adequate instruction on how SMART data should be processed, analyzed, and presented for a response of this magnitude. It is important to note that the Deepwater Horizon dispersant operations were of an extraordinary scale and duration. As dispersant use became more visible (and controversial) during the course of the response, the FOSC requested SMART data products that could be distributed to a broader audience. Thus, the SMART data processing and data analysis team had to create a data product that provided the NOAA SSC with the technical information needed to make an informed recommendation to Command, as well as a more generalized data product suitable for a broader, less technical audience.

- **Tier I:**
  - The Tier I data consisted primarily of an Operations Log, Photo Log, and a set of photographs. Once the data arrived at ICP Houma, it was reviewed by the Environmental Unit for completeness and accuracy then converted to a KML or KMZ file format by the NOAA data team (Figure A-11). Initially, the KML and KMZ files were created by manually tagging the photographs with the GPS position documented by the observers. Later, the Tier I teams procured digital cameras that could communicate wirelessly (via Bluetooth) with handheld GPS units. This allowed GPS information (date, time, location, and elevation) to be digitally encoded with the photograph. The location associated with the photograph was the location of the photographer, not the location of the target. The KML and KMZ files were then uploaded to the Environmental Protection Agency On-Scene Commander (EPAOSC) web server, and the web-based NOAA Environmental Response Management Application® (ERMA) situation map, both of which are available to the NOAA SSC and FOSC.



ED_001324_00007763-00052

Figure A-11. DWH SMART Tier I data processing flow chart.

- **Tier II/III:**
  - SMART Tier II/III data processing (Figure A-12) and analysis practices evolved and improved dramatically during the course of DWH SMART operations. Early in the DWH response, the SMART Tier II/III field team members performed basic data processing in the field after each mission. The field processed data package included basic Excel charts of the fluorometry data, annotated photos in a PowerPoint format, and a written Operations Log. The data package was emailed to the Monitoring Group Leader who passed it on the NOAA SSC at ICP Houma. The SSC considered the fluorometry data, photo documentation, and Operator comments when evaluating the effectiveness of the dispersant application. One SSC involved in SMART operations at the time commented that, though not ideal, the field processed data package provided adequate information to form the basis of an evaluation. During this early phase of the response, there was a USCG NSF member on the field team with exceptional data processing skills. This individual was able to generate valuable dispersant monitoring data that was of use to the NOAA SSC without further processing at ICP Houma. The Monitoring Group quickly identified the need for a dedicated SMART processing team at ICP Houma however, to relieve the field teams of the data processing burden and provide a level of constancy to the process.

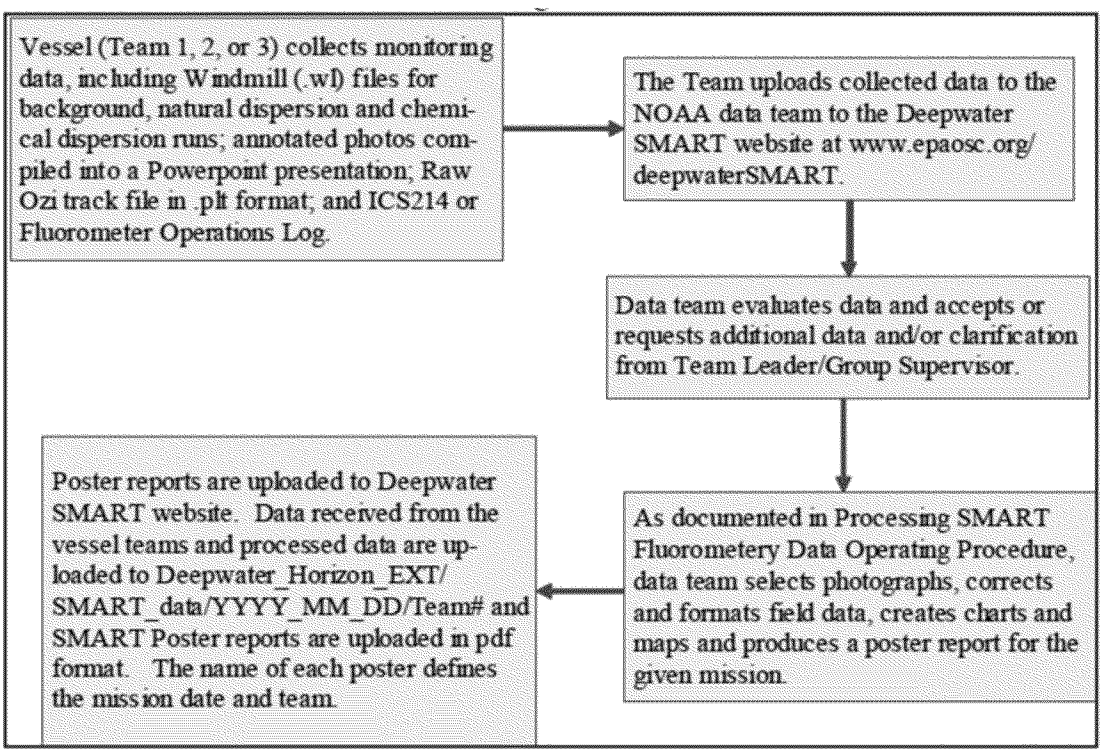


Figure A-12. Flow chart for the Tier II/III data processing procedure that evolved during the DWH response.

  - Later, a standardized SMART Tier II/III field-reporting guide was developed to facilitate the processing of the large amount of data arriving from the field teams. This guide provided the field teams with a standardized format for packaging the data and standardized process for transmitting their field data to ICP Houma. The C-3 SMART Data Formatting Guide specified which data files are included in the package, how the files are formatted and named, how the data is transmitted, and where the data package is delivered. (Figure A-13)

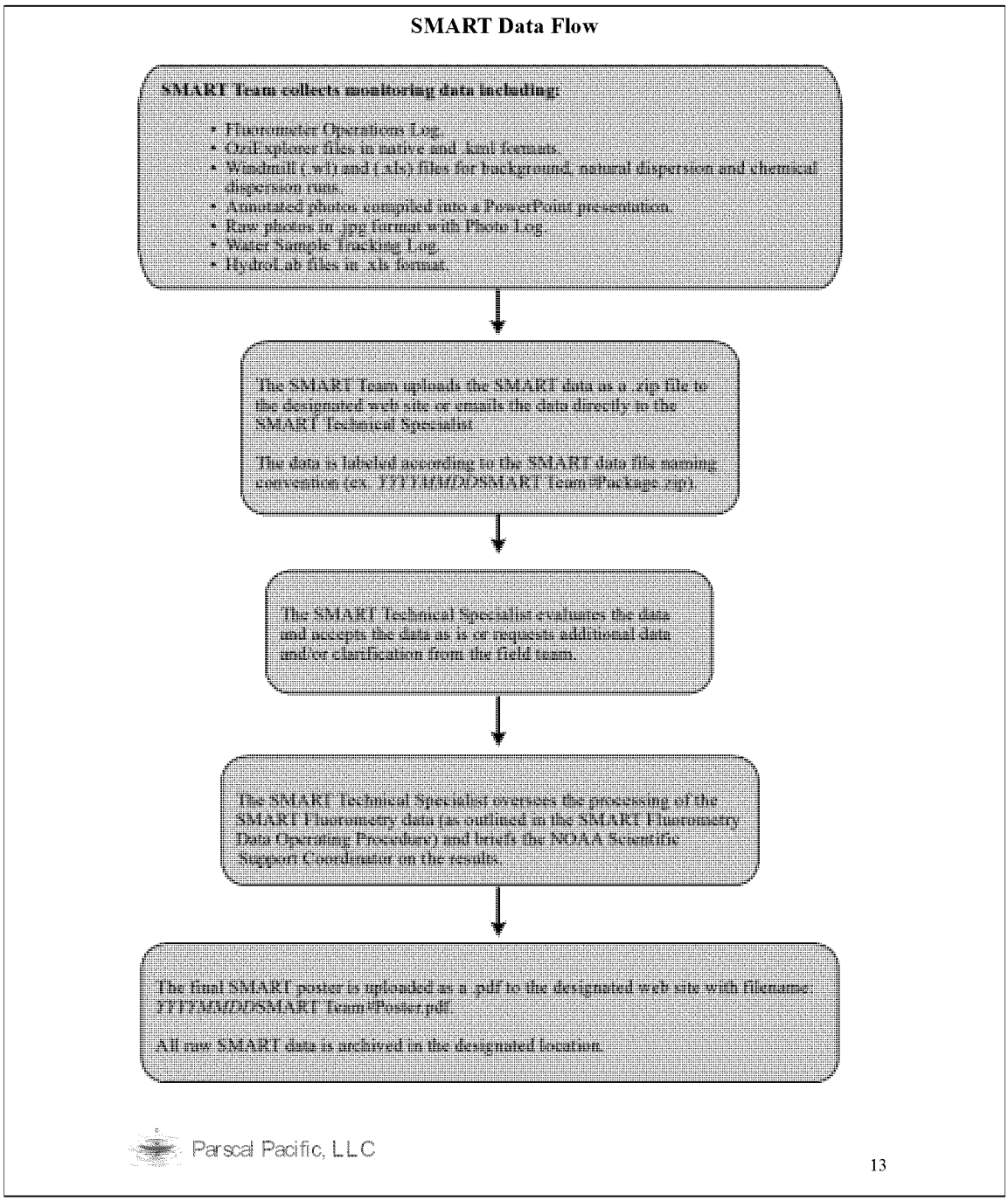


Figure A-13. Flowchart summarizing the SMART data formatting procedure.

- The SMART Tier II/III data processing team initially consisted of two NOAA contracted Geographic Information System (GIS) experts working closely with the SMART Technical Specialist (TS) and an OSRL SMART team member. Later, the NOAA GIS experts were replaced by two GIS experts from the Environmental Protection Agency (EPA) who were available to the SMART processing team full time. After SMART Tier II/III operations were scaled back to one field team, the SMART data processing team was reduced to one GIS expert and the SMART TS. The GIS expert provided geospatial support, while the SMART TS performed the fluorometry processing and overall data analysis.

ED_001324_00007763-00055

- When evaluating the effectiveness of a dispersant application, the SMART TS considered all the data available. For DWH SMART operations, this data included fluorometry readings taken at 1 and 5 meters (or 1 and 10 meters, depending on the methodology of the field team), photographs taken by the field team, and the field team's Operations Log. If there were any ambiguities or inconsistencies in the SMART data, the TS contacted the SMART Field Team Leader for clarification.
- The SMART Protocol (2006) recommends the TS "look for trends and patterns providing good indications of increased hydrocarbon concentrations above background. As a general guideline only, a fluorometer signal increase in the dispersed oil plume of five times or greater, over the difference between the readings at the untreated oil slick and background (no oil), is a strong positive indication." Due to the enormous amount of oil in the water from prolonged natural dispersion and extensive chemical dispersant application during the DWH response, the background fluorometry readings became unreliable. The SMART field teams had little confidence that they were encountering any water that was unaffected by the spill. As a result, the TS placed less emphasis on the background fluorometry readings, and more emphasis on the difference between the Natural Dispersion and Chemical Dispersion readings.
- The fluorometry data from each SMART mission was examined for accuracy and reliability, and then combined with the SMART photographs, Operations Log, and Field Team Leader comments to arrive at a final evaluation.

- **Tier III+:**
  - Though the data from the LISST instrument was of interest to the research community, it was not included in the processing and evaluation of the SMART Tier II/III data.

APPENDIX H Deep Water Horizon, 2010 (Dispersant Operations): Data Transmission

Due to the magnitude of the DWH event, data transfer was a formidable challenge throughout the duration of SMART operations. With multiple SMART Teams operating over a large geographic area far from ICP Houma, data flow was one of the first challenges faced by the Dispersant Monitoring Group during the DWH response. The 2006 SMART Protocol provides a general guideline for data flow, but does not address the specifics of efficiently moving data from the field to Incident Command in a timely manner.

- **Tier I:**
  - SMART Tier I operations were based out of ICP Houma, so the teams were able to hand deliver their photos and documentation to Command Staff immediately after each flight. Later in the response, the EPA offered their limited access On-Scene Coordinator website as a repository and clearinghouse for the DWH SMART data. This allowed the field teams to upload their data directly from the field.
- **Tier II/III:**
  - The first Tier II/III SMART teams on scene were made up of USCG NSF personnel who set up a SMART Forward Command Base in Venice, LA. The SMART vessels departed Venice each morning and returned late in the evening with the day's data. These data were then handed over to the USCG Field Response Coordinator in Venice who emailed the data up the USCG chain of command and ultimately to the NOAA SSC. Later in the response, the EPA offered their On-Scene Coordinator website as a limited access repository and clearinghouse for the DWH SMART data. This allowed the field teams to upload their formatted data (as described in Section A.1.5) directly from the Forward Command Post.

ED_001324_00007763-00056

APPENDIX I Deep Water Horizon, 2010 (Dispersant Operations): Data Product Turnaround Times

Delivering processed SMART data to Command in a timely manner was an immense challenge for the SMART teams early in the response. This was primarily due to the geographic scale of the response and the limited communications capability available to the field teams. Data turn-around times improved greatly over the course of the response as the SMART teams developed more efficient techniques.

- **Tier I:**
  - Verbal Tier I reports were phoned in to ICP Houma when circumstances allowed. This was generally done when the helicopter landed for re-fueling or at the end of the flight.
  - Digital Tier I data were delivered to the Monitoring Group (either in person or by webserver) shortly after the flight ended (usually by early evening), and the final data package was available to Command Staff later that evening or early the following morning.
- **Tier II/III:**
  - Immediate verbal reports from the Tier II/III field teams were delivered to ICP Houma when the technology on the vessel allowed and the information was requested by Command Staff.
  - Generally, the Tier II/III field data were available to the ICP Houma Processing Team late in the evening (initially via email, later via webserver) and the final data product was available to Command Staff mid to late the following day. The data processing team could usually turn around the Tier II/III data within 24 hours. The Tier II/III water sample analyses were generally available within 2-7 days, depending on the backlog. (M. BenKinney, February 3, 2014).

APPENDIX J Deep Water Horizon, 2010 (Dispersant Operations): Level of Satisfaction with the Data Product

There appeared to be a high level of satisfaction with the SMART data products during the DWH response. The NOAA SSC, the primary user of SMART data, commented that even the earlier, less sophisticated SMART data products provided him with adequate information to make informed operational recommendations to the FOSC. (E. Levine, 2014)

- **Tier I:**
  - A NOAA SSC involved with the DWH dispersant operations indicated that the SMART Tier I data were useful and provided the information necessary to make informed operational recommendations to the FOSC (E. Levine, 2014).
- **Tier II/III:**
  - Though the data products from the earlier Tier II/III operations were not as sophisticated as the SMART posters developed later in the response, the SSC found the earlier products sufficient to make informed operational recommendations.
  - The SMART Tier II/III poster and associated written evaluation that was developed later in the DWH response was well received and seemed to satisfy the needs of the SSC and Command Staff.
  - A NOAA SSC involved with the DWH dispersant operations indicated that the results from the Tier II/III water sample analyses were not considered when making operational recommendations to the FOSC. The water sample analyses were generally not available until days or weeks after collection and were not considered pertinent to ongoing operations. (E. Levine, 2014)

APPENDIX K Deep Water Horizon, 2010 (Dispersant Operations): Evolution of the SMART Protocol Following the Event

SMART dispersant monitoring procedures and methodologies evolved a great deal during the DWH response. Though much of this evolution was in response to the unanticipated challenges of a large and prolonged response, the Dispersant Monitoring Group also learned many lessons that are equally applicable to a smaller, more typical dispersant operation.

In an effort to improve SMART program effectiveness, many SMART stakeholders and participants have documented their experience with SMART during the DWH response and have offered comments and recommendations for future SMART operations. Below are some of the comments and recommendations that came out of the DWH experience.

- The USCG BP Deepwater Horizon Oil Spill Incident Specific Preparedness Review Final Report, January 2011 notes: (United States Coast Guard [USCG], 2011)
    - SMART monitoring is a suitable protocol to evaluate dispersant effectiveness. However, its application in an offshore environment, including coordination with spray aircraft, remains a challenge.
    - Rapid deployment of dispersant resources is critical to the successful use of dispersants. This implies that the rapid notification and deployment of the SMART teams is critical to a successful dispersant monitoring effort.
    - There needs to be a rigorous sampling and monitoring program if dispersants are applied in subsea environments.
    - The Coast Guard should engage EPA and the National Oceanic and Atmospheric Administration (NOAA) to continue to enhance SMART monitoring technologies and protocols in offshore environments.
    - Training, field exercises, and field experience are necessary to maintain proficiency of spotters, logistical and operational coordinators, pilots, and SMART teams.
    - The Coast Guard should ensure that training and exercise programs include key potential participants (e.g., Oil Spill Response Organizations [OSROs], industry, Coast Guard, EPA, and Department of Defense components) in dispersant operations including monitoring in the offshore environment to improve performance of spotters, pilots, aircraft spray systems, logistics, communication, and coordination.
- The United States Government Accountability Office notes (United States Government Accountability Office [USGAO] (2012):
    - One expert said that the SMART Protocols are simple, well defined, and standardized and are able to quickly provide information to decision makers during emergency response operations. However, other experts noted that the protocols do not provide an analysis of oil composition to determine whether and how long the dispersant remains present in the water and continues to break up the oil, making it difficult to assess the true effectiveness.
    - Additionally, the SMART Protocols were focused on providing operational guidance on dispersant effectiveness and were not designed to monitor the fate, effects, or impacts of chemically dispersed oil, but many experts said that research should be conducted to integrate monitoring of fate and effects into the protocols. Doing so would help inform research efforts to better address gaps and help spill responders make better decisions.
    - Some experts also noted that the fluorometry technology used in SMART is limited in that it only measures a portion of oil components and that the standardization and calibration of this

ED_001324_00007763-00058

equipment could be improved.
  - Many experts also noted that SMART could be enhanced with different, newer equipment, such as particle size analyzers to measure oil droplet size, which could better monitor chemically dispersed oil.
  - Moreover, a February 2012 NOAA review of SMART monitoring protocol implementation during the Deepwater Horizon incident found that the SMART Protocols were not sufficient to determine the effects of the dispersant and oil on marine life in the water column. In addition, the report found that for large spills with information needs beyond the question of whether the oil is dispersing, the protocols need to be revamped. This review concluded that the SMART monitoring methodologies used during the Deepwater Horizon incident lacked rigor and repeatability.
  - The SMART Protocols are designed for use with surface application of dispersants and do not monitor dispersed oil resulting from deep water dispersant application. NOAA recognized such limitations in its recent review of the SMART data from dispersant monitoring during the Deepwater Horizon incident and has acknowledged improvements could be made.
- John Joeckel of SEA Consulting Group noted that SMART procedures, data deliverables and method of delivery, should be reviewed and revised in light of the actual operational and coordination requirements encountered during the DWH response. (Joeckle, Walker, Scholz, & Huber, 2011)
- The Coastal Response Research Center identified subsurface dispersant monitoring as a technology area with a large information gap and suggested the use of the SMART Protocol or some analogous methodology to fill that gap. (National Oceanic and Atmospheric Administration [NOAA], 2012)
- The SMART Technical Specialist for the DWH response recommended: (Parscal, 2011)
  - Identifying and training the personnel required to fill the various SMART operational roles including, SMART aerial spotting, SMART data acquisition and SMART data processing.
  - Developing standardized, equipment specific training for the SMART field teams.
  - Developing standard operating procedures (SOP) for the various SMART operational roles including, SMART aerial spotting, SMART data acquisition and SMART data processing.

As evident by some of the above comments and recommendations, there is a wide range of views on not only how to best implement SMART but at a more fundamental level, how to define the core mission of SMART. From a practical perspective, expanding the core mission of SMART to include measuring the fate and effects of the dispersed oil or determining the effects of the dispersed oil on marine life (as suggested by the GAO report) will add a level of complexity that is currently beyond the capabilities of the SMART teams. Although the additional information gained by an expanded SMART program would be of value to a broader response community, adding complexity to the program runs the risk of distracting the teams from the current SMART mission of providing decision makers with real time operational guidance on dispersant effectiveness. As noted in the SMART Protocol, SMART recommends monitoring methods, equipment, and personnel training that strike a balance between the operational demand for rapid response and the informational needs of Unified Command.

To date, only a few of the above recommendations have been implemented into the SMART program. Standard operating procedures (SOP) have been developed for SMART fluorometry and in 2012 and 2013 the USCG sponsored SMART training for the National Strike Force that included hands-on fluorometry experience. There is an overall awareness within the SMART community for the need to develop SOPs and

ED_001324_00007763-00059

training curriculum for other aspects of SMART (aerial spotting, water sampling, data processing, etc.) but thus far progress is slow. (Parscal, 2013)

APPENDIX L Deep Water Horizon, 2010 (In-Situ Burning)

APPENDIX M Deep Water Horizon, 2010 (In-Situ Burning): Incident Overview

Due to the enormity of the oil released, initial mechanical skimming assets were not sufficient to contain and collect all the surface oil that was released by the blowout. On 26 April 2010, the use of in-situ burning of the surface oil was proposed. Between 28 April and 19 July 2010, the Controlled In-Situ Burn (CISB) Group under the Offshore Operations Branch of ICP Houma conducted 411 burns, removing 5 percent of the 4.9 million barrels of discharged oil. Burn task forces conducted burns within the specified and approved CISB Burn Area, typically within 3 to 8 miles of the spill site.

In 1994, RRT 6 published an In-Situ Burn Operations Plan (RRT6, 1994), which required monitoring for any potential impact to the general public by the smoke generated from the burning of oil. In order to fulfill the criteria of the RRT 6 Pre-Authorization for in-situ burning, the NOAA SSC helped implement the SMART In-Situ Burn monitoring protocol for the first test burn on 28 April 2010 (Figure A-14). SMART In-Situ Burn monitoring protocols are designed to alert the FOSC of any potential impact of the smoke on a populated area.

Figure A-14. 28 April 2010 test burn monitored by NSF SMART team.

USCG NSF personnel deployed in-situ burn monitoring equipment to an off-shore platform approximately 13 miles southwest of the planned test burn site. This was the closest location where non-responding personnel were located. SMART sampling detected no oil burn related particulates at this location. NOAA worked with the National Atmospheric Release Advisory Center (NARAC) to model potential plume releases from in-situ burns. NOAA and NARAC determined that the off-shore location (a great distance from any populated areas) and atmospheric conditions would not pose a problem to the general population

ED_001324_00007763-00060

from particulates from the burns. Thus, SMART monitoring was not required for further burns, and the USCG NSF burn monitoring effort was suspended.

APPENDIX N Deep Water Horizon, 2010 (In-Situ Burning): Level of Effort (Number of Personnel and Number and Timing of Sorties)

The NSF and the EPA both performed Particulate Matter (PM) air monitoring during the DWH response. The NSF effort was performed at the request of the FOSC specifically for a single test burn and was done in accordance with the SMART Protocol. The EPA, with its own extensive air monitoring network performed similar PM air monitoring as part of a much larger air monitoring effort. Since the EPA PM air monitoring effort continued long after the NSF SMART air monitoring was suspended, it is not known whether the EPA effort was driven by, or related to, the SMART Protocol.

- **National Strike Force (NSF):**
  - A NSF SMART burn monitoring team of 2 persons was deployed on 28 April 2010 for a single test burn conducted by the DWH CISB Group (C. Barnett, 2014). The SMART team was deployed to an offshore platform approximately 13 miles downwind from the burn site C. Barnett, 2014).
  - The NSF SMART team utilized two DataRAM 4™ particulate air monitors manufactured by Thermo Scientific.
  - The SMART team was on location for the duration of the test burn (no records were found to document the exact duration).
- **EPA:**
  - Throughout the DWH response, the EPA and its state and local agency partners implemented an air monitoring plan in response to the oil spill in the Gulf of Mexico that was not coincident with or associated with the monitoring conducted by the Strike Team. The plan was designed to look specifically for impacts of the spill on the coastal areas of Louisiana, Mississippi, Alabama and Florida. This included the monitoring of particulate matter (PM) that could come from the controlled burns of the oil (Environmental Protection Agency [EPA], 2010). However, it is unclear if this air monitoring was driven by the SMART Protocol, as the EPA followed its own prescribed procedures. The EPA established a monitoring station in Venice, LA that had PM10 capability and collected data on the same day. Figure A-17 is the PM10 data from that EPA station. In either case, this monitoring did provide additional air quality data. (USCG, 2011)
  - According to the QUALITY ASSURANCE SAMPLING PLAN AIR SAMPLING AND MONITORING FOR DEEPWATER HORIZON INCIDENT (5 May 5 2010), the EPA Superfund Technical Assessment and Response Team (START) was to "conduct particulate (dust) monitoring downwind of the in-situ burn using DataRAM instruments over a 24-hour period. The DataRAM collects air monitoring readings for PM10, and the instrument is capable of data logging, with results logged no less than every 5 minutes, and downloaded to a computer at the end of each operating period. The logged particulate data is then distributed through the Unified Command as directed by EPAOSC to support the NOAA SMART Air Monitoring Plan for In-Situ Burns." (EPA, 2010b)

APPENDIX O Deep Water Horizon, 2010 (In-Situ Burning): Measurement Techniques

The NSF and EPA utilized air monitoring techniques specific to their respective organizations.

- **NSF:**

- Monitoring techniques closely followed those prescribed by the SMART Protocol. The particulate monitoring equipment was set-up at the location nearest the burn site where a non-responding population was located. The instruments were monitored continuously during the burn period.

- **EPA:**
  - The EPA utilized its own monitoring protocol. The PM10 component of that protocol is similar to SMART but the EPA does not appear to require continuous monitoring of the sampling equipment.

APPENDIX P Deep Water Horizon, 2010 (In-Situ Burning): Equipment and Technology Used

The NSF and EPA utilized similar PM10 air monitoring instruments during the DWH response. Whereas the NSF utilized a single type of instrument specifically for SMART oil burn air monitoring, the EPA deployed many PM10 instruments as part of a much more extensive air monitoring effort, which used other types of monitoring equipment as well.

- **NSF:**
  - The NSF SMART team utilized two DataRAM 4™ particulate air monitors manufactured by Thermo Scientific (C. Barnett, 2014) (Figure A-15).
- **EPA:**
  - The EPA used DataRAM 4™ instruments for PM10 air monitoring.

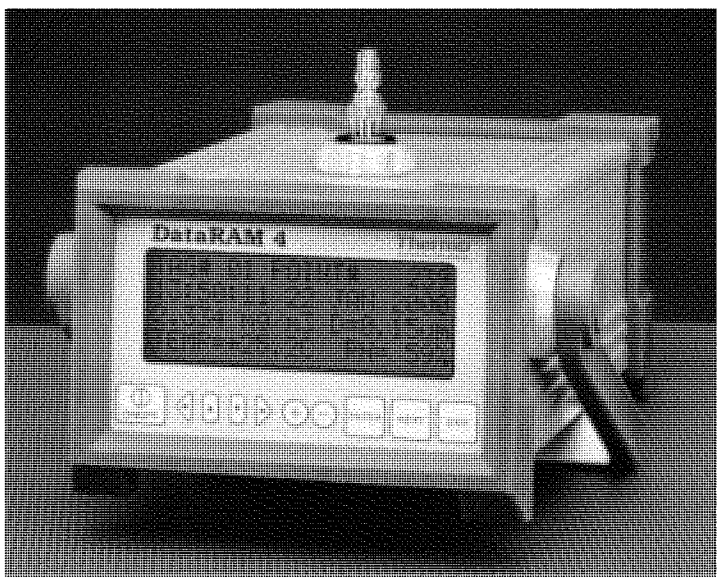


Figure A-15. Thermo Scientific DataRAM 4™ Particulate Monitor.

APPENDIX Q Deep Water Horizon, 2010 (In-Situ Burning): Data Products

The NSF did not generate a data product for the sole SMART air monitoring deployment during the DWH response. The EPA routinely generated Air Particle Matter Reports (Figure A-14) from PM10 monitoring sites. (Figure A-16)

- **NSF:**
  - The NOAA SSC did not request any data product other than the immediate notification of any PM10 readings above the LOC at the monitoring site. (E. Levine, 2014)

- **EPA:**
  - The EPA Air Particle Matter Reports were available to Command Staff in the NOAA ERMA Mapping web site.

ED_001324_00007763-00063

U.S. ENVIRONMENTAL PROTECTION AGENCY

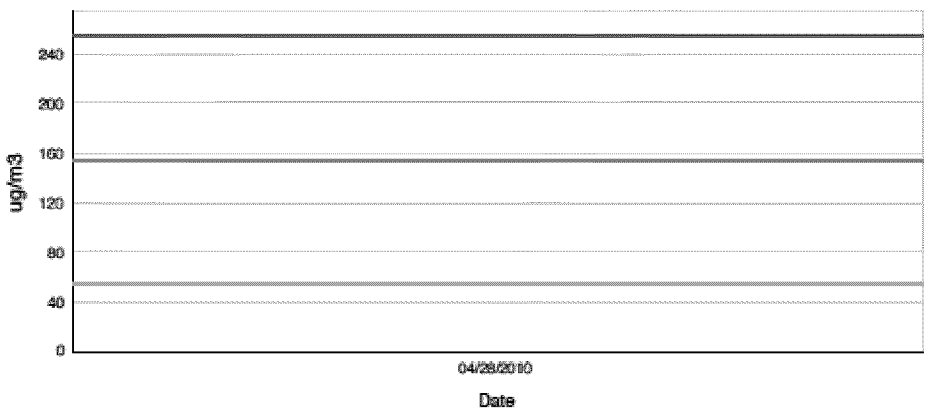
Air Particulate Matter Report

Location	V01
City, State	Venice, Louisiana
Latitude	29.27425
Longitude	-89.35406

Monitoring PM10 Daily Averages	Air Quality Index Value	Air Quality Index Levels of Health Concern	Cautionary Statements
0-54	0 to 50	Good	None
55-154	51 to 100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
155-254	101 to 150	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
255-354	151 to 200	Unhealthy	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
355-424	201 to 300	Very Unhealthy	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
425-604	301 to 500	Hazardous	People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors

Particulate Matter 10 microns and smaller

Date	Number of Hours Averaged	Average for this day	Unit of Measure
04/28/2010	8*	0	mg/m3



* AQI daily averages are based on a minimum of 18 hours of data. On this date, at this monitoring location, there were less than 18 hours of data collected

Figure A-16. Example of an EPA Air Particulate Matter Report from Venice, LA for 28 April 2010.

APPENDIX R Deep Water Horizon, 2010 (In-Situ Burning): Data Processing and Analysis Practices

The NSF SMART data processing and analysis was very simple: observe the air monitoring instruments during oil burn operations and immediately notify Command of any PM10 readings above the Level of Concern (LOC). The EPA utilized a much more sophisticated data processing and analysis program based on their own air monitoring protocols (Figure A-17).

- **NSF:**
  - The NOAA SSC was not aware of any processed air monitoring data provided by the SMART team. The SSC stated that immediate notification of elevated time-weighted average (TWA) readings was the goal. (NOAA, 2009a)
- **EPA:**
  - Field personnel retrieved the instrument log file, processed that data into a Scribe compliant Electronic Data Deliverable (EDD) format, and loaded it into a data reduction Scribe project. Scribe is a software tool developed by the EPA's Environmental Response Team (ERT) to assist in the process of managing environmental data. Scribe captures sampling, observational, and monitoring field data. Queries within the data reduction Scribe project create 8 hr and max result records for each parameter, by location and day. These reduced data are then loaded to the master project (Figure A-17). (EPA, 2010c)

ED_001324_00007763-00065

2) Overall Workflow

2a) Data Flow Diagram:

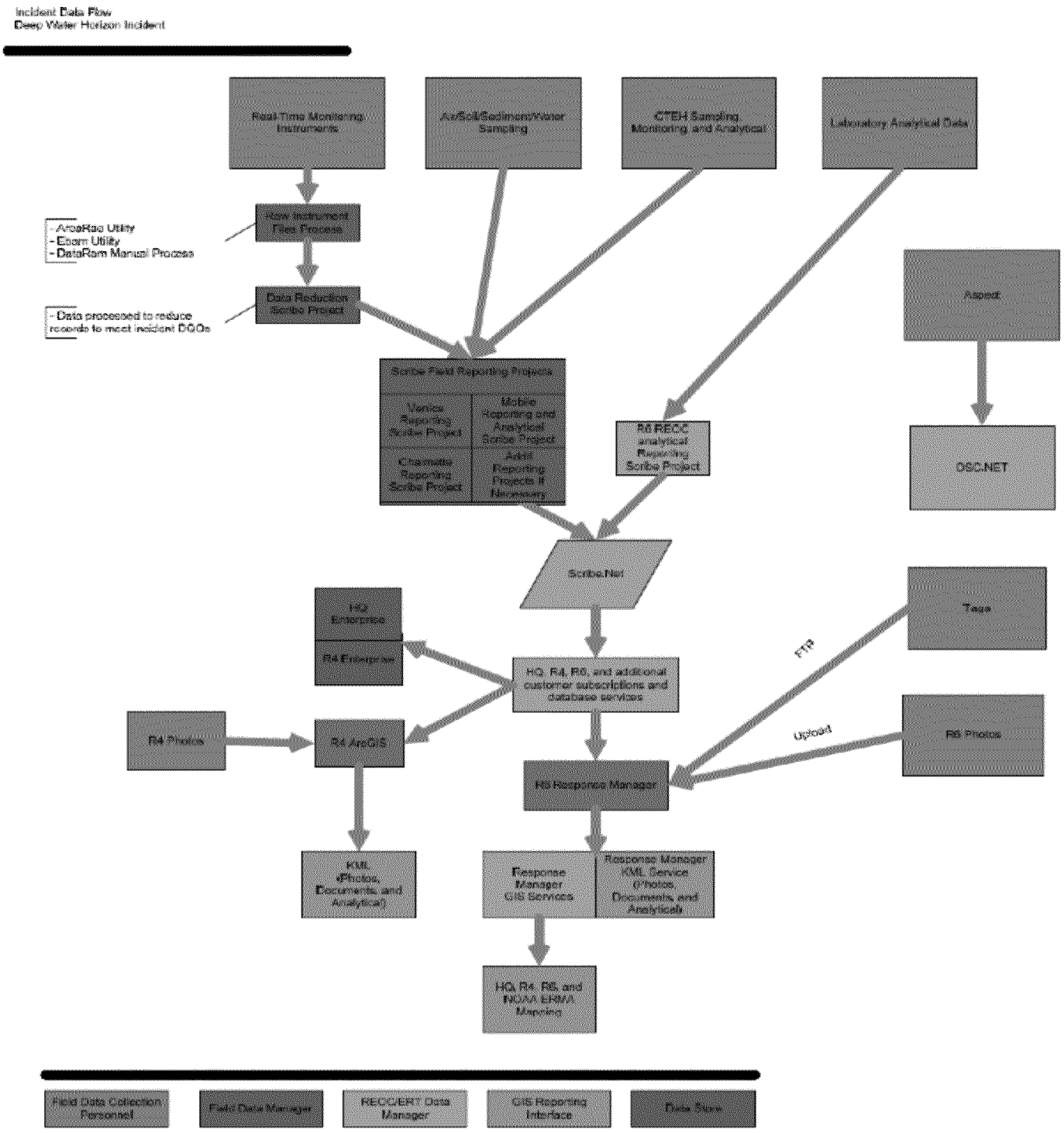


Figure A-17. EPA data flow diagram for the DWH response (EPA, 2010c).

APPENDIX R

ED_001324_00007763-00066

APPENDIX SDeep Water Horizon, 2010 (In-Situ Burning): Data Transmission

Unlike the EPA, the NSF SMART air monitoring team did not transmit data from the field to Command. The goal was to immediately notify Command in the event of elevated PM10 reads, but since no elevated readings were observed, no data were transmitted. Although NSF monitoring data may have been saved, no such data has been located.

- **NSF:**
  - The air monitoring data were observed by NSF personnel at the monitoring site and recorded by the monitoring equipment. Any indication of elevated readings would have prompted a telephone call to the NOAA SSC at ICP Houma, as the monitoring team was in telephone contact with ICP Houma. (C. Barnett, 2014)
- **EPA:**
  - Field personnel downloaded the monitoring files from the instruments at a frequency between once an hour and once in 24 hours, then stored the data in the appropriate directory specific for that day or delivered the data directly to the Data Manager. Generally, the filed data were uploaded to an EPA webserver from the field. (EPA, 2010c)

APPENDIX T Deep Water Horizon, 2010 (In-Situ Burning): Data Product Turnaround Times

The NSF did not generate a SMART air monitoring data product, but the EPA Air Particle Matter Reports were generally available to Command within 1.5 – 2 days.

- **NSF:**
  - ICP Houma would have been immediately notified if the team observed any PM10 readings above the LOC. The NSF SMART team did not see any PM10 readings above the LOC at the monitoring site during the test burn so immediate notification was not implemented.
- **EPA:**
  - Turnaround time for the EPA PM10 data were approximately 1.5 - 2 days. This includes:
    - Approximately 24 hours for EPA regions to input data into the Scribe database, and for the database operators to collate these data and perform necessary data review (address any data input or other issues), and
    - Up to 24 hours for review by Emergency Operations Center (EOC) Environmental Unit and Air Desk. Some data, on occasion, required follow up by the Air Desk with regional and field personnel as part of data interpretation. The EOC prepared language for posting to the website during this time period as well.

APPENDIX U Deep Water Horizon, 2010 (In-Situ Burning): Level of Satisfaction with the Data Product

Though no data product was delivered by the NSF SMART air monitoring team, the NOAA SSC was satisfied with the effort and felt no data product was necessary since no elevated PM10 readings were observed.

- **NSF**
  - The NOAA SSC involved in the DWH SMART in-situ burn monitoring operations was satisfied

with the performance of the monitoring team and was confident that no detectable level of smoke particulates reached the monitoring location (E. Levine, 2014).

ED_001324_00007763-00068

- **EPA:**
  - The NOAA SSC involved in the DWH SMART in-situ burn monitoring operations noted that he did not utilize the EPA air monitoring data (E. Levine, 2014).
  - During the oil spill, EPA monitored for PM at the shoreline and found the levels to be consistent with Gulf Coast summertime levels (Congressional Research Service [CRS], 2010).

APPENDIX V Deep Water Horizon, 2010 (In-Situ Burning): Evolution of the SMART Protocol Following the Event

With only one SMART air monitoring deployment during DWH, no evolution of the SMART Protocol was achieved.

APPENDIX W T/V *Krymsk* Oil Spill, 2009 (Dispersant)

APPENDIX X T/V *Krymsk* Oil Spill, 2009: Incident Overview

On 20 October 2009, the OSV *AET Endeavor* collided with the T/V *Krymsk* (Figure A-18), an 820 ft, 62,395 gross tons (GT) Liberian-flagged double-hull crude oil carrier located approximately 40 NM off-shore of Galveston, TX. The vessel reported a 1 m x 1 cm crack on the No. 2 port bunker (fuel) tank approximately 2-4 ft above the waterline. The crack was in a fuel tank and did not impact the cargo area. USCG estimated a loss of roughly 13,600 gallons of bunker oil to the sea. Internal transfers prevented additional oil from being released. An oil dispersant plan was developed and an RRT conference call occurred. The RRT provided concurrence to the FOSC for the use of dispersants if suitable oil was discovered during an overflight.

Figure A-18. T/V *Krymsk* with damaged hull.

ED_001324_00007763-00069

On 21 October 2009, an Airborne Support Inc. DC-3 aircraft (Figure A-19) applied 1,000 gallons of COREXIT® 9500 dispersant, making several passes over the area of heaviest oiling off-shore, as well as in areas of fringe sheening. SMART Tier I observers reported that the dispersants appeared to have been somewhat effective (milky emulsion observed). Heavy weather prohibited a second dispersant sortie in the afternoon.

Figure A-19. SMART Tier I photo of a DC-3 aircraft applying dispersant to an oil sheen 40 miles off of Galveston, TX.

On Friday, 23 October 2009, a limited dispersant application was applied to the residual slick to assess the potential for mitigation. The dispersant was deemed ineffective, and a decision was made to not continue dispersant applications.

APPENDIX Y T/V *Krymsk* Oil Spill, 2009: Level of Effort (Number of Personnel and Number and Timing of Sorties)

Though operational details for this response are scarce, the USCG Gulf Strike Team Operations Log provides a general timeline for the dispersant operations.

- 21 October 2009, 0145: Marine Safety Unit (MSU) Galveston requested GST dispersant monitoring assistance.
- 21 October 2009, 0435: Two GST members departed Coast Guard Aviation Training Center Mobile via USCG HC-144 aircraft in route to Houma, LA.
- 21 October 2009, 0545: Two GST members prepared for SMART Tier I and Tier II/III operations arrived in Houma, LA.

ED_001324_00007763-00070

- 23 October 2009, (no time available): GST members provided Tier I support for a dispersant application sortie.
- 23 October 2009 (no time available): GST SMART team was demobilized.
- Tier II/III was not mobilized due to adverse weather conditions.

APPENDIX Z T/V *Krymsk* Oil Spill, 2009: Measurement Techniques

All indications are that the team utilized standard Tier I measurement techniques as prescribed by the SMART Protocol.

APPENDIX AA T/V *Krymsk* Oil Spill, 2009: Equipment and Technology Used

Tier I team members shared a King Air aircraft with the spray spotting personnel. The twin engine King Air was considered a safer air platform for the SMART team, considering the distance off-shore for the area of operation (C. Henry, 2014). Though not specifically identified in the reports, the Tier I photographs indicate the team utilized a digital camera. There is no mention in the reports of whether the team had a portable GPS unit. There is also no mention in the reports of what in-flight communications technology was available to the team, but the NOAA SSC recalled that the Tier I team was not able to communicate with Incident Command during flight operations. (C. Henry, 2014)

APPENDIX AB T/V *Krymsk* Oil Spill, 2009: Data Products

Tier I Data included digital photographs and a verbal report. The data may have included a written log, as is standard procedure, but no log was discovered.

APPENDIX AC T/V *Krymsk* Oil Spill, 2009: Data Processing and Analysis Practices

The NOAA SSC recalled receiving a set of photographs and a verbal report from the Tier I team shortly after the flight.

APPENDIX AD T/V *Krymsk* Oil Spill, 2009: Data Transmission

Tier I photos and verbal assessments were relayed to Unified Command. (C. Henry, 2014)

APPENDIX AE T/V *Krymsk* Oil Spill, 2009: Data Product Turnaround Times

The NOAA SSC recalled receiving a set of photographs and a verbal report from the Tier I team shortly after the flight (C. Henry, 2014). There was no communication between the Tier I team and the SSC during flight operations.

APPENDIX AF T/V *Krymsk* Oil Spill, 2009: Level of Satisfaction with the Data Product

The NOAA SSC was satisfied with the SMART data for this incident. He felt the Tier I data were sufficient for him to make informed recommendations to the FOSC (C. Henry, 2014).

APPENDIX AG Eugene Island Pipeline Spill, 2009 (Dispersant)

Very little information was discovered concerning SMART operations on this incident._

ED_001324_00007763-00071

APPENDIX AH Eugene Island Pipeline Spill, 2009: Incident Overview

On 26 July 2009, USCG MSU Morgan City notified the NOAA HAZMAT Duty Officer of an oil spill 65 miles due south of Atchafalaya Bay. An alarm indicated a pressure drop in a pipeline, but the location of a leak was unknown. Later the same day, a slick was observed 20-25 miles south of Lake Pelto in the Gulf of Mexico. The Responsible Party, Shell Pipeline, estimated 600 bbls of 33.7 American Petroleum Institute (API) gravity crude oil had leaked from the pipeline. On the morning of 27 July 2009, the Responsible Party requested authority to use oil dispersants on the surface oil. Under the RRT 6 preauthorization plan, authority was granted by the FOSC. The extended forecast suggested that on-shore transport conditions were predicted for the next few days, but landfall was still days out.

USCG Strike Team personnel were mobilized to Gibson, LA to meet the morning overflight and provide SMART Tier I visual observation for the dispersant application. It was thought practically impossible to get the NSF SMART Tier II/III Team off-shore and in position before the planned morning sortie.

On 27 July 2009, two dispersant application sorties (Figure A-20, Figure A-21, and Figure A-22) were executed applying a total of 504 gallons of COREXIT® 9527 dispersant to the oil slick. Dispersant application was performed by Marine Spill Response Corp. (MSRC) using a King Air spray platform.

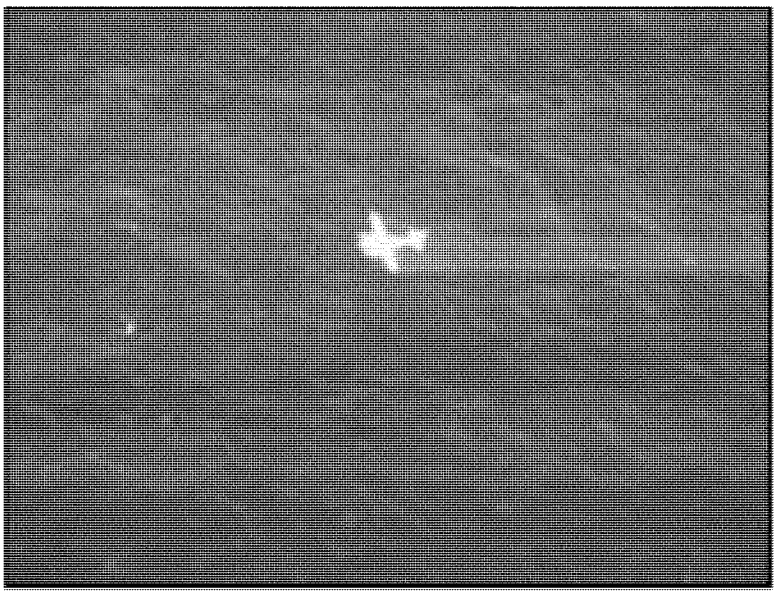


Figure A-20. SMART Tier I photo taken during dispersant application.

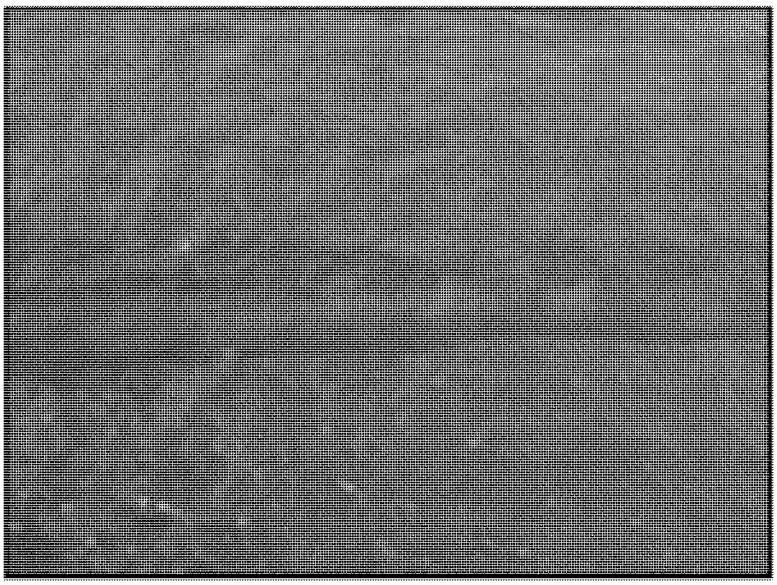


Figure A-21. SMART Tier I photo taken after dispersant application.

Figure A-22. 27 July 2009 SMART Tier I photo taken after dispersant application.

SMART Tier II/III equipment and personnel were deployed for the second 27 July 2009 sortie, and did arrive in the general area of dispersant operations. The team was unable to connect with the application aircraft, however, due to a last minute change in the dispersant target area.

On 28 July 2009, a 9 mile by 1 mile slick was observed further northeast of the 27 July position. The slick was composed of 6 streamers of heavier oil, rainbow sheen, and silver sheen that thinned into no observable sheen. This slick was believed to be the remnants of the original release. The leading edge was still within the pre-approval zone, and one dispersant application sortie was executed (NOAA, 2009b). On 29 July 2009, two dispersant application sorties (Figure A-23) were executed, applying something less than 600 gallons of dispersant. The Tier I report indicated there was some degree of effectiveness (NOAA, 2009a).

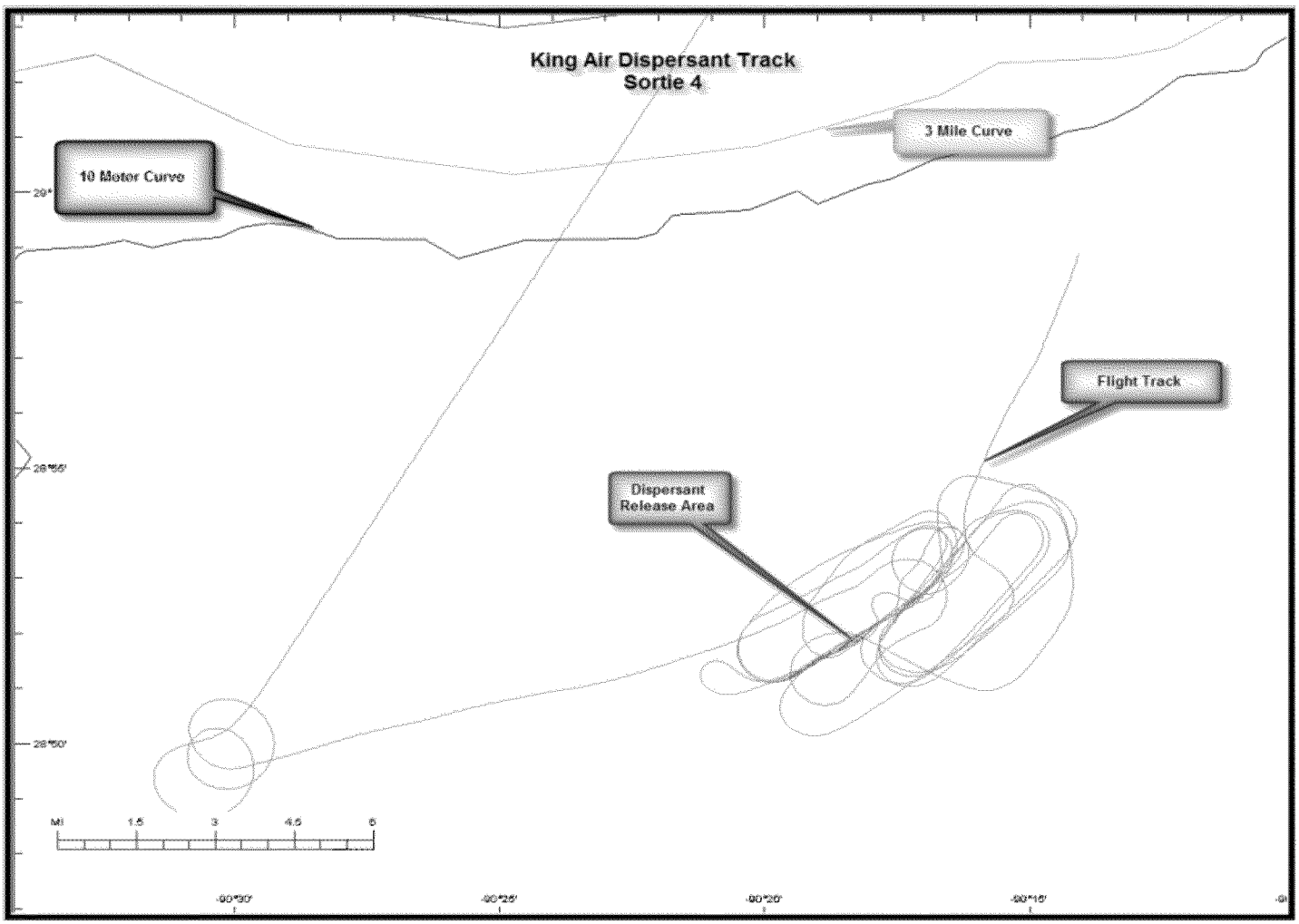


Figure A-23. Flight path for King Air dispersant spray aircraft sortie #4, 29 July 2009 (C. Henry, interview, 2014)

APPENDIX AI Eugene Island Pipeline Spill, 2009: Level of Effort (Number of Personnel and Number and Timing of Sorties)

Though operational details for this response are scarce, the USCG Gulf Strike Team Operations Log provides a general timeline for the dispersant operations.

ED_001324_00007763-00074

- 26 July 2009 (no time available): MSU Morgan City requested GST support for possible dispersant monitoring operations.
- 27 July 2009 (no time available): GST provided Tier I support for two dispersant application sorties.
- 27 July 2009 (no time available): Tier II/III support was requested by Unified Command, but not executed due to Responsible Party logistical constraints.
- 28 July 2009 (no time available): GST provided Tier I support for one dispersant application sortie.
- 29 July 2009 (no time available): GST provided Tier I support for two dispersant application sorties.
- 30 July 2009 (no time available): MSU Morgan City released the GST.

APPENDIX AJ Eugene Island Pipeline Spill, 2009: Measurement Techniques

All indications are that the team utilized standard Tier I measurement techniques as prescribed by the SMART Protocol.

APPENDIX AK Eugene Island Pipeline Spill, 2009: Equipment and Technology Used

The Tier I photographs indicate that the team utilized a digital camera. Beyond that, there is no information on other equipment or technology that may have been utilized for Tier I operations.

APPENDIX AL Eugene Island Pipeline Spill, 2009: Data Products

Tier I data included photographs and a verbal report. The data may have included a written log, as is standard procedure, but no log was discovered.

APPENDIX AM Eugene Island Pipeline Spill, 2009: Data Processing and Analysis Practices

The NOAA SSC recalled that receiving a set of photographs and a verbal report from the Tier I team shortly after the flight.

APPENDIX AN Eugene Island Pipeline Spill, 2009: Data Transmission

Tier I photos and verbal assessments were relayed to Unified Command after each flight. There was no communication between the Tier I team and the SSC during flight operations.

APPENDIX AO Eugene Island Pipeline Spill, 2009: Data Product Turnaround Times

The NOAA SSC recalled receiving a set of photographs and a verbal report from the Tier I team shortly after the flight. Again, no written log was discovered.

APPENDIX AP Eugene Island Pipeline Spill, 2009: Level of Satisfaction with the Data Product

The NOAA SSC was satisfied with the SMART data for this incident, and felt the Tier I data were sufficient to support informed recommendations to the FOSC. The SSC mentioned that if Tier II/III data been collected (as requested by the FOSC), he doubts the Tier II/III data would have changed his recommendation. He considered the Tier I data very convincing for this incident. (C. Henry, 2014)

ED_001324_00007763-00075

APPENDIX AQ M/V *New Carissa*, 1999 (Atmospheric Monitoring)

APPENDIX AR M/V *New Carissa*, 1999: Incident Overview

The freighter M/V *New Carissa* ran aground on the Oregon coast in a gale-force wind on 4 February 1999. Bad weather and logistics ruled out pumping the oil off the ship. After the ship was battered by high waves for a week, the engine room flooded and the ship began leaking oil. The Unified Command acted quickly to minimize the possibility that all 425,000 gallons of heavy fuel oil and diesel fuel aboard the vessel would spill into a pristine, protected environment. The FOSC decided to burn the oil aboard the ship to prevent a catastrophic spill. On 10 February 1999, the FOSC, Responsible Party, and the Oregon State Incident Command signed a memo documenting their decision to attempt a controlled burn aboard the stricken vessel (Figure A-24).

The FOSC requested SMART particulate monitoring at nearby population centers, considering the potential for a large amount of black smoke to be generated from a burn of this magnitude, and the corresponding public health concerns. An incident-specific monitoring program was prepared by NOAA, reviewed and signed by representative of the USCG, NOAA, EPA, and Department of Environmental Quality (DEQ), and adopted for use in this incident. The monitoring program was based on the SMART Protocol and called for several teams equipped with portable particulate air monitors to collect real-time data on particulate concentration trends at ground level.

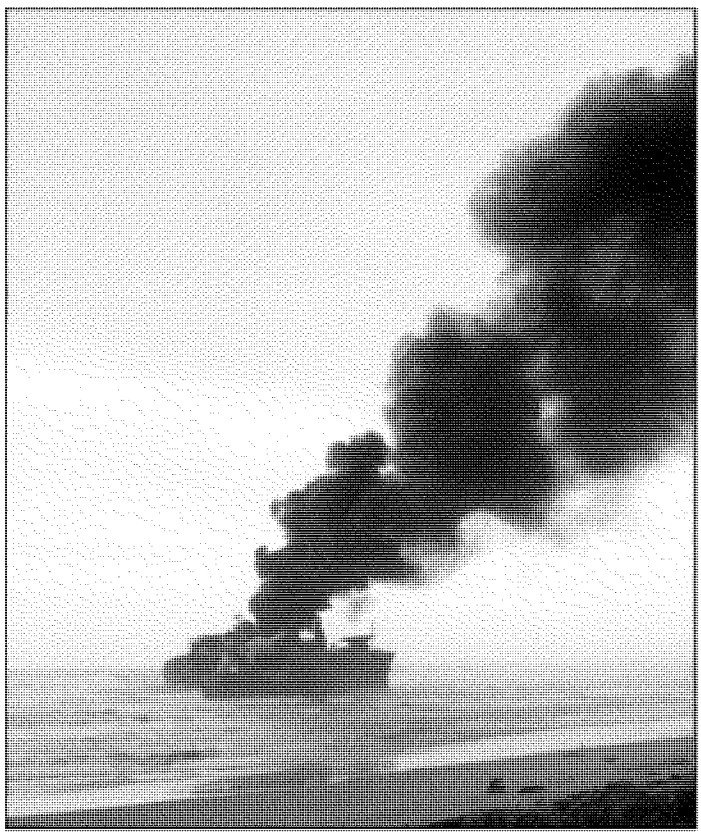


Figure A-24. Smoke plume from the burning of oil aboard the M/V *New Carissa*.

The first USCG NSF SMART monitoring team arrived on-scene at 1400 on 10 February 1999. Sustained burn operations commenced the evening of 11 February and by 0800 on 12 February 1999, most of the fires had burned out, with the exception of a fire on the stern section of the ship that burned for approximately 33 hours. At midnight on 13 February 1999, the monitoring teams were placed on standby, and later de-mobilized.

The highest reported measured concentration for particulate in air was 1.5 micrograms per cubic meter of air ($\mu g/m^3$). This is well below the most stringent standard, which is the Oregon State 8-hour time weighted average concentration of 10 $\mu g/m^3$. All measurements were either below the minimum detection limits of the instruments, or well below established threshold limits.
In the end approximately 200,000 gals of fuel oil, half of the oil on board, were burned in the operation and there were no reported adverse health effects from the smoke to the local population or the responders (USCG, 1999).

APPENDIX AS M/V *New Carissa*, 1999: Level of Effort (Number of Personnel and Number and Timing of Sorties)

USCG NSF, EPA, and State of Oregon monitoring teams were called on-scene as soon as it became apparent that a burn could take place. The Monitoring Group Supervisor coordinated the teams, a role shared by the USCG and NOAA.

Monitoring teams were deployed well before the burn at the following locations: The town of Empire, the airport at North Bend, near the Umpqua river outlet, and a roving monitor near Hauser and Shutter Creek (a correctional facility). In addition, a DEQ monitoring team collected air samples at Horsefall Beach, 2.5 miles north of the ship, and later at Lakeside. See Figure A-25. Particulate concentration levels exceeding the LOC would trigger calling in more monitoring teams, as well as notifying DEQ and public health officials. Monitoring teams remained on-scene for the duration of the burning operations, which lasted approximately 3 days (NOAA, 1999).

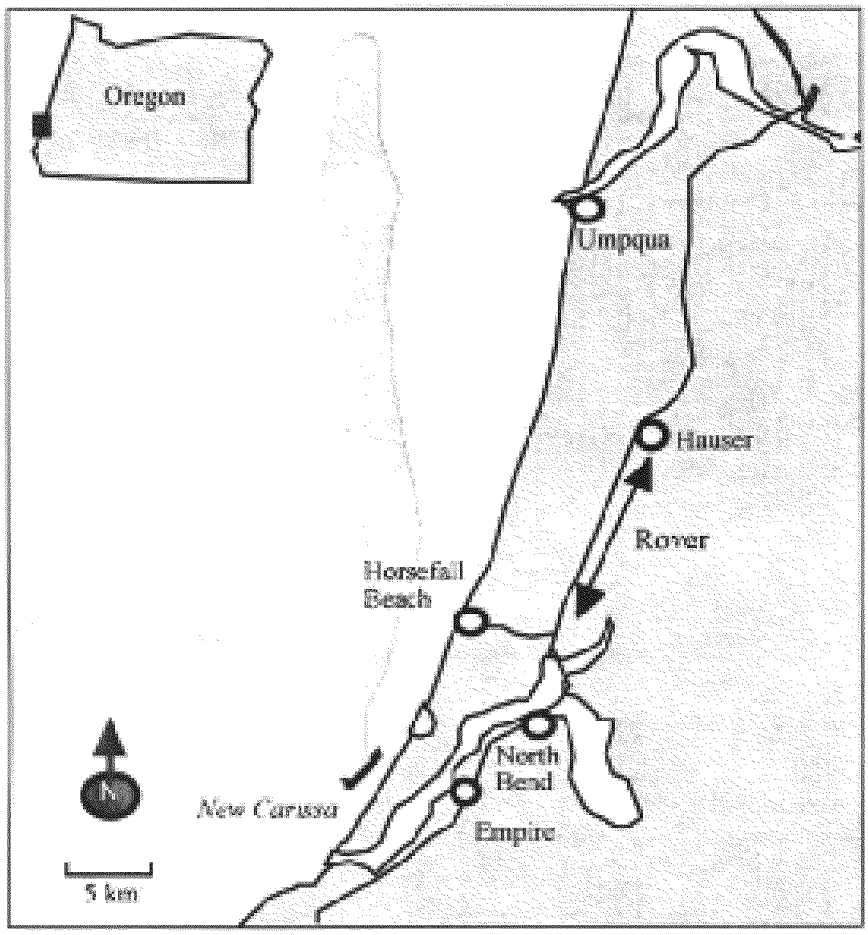


Figure A-25. Five SMART Tier I monitoring locations on 11 February 1999 (Barnea, Holloway, Kim, & Orme, 2001)

APPENDIX AT M/V *New Carissa*, 1999: Measurement Techniques

The LOC adopted for this operation was 150 µg/m3 of particulates smaller than 10 micrometers in diameter (PM-10) averaged over a 1-hour period. The Region 10 RRT (RRT 10), of which Oregon is a member, adopted this LOC value for in-situ burning operations.

APPENDIX AU M/V *New Carissa*, 1999: Equipment and Technology Used

The teams used DataRAM™, Personal DataRAM™, and Nephelometer instruments. These instruments work on the principle of light scattering, with the readings converted to weight of particulates in µg/m^3. The instruments were calibrated and/or zeroed before field use.

APPENDIX AV M/V *New Carissa*, 1999: Data Products

The SMART monitoring data were presented to the FOSC by the NOAA Scientific Support Coordinator during scheduled incident briefings. (NOAA, 1999)

ED_001324_00007763-00078

APPENDIX AW M/V *New Carissa*, 1999: Data Processing and Analysis Practices

NOAA and the USCG reviewed the reported data and briefed representatives of the Unified Command and local health officials. The digital and manually recorded data were collected and archived by the Unified Command Documentation Unit. Monitoring operations were closely coordinated with the State of Oregon and local public health officials, who provided full support and assistance.

APPENDIX AX M/V *New Carissa*, 1999: Data Transmission

Monitoring teams were instructed to immediately notify the Group Supervisor at the Command Post when readings were above the level of concern and/or when three consecutive recorded readings were above background. Communication between the field teams and Command was conducted via radios and cell phones.

APPENDIX AY M/V *New Carissa*, 1999: Data Product Turnaround Times

Had there been any readings above the LOC, they would have been reported immediately to the SSC, however there were no such readings. The day's monitoring data were available for the evening FOSC briefing.

APPENDIX AZ M/V *New Carissa*, 1999: Level of Satisfaction with the Data Product

The NOAA SSC commented that "The SMART real-time monitoring played an important role. In addition to providing the Unified Command with real-time input on particulate concentrations in the field, it provided public health officials with the data they needed to either advise the population of protective measures, or assure the public (and the media) that all was well, that exposure was monitored and did not occur, as was the case." (Barnea et al., 2001)

ED_001324_00007763-00079

APPENDIX B. GAP ANALYSIS OF SMART, TECHNOLOGY, METHODS, AND OUTCOMES 2014

B.1 Deepwater Horizon, 2010 (Dispersant Operations) (Primary Attention)

B.1.1 Deepwater Horizon, 2010 (Dispersant Operations): Level of Effort (Number of Personnel and Number and Timing of Sorties)

Though few of the personnel participating in Deepwater Horizon (DWH) Special Monitoring of Applied Response Technologies (SMART) dispersant monitoring operations had previous SMART response experience, most had been trained in SMART procedures prior to the DWH response. The few team members without formal SMART training were quickly brought up to speed by those team members with more training and experience (Parscal, 2011). Of the 80 personnel associated with SMART operations, not all were participating simultaneously. Due to the protracted nature of the response, very few SMART team members served continuously for the duration of the response. The rotation of personnel in and out of SMART operations caused some discontinuity within the operation. (Parscal, 2011)

The coordination of SMART assets and dispersant aircraft proved to be an immense challenge during the early portion of the response. Since the oil was being released at a depth of 5,000 feet, shifts in ocean currents changed the location of its surface expression (i.e., where the oil broke the surface), sometimes by as much as two to three miles. This movement of the oil greatly increased the area in which dispersant aircraft, and consequently SMART teams, had to operate. The dynamics of this "moving target," combined with the nearly four-hour boat transit time to get the SMART Tier II/III teams on scene, sometimes meant there would not be any oil in the area by the time the teams arrived. (Levine, Mearns, Shigenaka, Miles, Bejarano, Magdasy, & Bond, 2012)

- **Tier I:**
  - SMART Tier I observations were conducted by United States Coast Guard (USCG) National Strike Force (NSF) personnel from helicopters in close coordination with spray aircraft. Due to the demands of such a large-scale response, there was initially a shortage of trained SMART Tier I personnel available. This necessitated the development of on-the-job training for Tier I responders. The National Oceanic and Atmospheric Administration(NOAA) Dispersant Application Observer Job Aid was the starting point for on-the-job training and established a standardization of Tier I reports and documentation. Later in the response, this job aid was supplemented by a DWH response-specific Mississippi Canyon 252 (MC252) Job Aid, training meetings, and ongoing discussions among SMART observers, spotters, NOAA Scientific Site Coordinator (SSC), and experienced Tier I field personnel. (BenKinney, Parscal, Huber, Wood, Russel, Nevin, & Gass, 2011b)
  - Of the 74 aerial observation missions flown, 13 were made with no dispersant observations. There were several reasons for this - sometimes the observation aircraft were unable to locate the dispersant spray platforms, and other times, logistical and operational constraints led to mission reassignments. (Levine, Mearns, Shigenaka, Miles, Bejarano, Magdasy, & Bond, 2012)
  - Close coordination of SMART Tier I aircraft and aerial dispersant spray aircraft and spray spotters was complicated by the fuel limitations and slower flying speed of the SMART helicopters, compared to the fixed wing spray aircraft. Occasionally, the timing of spraying activities had to be delayed to enable the SMART aircraft to get into position and make

ED_001324_00007763-00080

observations prior to dispersant application. The coordination of SMART Tier I aircraft and aerial dispersant spray aircraft was made more difficult by the fact they were operating from different airports. The DWH Aerial Dispersant Group Leader noted that the SMART Tier I teams would have benefited from attending the pre-flight briefings for the spray teams. (C. Huber, email) (Hunt, 2012)

- **Tier II/III:**
  - The SMART Tier II/III field teams were made up of personnel from USCG NSF and Oil Spill Response Limited (OSRL). For the most part, the field personnel worked well together, and the OSRL personnel adopted the USCG NSF operational procedures. However, at the supervisory level, there was occasionally some confusion as to who was directing the OSRL field activities. The OSRL field teams sometimes received conflicting instructions from the OSRL Supervisors and USCG NSF Monitoring Group Leaders.
  - Coordinating SMART Tier II/III on-water operations with aerial spray operations was quite challenging. The relative slow speed of the SMART vessels (cruising speed of approximately 20 knots) compared to the speed of the spray aircraft (120 knots +) meant that the Tier II/III teams sometimes could not reach the spray site before the end of spray operations. Since SMART relies on information collected before and after dispersant application, arriving on scene after spray operations ended diminished the value of the Tier II/III data. (Parscal, 2011; Gass, Albert, Huber, Landrum, & Rosenberg, 2011)
  - The lack of a dedicated SMART spotting aircraft added to the challenge of coordinating SMART Tier II/III on-water operations with spray operations. A SMART spotter aircraft can guide the Tier II/III teams to the area of interest before spray operations and help them return to the same sampling location after dispersant application. Without aerial spotter assistance, the Tier II/III teams found locating the sampling site after spray operations quite difficult. This was made more difficult after a two-mile safety stand-off was established. This meant the Tier II/III teams had to be at least two miles away from the sample location during spray operations. Without aerial guidance, the teams found it quite difficult to return to the sample site and locate the dispersant application area after the spray aircraft departed. (Parscal, 2011)

B.1.2 Deepwater Horizon, 2010 (Dispersant Operations): Measurement Techniques

- **Tier I:**
  - For Tier I operations, the teams closely followed the procedures outlined in the SMART Protocol. These procedures were augmented with the use of customized forms such as the Dispersant Application Observation Reporting Form, SMART Tier I Photograph Log, and SMART Incident Command System (ICS) 214 Form. The Dispersant Application Observation Reporting Form is notable in that it includes a standard dispersant effectiveness ranking system that provided standard reporting criteria for the Tier I personnel.

ED_001324_00007763-00081

Dispersant Application Observation Reporting Form 30

Observers: Mandy Pistole, Justin Sawyer

Date: 21June2010

Start time: 1059 End Time: 1145

Platform: N790P

RANK	STANDARD PHRASE	DESCRIPTION	TIME	TIME	TIME
01	No obvious dispersion	Dispersant being washed off the black oil as white, watery solution leaving oil on surface. Quantity of oil on sea surface not altered by dispersant.			
02	Slow or partial dispersion	Some surface activity (oil appearance altered). Spreading out of oil. Droplets of oil seen rapidly rising back to sea surface, but overall quality appear to be similar to that before dispersant spraying.	1059	1115	
03	Rapid dispersion	Oil rapidly disappearing from surface. Light brown plume of dispersed oil visible in water under the oil and drifting away from it. Oil in some areas being dispersed to leave only sheen on sea surface, but in other areas still some oil present.	1130	1145	

Time of observations should be recorded from initial application or arrival on scene and then approximately 15min apart until observations are ceased.

Figure B-1. Example of a dispersant application observation reporting form.

- **Tier II/III:**
  - The Tier II/III teams made every effort to follow procedures outlined in the SMART Protocol, but due to the extraordinary scale of the DWH event, several challenges became evident early on, including:
  - The lack of dedicated SMART spotting capability. A trained SMART aerial spotter can coordinate a SMART mission and guide the air and surface assets to the proper location in the proper sequence. The DWH SMART teams suffered from a lack of dedicated SMART spotting throughout the course of the SMART operations.
  - The enormity of the area of operations (over 12,000 sq. mi.).
  - The difficulty of coordinating SMART operations with multiple spray aircraft.
  - The lack of communication capability between the SMART vessels and aircraft, both spray and spray spotting.
  - The challenges of deploying instrumentation and retrieving water samples from a depth of 10 m.

B.1.3 Deepwater Horizon, 2010 (Dispersant Operations): Equipment and Technology Used

Complicating all SMART operations was the fact that the aircraft and marine vessels used completely different radio systems. To retrofit aircraft with marine band radios would have been a complex and expensive proposition due to Federal Aviation Administration (FAA) regulations, and hand held aircraft band radios for use on vessels have limited power and range. Communications between vessels and aircraft was a consistent problem throughout the event. (Hunt, 2012; Levine, Stout, Parscal, Walker, & Bond, 2011)

The two 100ft+ vessels (OSV *International Peace* and OSV *Warrior*) used for Tier II/III offshore operations were well suited for the large area of operation. They provided ample deck space for instrument deployment, comfortable accommodations for the crew during the long transit times, and the 20+ kt cruising speed was an asset, considering the large area of operation. These vessels were not well suited, however, for slow speed operations. Deployment of the SMART instrumentation at a depth 10 m requires a towing speed of less than 2 kts. Both the OSV *International Peace* and OSV *Warrior* struggled to maintain a speed of less than 2 kts, making it very difficult to deploy the fluorometers at a 10 m depth.

- **Tier I:**
  - For Tier I operations, close coordination between the SMART team members and aircraft pilots during flight operations are essential. Because some aircraft utilized by the Tier I teams did not have intercom headsets for the team members, and background noise in the helicopter made verbal communication difficult, coordination between the team members and pilots sometimes proved difficult. (Levine et al., 2012)
  - Air-to-surface and air-to-staging base communications are always necessary for SMART coordination. Although handheld marine Very High Frequency (VHF) radios were provided to the Tier I teams later in the response, they detract from overall flight effectiveness and safety. There is a need for a marine band radio to be built into spotter aircraft. (Gass, Albert, Huber, Landrum, & Rosenberg, 2011)
  - Because the Tier I helicopters had less speed and endurance than the spray aircraft, it was difficult for the Tier I teams to rendezvous with the spray aircraft in a timely manner, and stay on scene during and after spray operations (BenKinney et al., 2011b; Gass et al., 2011). This sometimes delayed spray operations, as the spray teams had to wait for the SMART team to arrive on scene.
  - The Tier I teams began the response with standard digital cameras and hand-held Global Positioning System (GPS) units, but later in the response they acquired high-resolution digital cameras with built in GPS capability. These cameras automatically added location information to each photo, which reduced the workload of the field teams and greatly enhanced the value of the photographs. (Levine et al., 2012)
  -
- **Tier II:**
  - For SMART Tier II operations (fluorometry and water sampling at 1 m) the USCG NSF teams utilized Turner Designs C3™ fluorometers fitted with crude oil optics. The instruments were mounted in towable bodies, which allowed the instrument to be towed through the water in a horizontal orientation. The fluorometers fed data through a hard-wired cable to a Panasonic CF-30 laptop computer with an internal GPS receiver. The fluorometry and GPS data were displayed and logged by a suite of software specifically configured for SMART operations.
  - The C3™ fluorometer held up well during the response. Of the six fluorometers deployed during the response, two were damaged during on-board operations but were quickly repaired by the manufacturer and put back in service. (Parscal, 2011). Overall, the C3™ fluorometer performed well. (USCG, 2011)
  - The towable body for the fluorometer was able to maintain the instrument at a consistent 1 m depth up to a towing speed of about 4 kts. At higher speeds, the water resistance increased drag to the point that maintaining a consistent instrument depth became difficult. Close coordination between the SMART team and the vessel Captain was required to maintain a slow towing speed and consistent 1 m instrument depth.

- For SMART tier II Operations the OSRL teams utilized Turner Designs Self-Contained Underwater Fluorescence Apparatus (SCUFA) fluorometers fitted with crude oil optics. The SCUFA is an earlier generation fluorometer that proved reliable, but the lack of a towable housing or the ability to record instrument depth made the SCUFA a less effective instrument than the C3 ™ fluorometer. The OSRL teams utilized the same type of computers and data logging software as the USCG NSF teams.
- The SMART data logging software proved adequate for the mission. Occasionally, the teams experienced a software issue during the start-up procedures but a restart of the computer usually solved the problem. The software did a fine job of combining the fluorometry, instrument depth, and GPS information into a single database.
- The Panasonic CF-30 laptop computer proved to be a suitable computer for SMART field operations, and none of the teams experienced any hardware failures with their computers.
- The 1 m water samples were collected in sample bottles by use of an off-the-shelf pole-mounted water sampler or equivalent. This method proved suitable for the 1 m water sampling.

- **Tier III:**
  - For SMART Tier III operations the teams used the same fluorometers as for Tier II operations but they were deployed at two different depths. If two instruments were available to the team, they were deployed at two different depths simultaneously. Otherwise, a single instrument was deployed at one depth for the first transect and at a second depth for a second transect. Because SMART attempts to compare the fluorometry readings from two separate depths, two fluorometers operating simultaneously at two different depths is the preferred method, thus, two complete fluorometer kits per team is preferable.
  - The Incident Command staff initially requested Tier III fluorometry and water sampling data from 1 m and 10 m depths. Early on, the USCG NSF team encountered difficulty deploying the fluorometer and collecting water samples at 10 m so they revised their procedures and collected Tier III fluorometry and water samples from 1 m and 5 m. Even at a sampling depth of 5 m the teams struggled to maintain a consistent instrument depth while towing the fluorometer. This was mainly the result of excessive vessel speed. The vessels used by the Tier II/III teams were designed for high speed operation and thus, not well suited for the 1 - 2 kt towing speed necessary to maintain consistent instrument depth.
  - Collecting water samples from 5 m water depth also proved challenging for the teams. The 5 m sample depth was beyond the reach of the off-the-shelf (or improvised) pole samplers, so the NSF teams devised a couple of different water samplers that utilized small pumps. For the most part these pumps worked well, but they had the disadvantage of moving different samples through the same hose, which could cause cross-contamination.
  - The OSRL team adhered to the 1 m and 10 m sampling depth that was requested by Command throughout the response. Because the SCUFA fluorometer used by the OSRL team did not record instrument depth, it is unknown if the team was able to consistently maintain a 10 m instrument depth.
  - The OSRL team utilized GO-FLO sample bottles to retrieve water samples from the 10 m water depth. These bottles are designed to retrieve samples from 10 m water depth and deeper, and all indications are the bottles performed well. The bottles were thoroughly cleaned between samples to avoid cross-contamination.
  - The different Tier III sampling depths (1 m & 5 m vs. 1 m & 10 m) between the teams caused some confusion in the final data product.

- **Tier III+:**
  - The Tier III+ team expanded the Tier III procedures by utilizing a Laser In-Situ Scattering and Transmissometry (LISST) instrument. The LISST instrument is a multi-parameter system for in-situ measurement of particle size, distribution, and volume concentration of particles suspended in the water column. For Tier III+ operations, the LISST was used to measure the size, distribution and amount of oil droplets in the water column before and after dispersant application. The LISST was not housed in a towable body, so all readings were taken with the vessel stationary. The ability to tow the LISST along with the fluorometer would have been an advantage.

B.1.4 Deepwater Horizon, 2010 (Dispersant Operations): Data Processing and Analysis Practices

Data processing was another formidable challenge for the Dispersant Monitoring Group. The 2006 SMART Protocol provides little information on how SMART data should be processed and presented. Data collection, handling, processing, and interpretation evolved through the course of the DWH response. After weeks of data flooded the command post, the SMART Data Processing Team was able to get the data into a more usable format. The methodology to archive and retrieve the data was also very cumbersome and evolved during the response. For future SMART operations, better data processing, analysis, and archival methodologies need to be implemented and institutionalized. (Levine et al., 2012)

It is important to note that the Deepwater Horizon dispersant operations were of an extraordinary scale and duration. As dispersant use became more visible (and controversial) during the course of the response, the Federal On-Scene Coordinator (FOSC) requested SMART data products that could be distributed to a broader audience. Thus, the SMART data processing and data analysis team had to create a data product that provided the NOAA SSC with the technical information needed to make an informed recommendation to Command, as well as a more generalized data product suitable for a broader, less technical audience. The SMART data poster (described in Section B.1.6) grew out of this need.

- **Tier I:**
  - The Tier I data consisted primarily of an Operations Log, Photo Log, and a set of photographs. Once the data arrived at Incident Command Post (ICP) Houma it was reviewed by the Environmental Unit for accuracy and completeness then converted to a Keyhole Markup Language (KML) or KML Zip archive (KMZ) format by the NOAA data team. The KML and KMZ files were then uploaded to the Environmental Protection Agency On-Scene Coordinator (EPAOSC) web server and web based NOAA Environmental Response Management Application® (ERMA) situation map, both of which were available to the NOAA SSC and FOSC.
- **Tier II/III:**
  - Early in the DWH response, the SMART Tier II/III field team members performed basic data processing in the field. During this early phase of the response there was an USCG NSF member on the field team with exceptional data processing skills. This individual was able to generate valuable dispersant monitoring data that was of use to the NOAA SSC without further processing at ICP Houma. Although this got the SMART teams off to a good start, it was not a sustainable situation. It is not reasonable to expect this level of data processing skill from the field teams, and without the data processing "ringer," field processing added several hours to the already overtaxed workday for the field teams. The Monitoring Group quickly identified the need for a dedicated SMART data processing team at ICP Houma to relieve the field teams of the data processing burden and provide a level of constancy to the process.

ED_001324_00007763-00085

- Adding to the challenge of setting up a SMART processing team was the fact that the number of SMART field teams increased from one to three. This meant that data from three separate field teams needed to be processed simultaneously. In order to facilitate the processing of this large amount of data, a standardized SMART field-reporting guide was developed. This guide provided the field teams with a standardized format for packaging and transmitting their field data. Although writing the field reports and formatting the SMART data added to the field team's workload, it eliminated a tremendous amount of confusion on the processing end. The standardized data package, along with the use of the EPAOSC website, greatly improved the SMART data management.
- The SMART data processing team initially consisted of two NOAA contracted Geographic Information System (GIS) experts working closely with the SMART Technical Specialist (TS) and an OSRL SMART team member, but because the NOAA contractors were not available to work with the Monitoring Group full time, it was a struggle to keep pace with the processing demands of three SMART field teams. Later, the NOAA GIS experts were replaced by two GIS experts from the EPA who were available on a full time basis. This allowed the processing team to keep up with the incoming data. When SMART field operations were scaled back to one Tier II/III field team later in the response, the processing team was reduced to one GIS expert and the SMART Technical Specialist. This proved to be an ideal combination. The GIS expert provided geospatial support while the SMART TS performed the fluorometry data processing and overall data analysis.
- Following collection, the Tier II/III water samples were sent to a contracted lab where they were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX); saturated hydrocarbons; polycyclic aromatic hydrocarbons (PAHs); petroleum biomarkers (steranes, triterpanes), and the dispersant indicator dipropylene glycol n-butyl ether (DPnB). Toxicity studies were conducted on undiluted samples using the estuarine inland silversides fish (Menidia beryllina), planktonic mysid shrimp (Neomysis americana), and marine diatom (Skeletonema costatum) following standard test procedures. (BenKinney et al., 2011a)
- The methodology for collecting samples left unknown concentrations at intermediate depths between 1 and 10 meters. Since discrete water samples were only taken at 1 and 10 meters (or 1 and 5 meters, depending on the sampling team) below the surface there were no analytical results for the water column outside those sample depths. (Levine et al., 2012)
- Due to the enormous amount of oil in the water column and sea surface, the variability of "background" sample concentrations, both from fluorometry and chemical analysis, varied greatly. In addition, due to the frequency of applications and the wide spatial area they covered, it was difficult to know if locations for background samples were actually in areas where no dispersants had been applied, or if they had been applied the day before or the day before that, or where oil had naturally dispersed. Depending on where and when samples were taken, the background levels could be as high as areas where the dispersant were being applied (Levine et al., 2012). Due to these factors, the background fluorometry and water samples became less reliable as the DWH response continued.

- **Tier III+:**
  - Though the data from the LISST instrument was of interest to the research community, it was not included in the processing and evaluation of the SMART Tier II/III data, due to its infrequent use during SMART operations.

B.1.5 Deepwater Horizon, 2010 (Dispersant Operations): Data Transmission

Due to the magnitude of the DWH event, data transfer was a formidable challenge throughout the duration of SMART operations. With multiple SMART Teams operating over a large geographic area far from ICP Houma, data flow was one of the first challenges faced by the Dispersant Monitoring Group during the DWH response. The 2006 SMART Protocol provides a general guideline for data flow but does not address the specifics of efficiently moving data from the field to Incident Command in a timely manner. The SMART Protocol also suggests the field teams provide a near real-time report verbally to Command immediately after the data is collected. Due to the geographic scale of the DWH response, this proved quite challenging.

When technology was available, the Tier I teams phoned in a report when the helicopter landed on an offshore platform for refueling. Otherwise the teams delivered their report after the helicopter returned to base. The Tier II/III teams phoned in a report if the vessel's location and communications capability allowed. All SMART field teams would have benefited by having their own dedicated satellite telephone capability.

- **Tier I:**
  - Since SMART Tier I operations were based out of the same Command Center (ICP Houma) as the Dispersant Monitoring Group, the Tier I photos and reports could be hand delivered to the Group Leader after each mission. Later in the response, a limited access webserver was established where the teams could upload their data directly from the field after each mission. Although both methods worked well, the teams found that uploading data to the webserver was a quicker way to get information to the end users.
- **Tier II/III:**
  - Transmitting Tier II/III data from the field to the ICP Houma proved much more challenging (Hunt, 2012). The Tier II/III teams were based out of Venice, LA (a 2.5 hr. drive from ICP Houma), with the Tier II/III vessels operating as far as 80 miles from Venice (a 4 hr. one-way transit). The SMART vessels would depart Venice in the morning and return late in the evening with the day's data. These data were then handed over to the USCG Field Response Coordinator in Venice who emailed it up the USCG chain of Command and ultimately to the NOAA SSC. With the SMART data passing through several sets of hands between the field and ICP Houma, delays in the data flow developed as everyone's workload increased. After several unsuccessful attempts to streamline the SMART data email procedures, the EPA offered their EPAOSC website as a repository and clearinghouse for the DWH SMART data. With this, the SMART field teams could upload their data to the web site where it would be available to Incident Command immediately. This proved quite effective and was utilized for the remainder of the response.
  - A standardized Tier II/III data format was established during the DWH response. This standardized format streamlined the data transmission process and reduced the need for the data processing team to request clarifications from the field teams.

B.1.6 Deepwater Horizon, 2010 (Dispersant Operations): Data Products

- **Tier I:**
  - The final Tier I data were delivered in a KML or KMZ format and was available on the web based NOAA ERMA situation map. The individual photos were geo-reference on the map and each photo was annotated with Observer comments and other pertinent information. This made for an effective presentation of the Tier I, data, but it was not fully implemented until later in the response.
- **Tier II/III:**
  - How best to present the results of the SMART Tier II/III monitoring effort was another challenge

faced early in the response and again, the 2006 SMART Protocol provided little guidance. After consulting with the NOAA SSCs and other end-users, the processing team developed a one-page poster format that summarized the SMART Tier II/III monitoring results. The poster was accompanied by a more detailed written evaluation of the Tier II/III data. The challenge was to present adequate dispersant monitoring information without overwhelming the decision makers who may have a limited knowledge of the SMART process. It is notable that the chemical and toxicity analysis of the water samples taken in conjunction with Tier II/III operations were not available in a timely manner and were not included in the Tier II/III poster.

B.1.7 Deepwater Horizon, 2010 (Dispersant Operations): Data Product Turnaround Times

- **Tier I:**
  - Tier I verbal reports were relayed to command when communications were available and Command requested a preliminary verbal report.
  - The final SMART Tier I data product was generally posted to the situation map (ERMA) and available to the SSC 24 hours after the field data arrived at ICP Houma.
- **Tier II/III:**
  - Preliminary Tier II/III verbal reports were delivered to Command when requested and the technology on the vessels allowed for telephone communication.
  - The SMART Tier II/III poster was generally delivered to the SSC within 24 hours of the field data arriving at ICP Houma.
  - The water chemistry analysis (Total Petroleum Hydrocarbon and Total Polycyclic Aromatic Hydrocarbon), and the toxicity analyses for water samples taken in conjunction with Tier II/III operations required post - action lead times and were not available to Command during dispersant operations. The Tier II/III water sample analyses were generally available within 2-7 days, depending on the backlog.

B.1.8 Deepwater Horizon, 2010 (Dispersant Operations): Level of Satisfaction with the Data Product

The SMART monitoring was able to determine the effectiveness of dispersant operations during the DWH response (Levine et al., 2012). SMART was able to provide monitoring data and oversight of the dispersant operations. Likening the Tier I and Tier II/III monitoring to the patrolman behind the billboard, the USCG SMART teams helped keep everyone honest and the application crafts (vessels and planes) within the boundaries agreed upon. SMART was not able to correlate between "effectiveness" and other factors such as oil weathering and field conditions during dispersal application. (Levine et al., 2012)

- **Tier I:**
  - The NOAA SSC involved in the DWH SMART dispersant monitoring operations was satisfied with the SMART Tier I data product and felt that it provided the necessary information to help make an informed recommendation to the FOSC (E. Levine, interview, 3 February 2014).
- **Tier II/III:**
  - The Tier II/III data product evolved during the course of the DWH response. The product for the

initial Tier II/III efforts consisted of a Unit Log (ICS FORM 214-CG), Photo Log, photos, raw fluorometry/GPS data files and an Excel graph illustrating the fluorometry data. The early data product initially satisfied the needs of Command, but as interest in the SMART data increased, a more sophisticated product with more information and analysis was requested. This led to a more comprehensive "poster" style presentation which was accompanied by a detailed written evaluation.

- The SMART Tier II/III poster and associated written evaluation that evolved over the course of the DWH event was well received and seemed to satisfy the needs of the SSC and Command Staff (E. Levine, interview, 3 February 2014).
- Due to the nature of the water sampling from a vessel, not all sites were sampled to the exact specifications of the protocols. This may explain why there is little or no correlation between the in-situ fluorometry and laboratory chemical testing data results. (Levine et al., 2012)
- Due to the long lead times associated with the water sample analysis, the results were not incorporated into the Tier II/III data product. Thus, the water chemistry analysis was not considered by the SSC when evaluating the effectiveness of a dispersant application. (E. Levine, interview, 3 February 2014)

B.2 Deepwater Horizon, 2010 (In-Situ Burning) (Primary Attention)

B.2.1 Deepwater Horizon, 2010 (In-Situ Burning): Level of Effort (Number of Personnel and Number and Timing of Sorties)

Overall, there is little evidence of coordination between the NSF and EPA in-situ burn air monitoring efforts. This may be due to the fact that SMART air monitoring was suspended after a single test burn and no further air monitoring was requested of the NSF. Throughout the DWH response, the EPA continued to monitor for Particulate Matter (PM10) levels at various sites, and all indications are that any elevated PM10 readings would have been reported to the EPAOSC, who would in turn inform the FOSC. In the absence of any elevated PM10 readings, the EPA air monitoring data were posted to the NOAA ERMA situation map which was available to all Command personnel. A NOAA SSC involved in the in-situ burn operations noted that he did not routinely look at the EPA air monitoring data that was posted the ERMA situation map.

The BP Deepwater Horizon Oil Spill Incident Specific Preparedness Review (USCG, 2011) recommends: "the Coast Guard should engage EPA regarding the air-monitoring protocols for ISB. As necessary, these protocols should be re-evaluated based on the empirical evidence from the Deepwater Horizon incident and additional air quality studies conducted to ensure the level of monitoring is consistent with the risk posed by ISB, particularly in offshore areas." (USCG, 2011)

- **NSF:**
  - Both the NOAA SSC and NSF field personnel agreed that the air monitoring field team was adequately staffed and equipped for the scope of the mission.
- **EPA:**
  - According to the BP Deepwater Horizon Oil Spill Incident Specific Preparedness Review (USCG, 2011) the EPA ISB "Monitoring of air emissions exceeded what was necessary to establish safe air quality levels for exposed shoreline populations, which increased the complexity of the response by increasing the risks posed by additional response operations." (USCG, 2011)

B.2.2 Deepwater Horizon, 2010 (In-Situ Burning): Measurement Techniques

- **NSF:**
  - The NSF team closely followed the air monitoring procedures as prescribed by the SMART Protocol and the NOAA SSC felt the techniques were adequate for the mission.
- **EPA:**
  - Although the EPA air monitoring effort utilized many different instruments, techniques, and platforms, and targeted many different compounds, only a small part of that effort was consistent with the air monitoring prescribed by the SMART Protocol. This included the monitoring of particulate matter (PM10) that could come from the controlled burns of the oil. Though not specifically providing SMART air monitoring, the EPA provided air quality monitoring similar to SMART but in accordance with the EPA's own prescribed procedures.

B.2.3 Deepwater Horizon, 2010 (In-Situ Burning): Equipment and Technology Used

- **NSF:**
  - The NSF field teams reported no issues with the DataRAM air monitoring instruments and had no issues with the communication capabilities at the monitoring location.
- **EPA:**
  - The EPA utilized DataRAM Particulate Monitors for the PM10 component of their overall air monitoring effort.

B.2.4 Deepwater Horizon, 2010 (In-Situ Burning): Data Processing and Analysis Practices

The NSF air monitoring team was instructed to notify the SSC immediately upon observing PM10 readings over the Level of Concern (LOC). The SSC did not request any data processing or analysis beyond the verbal report. This may be due to the fact that no elevated readings were observed by the field team.

B.2.5 Deepwater Horizon, 2010 (In-Situ Burning): Data Transmission

The NSF field team had telephone communications with ICP Houma. The team did not attempt to transmit any data, but had no issues maintaining verbal communications with Command.

B.2.6 Deepwater Horizon, 2010 (In-Situ Burning): Data Products

The NOAA SSC did not request any data product other than the immediate notification of any PM10 readings above the LOC at the monitoring site. Again, this may be due to the fact that no elevated PM10 readings were observed.

B.2.7 Deepwater Horizon, 2010 (In-Situ Burning): Data Product Turnaround Times

The NSF air monitoring team was instructed to notify the SSC immediately upon observing PM10 reading over the LOC. This level was not reached.

B.2.8 Deepwater Horizon, 2010 (In-Situ Burning): Level of Satisfaction with the Data Product

- **NSF:**

ED_001324_00007763-00090

  - The NOAA SSC involved in the DWH SMART in-situ burn monitoring operations was satisfied with the performance of the monitoring team and was confident that no detectable level of smoke particulates reached the monitoring location (E. Levine, interview, 3 February 2014). Since immediate notification was the mission objective, the SSC felt the objectives were met.
- **EPA**
  - Though the EPA air monitoring data were posted to the ERMA situation map (later in the response) and available to the NOAA SSC, the SSC noted that he did not utilize the data.

B.3 T/V Krymsk Oil Spill, 2009 (Dispersant)

B.3.1 T/V *Krymsk* Oil Spill, 2009: Level of Effort (Number of Personnel and Number and Timing of Sorties)

Early notification by MSU Galveston and the availability of Coast Guard Aviation Training Center Mobile aircraft enabled the GST team to meet the aggressive dispersant application timeline and be on scene for the first dispersant flight. Three GST members were mobilized in support of this response. This may not have been sufficient personnel had both Tier I and Tier II/III been deployed simultaneously.

B.3.2 T/V *Krymsk* Oil Spill, 2009: Measurement Techniques

All indications are that the Tier I teams adhered to the standard SMART Tier I procedures.

B.3.3 T/V *Krymsk* Oil Spill, 2009: Equipment and Technology Used

Tier I team members shared a King Air aircraft with the spray spotting personnel. The twin engine King Air was considered a safer air platform for the SMART team, considering the distance off shore for the area of operation. (C. Henry, interview, 18 February 2014)

The quality of the Tier I photos indicate that the digital camera used was sufficient for the mission.

The reports do not indicate what communication technology was available to the Tier I team, but one team member mentioned that the communication capability was insufficient. The NOAA SSC recalled that the Tier I team was not able to deliver a report until after the aircraft landed.

B.3.4 T/V *Krymsk* Oil Spill, 2009: Data Processing and Analysis Practices

The Tier I data most likely included an Operations Log and photos, neither of which would require post-acquisition processing.

B.3.5 T/V *Krymsk* Oil Spill, 2009: Data Transmission

Communication between the SMART field team and Unified Command proved challenging due to inadequate communications equipment.

B.3.6 T/V *Krymsk* Oil Spill, 2009: Data Products

The NOAA SSC commented that the Tier I photos were not labeled with date, time, and location information.

B.3.7 T/V *Krymsk* Oil Spill, 2009: Data Product Turnaround Times

The reports suggest the Tier I photos and logs were delivered to the UC shortly after each flight.

B.3.8 T/V *Krymsk* Oil Spill, 2009: Level of Satisfaction with the Data Product

The NOAA SSC was satisfied with the SMART data from this response and confirmed that the Tier I data were adequate to make an informed recommendation to the FOSC.

B.4 Eugene Island Pipeline Spill, 2009 (Dispersant)

Very little information exists concerning the SMART deployment for the Eugene Island Pipeline Spill. The NSF provided a Gulf Strike Team Incident Summary Message that gives a basic timeline for NSF participation but provides no specifics on the procedures and technologies utilized. The NOAA SSC was also unable to provide many operational details.

B.4.1 Eugene Island Pipeline Spill, 2009: Level of Effort (Number of Personnel and Number and Timing of Sorties)

NSF personnel provided Tier I support for all dispersant spray sorties.

NSF personnel were unable to perform Tier II/III despite being requested by the FOSC.

B.4.2 Eugene Island Pipeline Spill, 2009: Measurement Techniques

All indications are that the Tier I teams operated as prescribed by the SMART Protocol.

B.4.3 Eugene Island Pipeline Spill, 2009: Equipment and Technology Used

The NOAA SSC recalled that the Tier I team shared a King Air aircraft with the spray spotting team. This was done mainly for safety reasons, a twin engine fixed wing aircraft was deemed safer than a helicopter given the distance off shore. The SSC also mentioned that Command wanted to minimize the number of aircraft in the area of dispersant operations.

The King Air aircraft lacked the communications capability to allow the Tier I team to contact Command from the air. The Tier I reporting did not take place until after the flight returned. (C. Henry, interview, 18 February 2014)

B.4.4 Eugene Island Pipeline Spill, 2009: Data Processing and Analysis Practices

The NOAA SSC recalled that Tier I photos, documentation, and verbal reports required no data processing or additional analysis.

B.4.5 Eugene Island Pipeline Spill, 2009: Data Transmission

The Tier I team lacked the capability to transmit photos or verbal reports from the aircraft. Thus, all

ED_001324_00007763-00092

reporting was delayed until the end of the flight.

B.4.6 Eugene Island Pipeline Spill, 2009: Data Products

The NOAA SSC recalled that the Tier I photos and verbal reports provided adequate information to support an informed recommendation.

B.4.7 Eugene Island Pipeline Spill, 2009: Data Product Turnaround Times

The NOAA SSC noted that the FOSC would have benefited from real time verbal reports from the Tier I team, but the capability was not available. As it was, the data were available shortly after the flight ended, and the delay was not a serious issue.

B.4.8 Eugene Island Pipeline Spill, 2009: Level of Satisfaction with the Data Product

The NOAA SSC was satisfied with the SMART data from this response and confirmed that the Tier I data were adequate to make an informed recommendation to the FOSC. He also noted that the failure to mobilize Tier II/III monitoring was not a set-back. The Tier I data were adequate to support the operational decisions.

B.5 M/V *New Carissa*, 1999 (Atmospheric Monitoring)

Although there is a fair amount of published information concerning the M/V *New Carissa* response, information specific to SMART air monitoring for that incident is somewhat scarce. The bulk of the information we obtained for this analysis came from three sources: a NOAA Office of Response and Restoration (ORR) fact sheet (NOAA, 2006), a USCG FOSC's Report (USCG, 1999), and a published case study by Nir Barnea (Barnea et al., 2001). We were unable to locate any USCG After Action Reports or Operation Logs associated with the M/V *New Carissa* SMART air monitoring effort.

B.5.1 M/V *New Carissa*, 1999: Level of Effort (Number of Personnel and Number and Timing of Sorties)

Early notification is key to timely monitoring. The first monitoring team arrived on scene at 1400 on 10 February 1999, in time to deploy for the first burning attempt. Rapid notification for monitoring should be given in future burns.

B.5.2 M/V *New Carissa*, 1999: Measurement Techniques

All indications are that the measurement techniques as prescribed by the SMART Protocol worked well and contributed to a successful deployment.

B.5.3 M/V *New Carissa*, 1999: Equipment and Technology Used

All indications are that the air monitoring equipment (DataRAM, Personal DataRAM, and Nephelometer instruments) worked well and satisfied the mission requirements.

B.5.4 M/V *New Carissa*, 1999: Data Processing and Analysis Practices

No information on the SMART data processing and analysis was discovered for this response.

ED_001324_00007763-00093

B.5.5 M/V *New Carissa*, 1999: Data Transmission

Communication was spotty at times. Radios did not always work due to distance and terrain. Cellular phones worked well, but not all teams had them.

B.5.6 M/V *New Carissa*, 1999: Data Products

We were unable to locate an example of the SMART data product produced by the *New Carissa* SMART teams nor did we find any mention of a SMART data product in the published reports. However, the FOSC's Report noted that the air monitoring data that was ultimately distributed to the local health agencies by Unified Command caused a certain amount of consternation and confusion in the local community (NOAA, 2006). Although disseminating air monitoring results to the local agencies is a Command level responsibility, all participants in SMART air monitoring operations should work towards clear and concise reporting.

B.5.7 M/V *New Carissa*, 1999: Data Product Turnaround Times

Despite the communications challenges, the NOAA SSC was briefed on the SMART air monitoring at the end of each operational period.

B.5.8 M/V *New Carissa*, 1999: Level of Satisfaction with the Data Product

Both the FOSC and NOAA SSCs appeared satisfied with the *New Carissa* monitoring effort and results. (Barnea et al., 2001)

While similar monitoring had been done before, this was the first monitoring under the SMART program. Both the concept and the execution worked well. (NOAA, 2006)

State and local public health officials were very interested in the monitoring results. Once informed of the monitoring plan, they cooperated closely and provided valuable assistance. Including them in the planning and providing them with timely results worked well. (NOAA, 2006)

The dissemination of conflicting information by State and local health agencies caused a certain amount of consternation and confusion in the local community. (USCG, 1999)

B.6 Performance Gaps Shared by Incidents or Circumstances

Communication is a persistent challenge faced by SMART field teams whether mobilized for dispersant monitoring or air monitoring activities.

- During the New Carissa response the air monitoring teams relied on VHF radios and cell phones for communication with Command. The radios had limited range, and were restricted by the local topography. Some of the team members did not have cell phones, and it is not known if there was adequate cellular coverage in the area. Team members are more likely to have cell phones today, but cellular coverage can still be spotty when working in remote locations.
- For the T/V Krymsk, Eugene Island, and DWH responses the Tier I teams did not have the ability to communicate with Command from the aircraft they were in. Many times the Tier I teams used aircraft of opportunity, with no assurance that these aircraft would have satellite phone or other long-

ED_001324_00007763-00094

range communication capability. Some of the Tier I personnel involved in the DWH response noted that they were not provided with headsets and had difficulty communicating with their own pilot.

- The Tier II/III teams faced similar challenges when working from vessels of opportunity. Satellite phones are becoming more common on larger vessels, but can be expected to be rare on smaller vessels of opportunity. The Tier II/III team also needs to communicate with spotter and spray aircraft. Very few vessels of opportunity have Aviation VHF capability, and very few aircraft have Marine VHF capability. Communication between SMART vessels and aircraft is an ongoing challenge
- Transmitting digital data (photos, fluorometry, and documentation) is even more challenging than voice communication for all SMART operations. Internet connectivity in remote locations can be hard to find and satellite phone systems have limited bandwidth.
- SMART is designed to provide the FOSC with near real-time, scientifically based information. In order to meet this goal, SMART field teams in remote areas must be able to rapidly and reliably convey observations to the decision-makers in command centers. This remains a significant challenge today.

B.7 Performance Gap Trends

SMART has been deployed relatively few times since its inception so it is difficult to identify performance gap trends with so few examples. However, communication does stand out as a performance gap for every deployment. From the *New Carissa* response in 1999 to the DWH response of 2010, communication between the field teams and Command has been the most significant challenge, and SMART communication capability has improved little in those intervening years. The DWH SMART teams faced many of the same communication challenges as the SMART teams from the *New Carissa* response eleven years earlier.

B.8 Performance Gaps Associated with Atypical Oil Spill Events

As an original contributor to the SMART Protocol noted, SMART was designed to address what was considered to be a typical oil spill dispersant operation: small scale (thousands of gallons of oil), short duration (several days), and near-shore (within 10 miles). The August 2006 version of SMART (US Coast Guard, 2006) provides sufficient guidance to address dispersant efficacy and to answer the needs of the Unified Command for operational decision-making. The DWH incident however, stretched those capabilities beyond the bounds of imagination. It is doubtful that anyone involved with SMART prior to DWH imagined a dispersant operation involving 20 aircraft, lasting 90 days and covering an area of over 18,000 square miles.

The core mission of SMART, providing real-time, scientifically based information to Unified Command, remains the same regardless of the scale of the response. However, the 2010 DWH oil spill illuminated some of the challenges of deploying SMART in an atypical oil spill response environment. For the purpose of this report atypical response operations may include surface dispersant operations far offshore, surface dispersant operations of a long duration, and deep sub-sea dispersant injection.

Below are some performance gaps identified by organizations that either participated in the Deepwater Horizon SMART operations or utilized the data from those operations. Though these comments are specific to the DWH response, they suggest gaps in the current SMART program that may apply to other atypical oil spill events.

ED_001324_00007763-00095

- The SMART teams initially fell short in providing the number of trained Tier I monitors required for the large scale spray operations. This situation improved as additional personnel were trained and put into service.
- Coordination between the SMART teams and the spray aircraft remained difficult throughout the response. This was partly due to the large number of vessels and aircraft involved in the response and the fact that few of the aircraft and vessels had compatible radio systems. (Parscal, 2011; Hunt, 2012)
- SMART was slow to expand into more scientifically sophisticated data collection methodologies as dispersant operations expanded. As dispersants became more visible (and controversial) during the DWH response the SMART teams struggled to provide the amount and type of monitoring information requested by Command. The SMART teams entered into the DWH response with the basic skills and equipment prescribed by the SMART Protocol (photography, fluorometry, water sampling etc.) but had to expand their operations to include the use of more advanced instrumentation (e.g., LISST) and more rigorous water sampling techniques. (Levine et al., 2012)
- The SMART teams were initially poorly equipped for the expanded water sampling methodologies requested by the FOSC. The teams were provided with suitable water sampling equipment later in the response but early on, the team's improvised equipment and methods did not meet the needs of the FOSC. (Parscal, 2011; Levine et al., 2012)
- The SMART teams did not initially have the data processing techniques and personnel in place to handle the amount of field data arriving at Incident Command. Later, as the informational needs of the FOSC expanded, the SMART teams struggled to develop a data product that satisfied those needs. (Parscal, 2011; Levine et al., 2012)
- Due to the large area of operation and the distance off shore communications between the SMART field teams and Incident Command proved quite challenging. The Tier I teams did not have the capability to communicate directly with IC Houma from the aircraft and the Tier II/III teams often times relied on the communications capabilities of the vessels they were operating from.
- The SMART teams had difficulty transmitting their field data to Incident Command in a timely manner. The lack of internet connectivity on the SMART aircraft and vessels prohibited the field teams from sending data directly from the field. Instead, the data was hand delivered to a Command Post or staging area where it could be emailed to the NOAA SSC. With the SMART data passing through several sets of hands between the field and IC, delays in the data flow developed as everyone's workload increased. (Levine et al., 2011; Hunt, 2012)
- The enormous operating area of the DWH dispersant operations continuously challenged the SMART teams. It was extremely difficult for the SMART vessels traveling at 20 kts to cover the distances required to successfully meet up with the spray aircraft traveling at 120+ kts. (Parscal, 2011; Gass et al., 2011)
- The SMART resources were insufficient to provide monitoring for the twelve dispersant application aircraft participating in spray operations. The SMART teams utilized three helicopters and two vessels to conduct 118 Tier I and/or Tier II/II sorties compared to the 412 spray application sorties. The teams quickly learned that they could not monitor every spray sortie and focused on the sorties that provided the highest likelihood of success. (Levin et al., 2012; Houma ICP Aerial Dispersant Group, 2010)
- The SMART teams were not equipped or trained for the task of monitoring the effectiveness of deep-sea dispersant injection.
- SMART procedures and methodologies were not sufficient to determine the effects of the dispersant and oil on marine life in the water column. (Levin et al., 2012)

ED_001324_00007763-00096

- SMART was not able to correlate between "effectiveness" and other factors such as oil weathering and field conditions during dispersal application. (Levin et al., 2012)

Although the SMART Protocol does not discuss dispersant monitoring in ice conditions nor has SMART been mobilized to perform dispersant monitoring in ice conditions, the possibility of such a response exists. Some research has been done that can serve as a starting point as we consider how (and if) SMART methodologies can be modified to address this challenging environment. (Daling, Holumsnes, Rasmussen, Brandvik, & Leirvik, 2010; Sørstrøm, 2009)

The SMART Protocol notes that SMART is not limited to oil spills and that the protocol can be adapted to other hazardous substance responses. This implies that the equipment, methodologies, and expertise of the SMART teams may be of value in responses other than oil spills. One recent example is the USCG Pacific Strike Team's involvement in the Sept. 2013 molasses spill in Honolulu, HI. In coordination with a NOAA SSC, the team deployed a Hydrolab DataSonde portable water lab equipped with a dissolved oxygen sensor. The premise was to identify any depletion of dissolved oxygen in Honolulu Harbor that could harm marine life. The operation lasted for "a day or so" and the NOAA SSC later reported that the data from the effort was of little value. (R. Yender, 9 April 2014)

APPENDIX C. SURVEY OF TECHNOLOGY AND METHODS TO ADDRESS SMART PERFORMANCE GAPS

C.1 Introduction

This Appendix proposes solutions that address the SMART performance gaps identified in Appendix B. To identify these solutions, the project team relied primarily on interviews with SMART stakeholders and web-based research. In addition, the project team attended the International Oil Spill Conference (IOSC) 2014 to meet with multiple vendors and discuss their offerings. The team also operated some equipment at field demonstrations. The result of these activities is the set of proposed solutions described here under four major categories: monitoring protocol, Coast Guard (CG) policies, personnel training, and technology.

C.2 Monitoring Protocol

The project team asked SMART stakeholders how well the 2006 SMART Protocol provides guidance for dispersant and in-situ burn (ISB) monitoring operations. The team discussed response operations currently considered by the SMART Protocol, as well as newer response operations that are not covered in the document. Monitoring topics discussed included:

- Tier I: Visual Observations.
- Tier II: On-Water Monitoring for Efficacy.
- Tier III: Additional Monitoring.
- Water parameter measurement.
- Water sampling.
- Deep Ocean Dispersant Injection Monitoring (not currently addressed by SMART).
- In-Situ-Burn Air Monitoring.
- Mobilizing Monitoring Resources.
- Using and Interpreting Monitoring Results.
- Information Flow and Data Handling.

Most SMART stakeholders agreed the current SMART Protocol is adequate in providing general guidance for monitoring a typical dispersant or ISB operation. They noted that the existing protocol was written to address the type of dispersant or ISB responses that were anticipated at that time - a response lasting on the order of a few days, covering a limited geographic area. All interviewees agreed that the 2010 Deepwater Horizon (DWH) dispersant monitoring requirements far exceeded the requirements that were provided in the SMART Protocol, and that such "atypical" response operations require more detailed guidance. Most stakeholders prefer an additional guidance document that addresses atypical response operations rather than expanding the scope of the current SMART Protocol. In addition, the National Response Team (NRT) finalized a document addressing atypical response prior to the beginning of this study. In that document, dispersant or ISB operations greater than 96 hours are considered atypical responses. When asked specifically about whether SMART should include guidance for monitoring sub-sea dispersant injection, most stakeholders agreed that such monitoring is beyond the technical capabilities of the existing SMART teams and beyond the scope of the SMART Protocol. Again, most stakeholders recommended a separate guidance document for this type of monitoring.

ED_001324_00007763-00098

There is however, one element of SMART that might be applied to an atypical response. The Tier I (visual monitoring) techniques described by the SMART Protocol (Section C.3.3) may also be of value for monitoring the surface expression of oil during a sub-sea dispersant injection program. This is an area where the USCG SMART teams may be able to contribute to a sub-sea dispersant injection monitoring effort.

Most stakeholders indicated that beyond general guidance, the current SMART Protocol lacks the detailed operational instructions required by the participating agencies. The USCG SMART field teams noted a lack of direction for their specific SMART data collection procedures, and equipment, and NOAA data evaluation teams noted a lack of operational instructions for data processing and data evaluation techniques. Some stakeholders suggested bringing this type of detailed operational instruction into the protocol, while others cautioned that such detail requires unnecessarily frequent updates and modifications to the document as technology evolves. More detailed procedural instructions, such as stand-alone job aids or additional attachments to the protocol might address both points of view. Section C.3.3 includes a list of recommended instructions.

C.3 Coast Guard Policies

The project team interviewed United States Coast Guard (USCG) and National Oceanic and Atmospheric Administration (NOAA) personnel to identify changes or additions to existing policies that would minimize the SMART performance gaps. The team discovered policy gaps in three broad categories: SMART roles and responsibilities, SMART response timelines, and SMART monitoring procedures. Recommendations based on that information are presented below.

C.3.1 SMART Roles And Responsibilities

Conversations with both the SMART data collection group (USCG) and the SMART data end-user (NOAA) helped the project team establish some basic roles and responsibilities for the SMART process.

C.3.1.1 SMART Data Collection

The NOAA and USCG personnel concurred with their respective roles and the data collection requirements described below. NOAA will provide general SMART mission objectives. The Strike Teams will conduct the SMART field activities, and provide the personnel, equipment, and logistics necessary for SMART data collection during a typical dispersant or burn operation. If dispersant or ISB operations extend beyond 96 hours, the Strike Teams will turn over SMART data collection activities to contracted SMART Teams, and provide oversight for SMART field activities. Both USCG and contracted SMART teams will provide a standardized SMART data package, similar to the package developed during the 2010 DWH response. The SMART data package may be modified per the needs of the NOAA SSC, but in general the SMART teams should be prepared to provide the following data for dispersant monitoring operations:

- Descriptive photographs (from both aerial and on-water platforms).
- Photo Log.
- Fluorometry data (from both 1 meter and 5 meter depths).
- Fluorometer Operator's Log.
- Water parameter data (water temperature, conductivity, dissolved oxygen content, pH, and turbidity) versus depth, down to 10 meters.
- Water Parameter Sampling Log.

ED_001324_00007763-00099

- Discrete water samples at depths down to 10 meters (collected and preserved in a manner appropriate for the level of analysis).
- Discrete Water Sampling Log and Chain of Custody (if required)

For ISB monitoring operations, NOAA requested immediate notification of particulate readings above the Level of Concern (LOC) followed up by a data package containing:

- Descriptive photographs.
- Photo Log.
- Air Monitor Operator's Log.
- Digital Air Monitoring data.

For both dispersant and in-situ burn monitoring operations the SMART data packages must be standardized and include all the information needed by the stakeholders. This will require the development of detailed operational guides.

C.3.1.2 SMART Data Processing and Evaluation

Discussions with NOAA personnel indicate that NOAA will take on the responsibility for SMART data processing and evaluation, and that NOAA has begun the process to put a SMART data processing program in place.

C.3.2 SMART Response Timelines

NOAA and USCG stakeholders agreed on the below as an acceptable SMART response timeline;

- ISB air monitoring is operational on Day 1 of burn operations.
- Tier I dispersant monitoring is operational on Day 1 of dispersant spray operations.
- Tier II/III dispersant monitoring builds in on Day 2 of dispersant spray operations.
- Contractors replace USCG monitoring teams after 96 hours of monitoring effort for both ISB and dispersant monitoring operations.
- USCG personnel continue to oversee contracted SMART data collection teams for as long as dispersant application operations occur.

C.3.3 SMART Monitoring Procedures

Stakeholders identified a lack of detailed operational guidance for the SMART data collection process. The 2006 SMART Protocol provides high level guidance on the overall SMART process along with some detailed operational instructions. However, USCG SMART teams indicated the need for more detailed information on the deployment, operation, and maintenance of the equipment and data collection techniques specific to USCG SMART operations. As an example, the Dispersant Water Sampling section of the SMART Protocol (Section 3.12) describes a sampling procedure based on a flow-through fluorometer, an instrument the USCG no longer uses.

The USCG should consider engaging other SMART stakeholder agencies for assistance in developing these guidance documents. The EPA in particular has a great deal of experience with field data collection techniques and data quality management issues, and has offered their assistance in developing SMART

procedures and practices. Below are some general categories of information useful in developing guidance documents more specific to USCG operations.

Tier I Aerial Observation and Photo Documentation

- Coordination with dispersant spray platforms
- Photography techniques
- Documentation
- Air to air communication
- Air to surface communication
- Data transmission
- Reporting to Command

SMART Aerial Spotting

- Mission planning
- Oil slick identification and characterization
- Coordination of dispersant spray platforms and SMART vessels
- Air to air communication
- Air to surface communication
- Reporting to Command

Tier II/III Water Sampling

- Site selection
- Sample collection protocols
- Documentation
- Sample storage
- Sample delivery
- Chain of Custody requirements

Tracking buoy deployment

- Data Processing and Evaluation
- Overall data quality control and quality assurance
- Evaluating data collection procedures
- Interpreting Tier I photos and Observer Log
- Processing and interpreting fluorometry data
- Processing and interpreting water quality data
- Overseeing water sample analysis
- Presenting the SMART data

Tier II/III Fluorometry Data Collection

- Site selection
- Tracking buoy deployment
- Instrument deployment & calibration
- Data logging
- Data formatting
- Documentation
- Data transmission
- Reporting to Command

Tier II/III Water Parameter Collection

- Site selection
- Instrument deployment & calibration
- Data logging
- Data formatting
- Documentation
- Data transmission
- Reporting to Command

ISB Air Monitoring

- Mission planning
- Site selection
- Instrument deployment & calibration
- Data logging
- Data formatting
- Documentation
- Data transmission
- Reporting to Command

C.3.3.1 Equipment and Instrumentation

The project team recognized the need for detailed guidance specific to the operation and maintenance of the USCG SMART equipment and instrumentation. This additional guidance need not be included in the SMART Protocol but should be available to the Strike Teams. For example, USCG standard operating procedures (SOPs) should specify the instrument or piece of equipment, and include detailed operational,

calibration, and maintenance instructions. Below is a list of the SMART equipment and suggested topics for USCG specific SOPs.

Radios and Satellite Communications Equipment
- Operating instructions
- Inspection checklist
- Maintenance procedures
- Inspection and maintenance schedule

Fluorometer
- Operating instructions
- Calibration check
- Inspection checklist
- Maintenance procedures
- Inspection and maintenance schedule

Water Sampling Equipment
- Operating instructions
- Inspection checklist
- Maintenance procedures
- Inspection and maintenance schedule

Photography Equipment
- Operating instructions
- Inspection checklist
- Maintenance procedures
- Inspection and maintenance schedule

Multi-Parameter Water Sonde
- Operating instructions
- Calibration check
- Inspection checklist
- Maintenance procedures
- Inspection and maintenance schedule

Particulate Air Monitors
- Operating instructions
- Calibration check
- Inspection checklist
- Maintenance procedures
- Inspection and maintenance schedule

C.4 Personnel Training

The current NSF SMART training curriculum addresses most of the topics below, but in some cases not to the level of detail needed to maintain proficiency in all aspects of SMART operations. As an example, SMART fluorometry operations are covered in great detail, while other components of SMART, such as water sampling, water parameters, and air monitoring are covered in theory only, and currently no hands-on equipment training exists. Below is a summary of the training modules that should be included in a comprehensive SMART training program.

Overall SMART Mission
- Purpose/Role
- Dispersant monitoring
- ISB monitoring

Tier I Aerial Observation
- Aircraft suitability
- Coordination with dispersant spray platforms
- Photography requirements & techniques
- Documentation
- Air to air communication

SMART Aerial Spotting
- Mission planning
- Oil slick identification and characterization
- Coordination of dispersant spray platforms and SMART vessels
- Air to air communication
- Air to surface communication
- Reporting to Command

Tier II/III Fluorometry Data Collection
- Site selection
- Instrument deployment
- Data logging
- Data formatting
- Documentation

ED_001324_00007763-00103

Air to surface communication
- Data transmission
- Reporting to Command

Tier II/III Water Sampling
- Site selection
- Sample collection protocols
- Documentation
- Sample storage
- Sample delivery
- Chain of Custody requirements

ISB Air Monitoring
- Mission planning
- Site selection
- Instrument deployment
- Data logging
- Data formatting
- Documentation
- Data transmission
- Reporting to Command

Data transmission
- Reporting to Command

Tier III Water Parameter Collection
- Site selection
- Instrument deployment
- Data logging
- Data formatting
- Documentation
- Data transmission

C.5 Technology

Of the SMART technology gaps identified in Appendix B, communications is the most persistent and pressing challenge facing the SMART field teams. The project team also noted several areas where the SMART technology is dated or does not meet the required functional capabilities. In some cases, mission capability will be enhanced with better deployment strategies and maintenance programs, while in other cases, newer, more effective equipment is needed.

C.5.1 In-Situ Air Monitoring Instrumentation Technology

The SMART Protocol prescribes the deployment of air monitoring teams when a concern about public exposure to smoke from the burning of oil exists. To perform this function effectively, each team requires a real-time particulate monitor capable of detecting the small particulates emitted by the burn (ten microns in diameter or smaller). Each monitoring instrument should display and log the instantaneous particulate concentration as well as a time weighted average (TWA) concentration. SMART recommends averaging concentrations over one-hour periods. The SMART Protocol does not require nor endorse a specific brand of particulate monitoring instrument. Rather, SMART specifies performance criteria, and instruments meeting those criteria useful for ISB monitoring Table C-1.

Table C-1. SMART ISB air monitoring performance criteria.

Criteria	Description
Rugged and portable	The monitor should be suitable for field work, withstand shock, and easily transportable in a vehicle, small boat or helicopter. Maximum size of the packaged instrument should not exceed that of a carry-on piece of luggage.
Operating temperature	15-120 °F
Suitability	The instrument should be suitable for the media measured, i.e., smoke particulates.

ED_001324_00007763-00104

Operating duration	Eight hours or more.
Readout	The instrument should provide real-time, continuous readings, as well as time weighted average (TWA) readings in μg/m³.
Data logging	The instrument should provide data logging for 8 hours or more.
Reliability	The instrument should be based on tried-and-true technology and operate as specified.
Sensitivity	A minimum sensitivity of 1 μg/m³.
Concentration range	At least 1-40000 μg/m³.
Data download	The instrument should be compatible with readily available computer technology, and provide software for downloading data.

Market research by the project team identified three particulate air monitoring instruments meeting the minimum performance criteria set by the 2006 SMART Protocol (sec. 3.6). Beyond these minimum performance criteria, the team also considered other features offering faster response times, lower maintenance requirements, or a better user interface. Details for each instrument are provided below and a cost summary to equip one Strike Team is provided in Table C-6.

C.5.1.1 ThermoScientific DataRAM 4 (Discontinued By Manufacturer)

Production of the DataRAM 4 (Figure C-1) is discontinued. However, because it remains the NSF's current air monitoring device, and because the manufacturer indicates it will continue to provide support for the unit through 2016, the product is included as a technology solution. The DataRAM 4 meets the minimum SMART performance criteria, but lacks some features that would assist the field operator – features that are included in newer generation instruments. In particular, the DataRAM 4 does not provide a real-time graphical display of the instantaneous and TWA concentrations. Since SMART is concerned with the overall trend of these values, a historical presentation of the data is valuable. In addition, the set-up software is not compatible with Windows operating systems beyond Windows XP. This will become more problematic as Windows 7 increasingly becomes the standard operating system for most USCG computers. A summary of the ThermoScientific DataRAM 4's characteristics against the SMART requirements is shown in Table C-2.

Table C-2. ThermoScientific DataRAM 4.

Pros	Cons
Currently in the NSF SMART inventory	Discontinued by Manufacturer (Replaced by ADR 1500)
	Product support will end 2016
	Interface software is not compatible with Windows 7

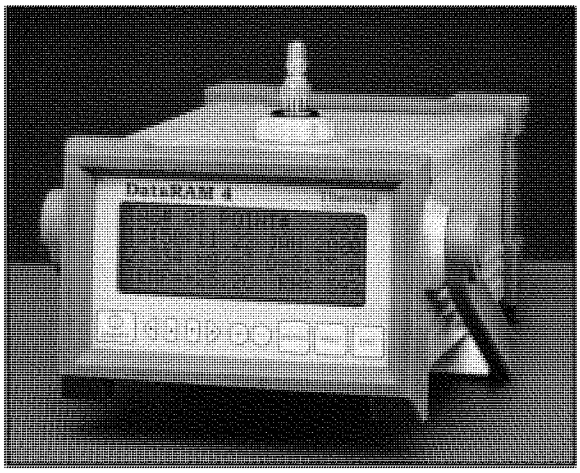


Figure C-1. ThermoScientific DataRAM 4.

C.5.1.2 ThermoScientific ADR 1500

The ThermoScientific ADR 1500 (Figure C-2) is the next generation air monitoring instrument recommended by the manufacturer to replace the discontinued DataRAM 4. The ADR 1500 is portable, self-powered (internal battery), and mounted in a weather proof case. The unit displays real time instantaneous and TWA concentration values in a text and graphical format to a connected laptop computer. The TWA display however is not configured to specifically display a one-hour TWA concentration. The project team considers this a serious drawback considering that the one-hour TWA is the most important piece of information monitored by the operator during SMART operations. A summary of pros and cons for the ThermoScientific ADR 1500's is shown in Table C-3; the field deployment configuration is shown in Figure C-3.

Table C-3. ThermoScientific ADR 1500.

Pros	Cons
Weatherproof enclosure	Poor instrument display
Real time laptop computer display	Configured more for unattended use
Battery powered	Cannot display one-hour TWA values

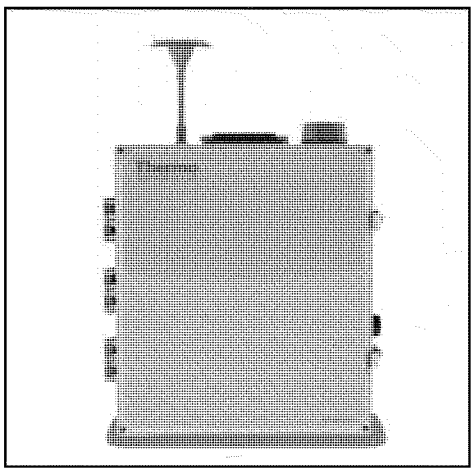


Figure C-2. ThermoScientific ADR 1500 Area Dust Monitor.

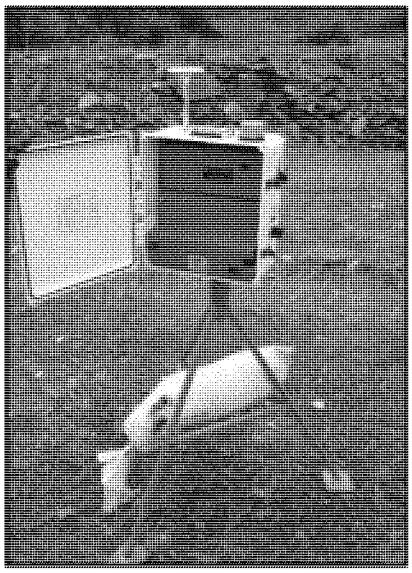


Figure C-3. ThermoScientific ADR 1500 Area Dust Monitor field deployment.

C.5.1.3 The TSI DustTrak DRX 8533 W/ Weather Proof Case

The TSI DustTrak DRX 8533 is portable, self-powered (internal battery), housed in a weather proof case (Figure C-4 and Figure C-5), and set up via the built in touchscreen or through a connected laptop computer. The built-in touchscreen display is capable of displaying instantaneous and TWA concentration values in either numerical or graphical form (Figure C-6). Though the unit can display only a single, user-selected particle size concentration (PM1, PM2.5, or PM10), the instrument simultaneously measures and logs the concentration of all three particle size categories, which might be valuable after the fact, if more detailed particle size analysis is requested.

Of the three instruments the project team considered, only the TSI DustTrak DRX 8533 has the capability to measure and log three particle size categories simultaneously. The project team had an opportunity to operate this instrument during an oil spill response training event, and the only disadvantage noted is that the unit cannot display real time data through a connected laptop. This instrument has a high quality built-in display screen that might make-up for the lack of a connected laptop (Figure C-6). Pros and cons of the TSI DustTrak DRX 8533 are shown in Table C-4.

Table C-4. The TSI DustTrak DRX 8533.

Pros	Cons
Unit is operated with case open or closed	No real-time computer display
Weather proof case (Pelican Case)	
Good computer interface for instrument set-up	
Battery powered (25-30 hr with aux battery mounted in case)	
Simultaneously logs PM1, PM2.5, and PM10	
Real time instrument display of instantaneous and one hour TWA particle concentrations (for a single particle size only)	
Very simple pre-deployment calibration	
Annual maintenance and calibration from manufacturer is	

available	

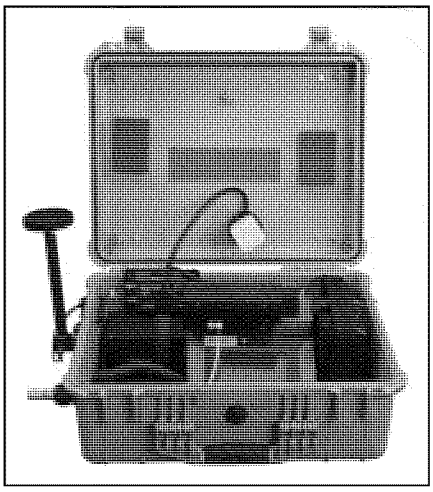


Figure C-4. TSI DustTrak DRX 8533 air monitor with weather proof enclosure.

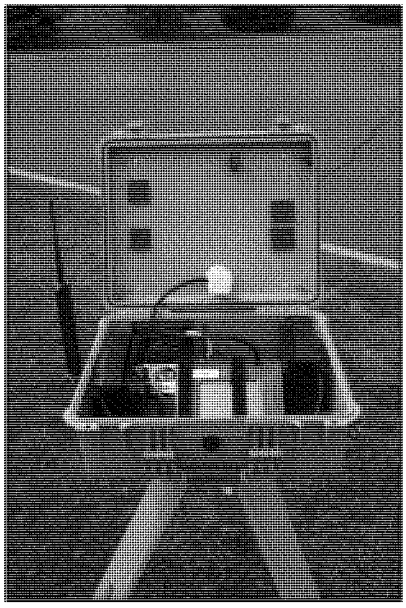


Figure C-5. TSI DustTrak DRX 8533 air monitor field deployment.

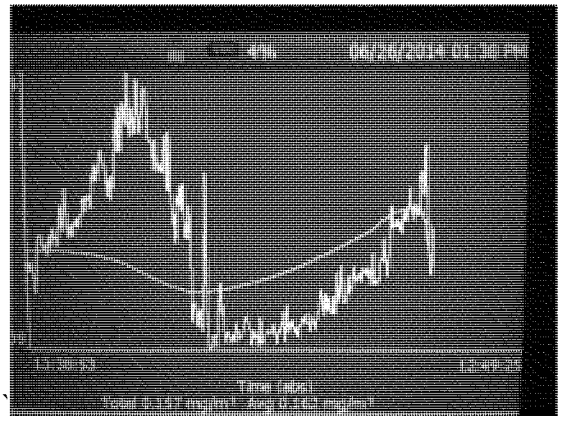


Figure C-6. TSI DustTrak DRX 8533 air monitor touch screen showing a graphical view of instantaneous and TWA particle concentration values.

C.5.1.4 Air Monitoring Instrument Summary

A summary of in-situ air monitoring instrumentation meeting SMART criteria is provided in Table C-5. Additional attributes are also displayed. The instruments described in Table C-5 satisfy the requirements of the SMART Protocol.

Table C-5. Air monitoring sensor table.

Performance Criteria **Air Monitoring Sensors**	Data RAM 4*	ADR 1500	Dust Trak DRX
SMART Performance Criteria			
Rugged and portable	✓	✓	✓
Operating temperature	✓	✓	✓
Suitability	✓	✓	✓
Operating duration	✓	✓	✓
Readout	✓	✓	✓
Data logging	✓	✓	✓
Reliability	✓	✓	✓
Sensitivity	✓	✓	✓
Concentration range	✓	✓	✓
Data download	✓	✓	✓
Other Attributes			
Currently within NSF SMART inventory	✓		
Simultaneously logs different particle size categories			✓
Real time graphical display of TWA on instrument			✓
Real time computer display		✓	
Weatherproof Case		✓	✓
Technological Maturity		✓	✓
Windows 7 Compatibility		✓	✓
Intrinsically Safe			
Hot-swappable battery			✓
PM2.5 and PM10 Concentration Capability	✓	✓	✓
Typical Battery Run Time (hrs.)	20	24	32
Package Weight (lb.)	12	29	38†
* The ThermoScientific DataRAM 4 has been discontinued by the manufacturer †Package Weight includes a second, auxiliary battery.			

Table C-6. Air monitoring instrumentation cost.

Acquisition Cost			
	ThermoScientific DataRAM 4	ThermoScientific ADR 1500	TSI DustTrak DRX 8533 W/ Weather Proof Case
Instrument cost	Currently within the USCG Strike Team inventory	$21,000 (3 units @ $9,000 each)	$39,000 (3 units @ $13,000 each)
Ruggedized laptop computer with weather proof case	$18,600 (3 units @ $6,200 each)	$18,600 (3 units @ $6,200 each)	$18,600 (3 units @ $6,200 each)
Software	not required	No cost	No cost
Total acquisition cost	**$18,600**	**$39,600**	**$57,600**
Annual Cost			
Manufacturer's maintenance and service plan.	$2,100 (3 plans @ $700/yr each)	$2,100 (3 plans @ $700/yr each)	$1,875 (3 plans @ $625/yr each)
In-house training*	$700	$700	$700
Total annual cost	**$2,800**	**$2,800**	**$2,575**

*Annual training cost represents the additional cost required to add the device specific training to the existing annual SMART training curriculum.

C.5.2 Spill - Tracking Drifters

As part of the SMART dispersant monitoring process, field teams attempt to sample the same portion of an oil slick at two different times. In between these two samples the field teams must move away from the area (sometimes up to two miles away) to remain safely clear of dispersant spray operations. Reestablishing the sampling locations for a subsequent sample following spray operations can be difficult. During the DWH response, USCG SMART teams improvised several different floating buoy systems that helped them mark and return to the sample location. These buoys were very simple (e.g., a weighted 5 gallon bucket), but they were effective as long as the field team could arrive within approximately 100 yards of the marker. Beyond 100 yards, the field teams had difficulty locating the marker. With a 2-mile safety standoff distance during spray operations, finding the marker proved quite challenging.

A better solution would be the use of a buoy system that would drift with the oil slick and transmit real time position information. The position information can be transmitted from the buoy either via a simple radio beacon (radio tracking system) or via a satellite communications network. Details for two tracking drifters are provided below and a cost summary to equip one Strike Team is provided in Table C-9.

C.5.2.1 NovaTech RF-700C2 Buoy and DF-500N Direction Finder

The NovaTech RF-700C2 radio tracking buoy (Figure C-7) transmits a repeating tone over a radio frequency that can be received by the DF-500N Direction Finder (Figure C-8). Past deployments have demonstrated that this portable radio tracking systems has an operational range of around two miles. The system provides the operator only with the direction to the buoy and a rough estimation of the distance (based on signal strength). The primary advantage of a radio beacon buoy is that it is a self-contained system - no outside communications network is required. The pros and cons of the NovaTech RF-700C2 buoy and DF-500N Direction Finder are listed in Table C-7.

Table C-7. NovaTech RF-700C2 buoy and DF-500N Direction Finder.

Pros	Cons

ED_001324_00007763-00110

Portable and self-powered: - buoys using standard D-cell batteries - DF-500 uses internal multi-year rechargeable battery*	Limited range
Does not require additional communications capability or network services	Directional information only
"Sticks" to the oil and tracks well with the slick	
Operating life of up to 8 days on a single charge (per manufacturer)	
Proven history in oil spill response	
A single DF-500N Direction Finder can operate with multiple buoys	

*Use of 7-8 years without issues reported by Parscal Pacific

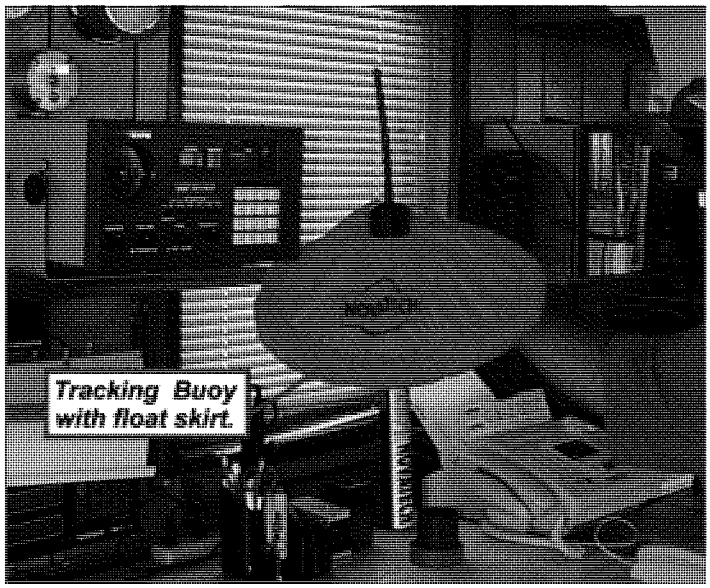


Figure C-7. NovaTech RF-700C2 buoy.

Figure C-8. NovaTech DF-500N Hand Held Direction Finder.

C.5.2.2 MetOcean iSphere Tracking Buoy

The MetOcean iSphere is a satellite tracking buoy with a history of use in the oil spill response industry. A satellite-based tracking buoy utilizes a built-in GPS receiver and has the capability to transmit an accurate position periodically over a satellite communications network. Retrieving the buoy position requires an internet connection, which may be problematic for the SMART field teams. However, if internet connectivity is available, a satellite tracking buoy system would be a valuable tool. The iSphere buoy is relatively small (about 16" in diameter) and designed to adhere to and drift with a surface oil slick (Figure C-9. and Figure C-10.). Once activated (via a magnetic switch) the unit automatically transmits position data every 10 minutes. The data are transmitted through the Iridium satellite network to an internet website where it can be accessed by registered users (Figure C-11). A third party vendor provides access to the Iridium satellite network and hosts the website where the data are displayed. The vendor, JouBeh, offers a service plan specifically designed for the emergency response industry that costs $175 per buoy annually for satellite access, plus a fee of $1.40 per kilobyte of data used. One kilobyte of data represents approximately 10 hours of buoy operation. The pros and cons of the MetOcean iSphere Tracking Buoy are listed in Table C-8.

Table C-8. MetOcean iSphere Tracking Buoy.

Pros	Cons
Built-in GPS receiver	Requires Iridium satellite communications data plan (Approx. $175/yr.)
Tracks well with the slick	Requires internet connectivity to access real-time data in the field
Data available to any operator with an internet connection	Internal batteries must be replaced by the manufacturer after 2-year shelf life (this cost is covered in the maintenance plan)
Provides accurate position information	
Long battery life (180-365 days of operation)	
Simple deployment	

Manufacturer offers a battery replacement and maintenance plan	

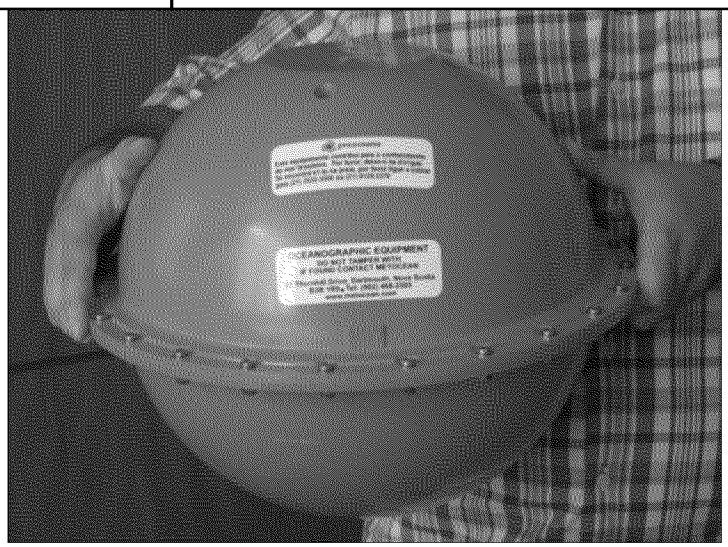


Figure C-9. MetOcean iSphere Tracking Buoy.

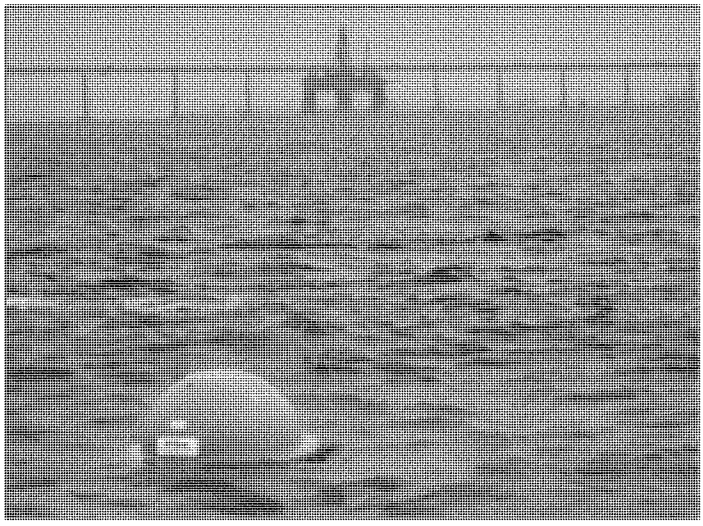


Figure C-10. MetOcean iSphere Tracking Buoy deployed.

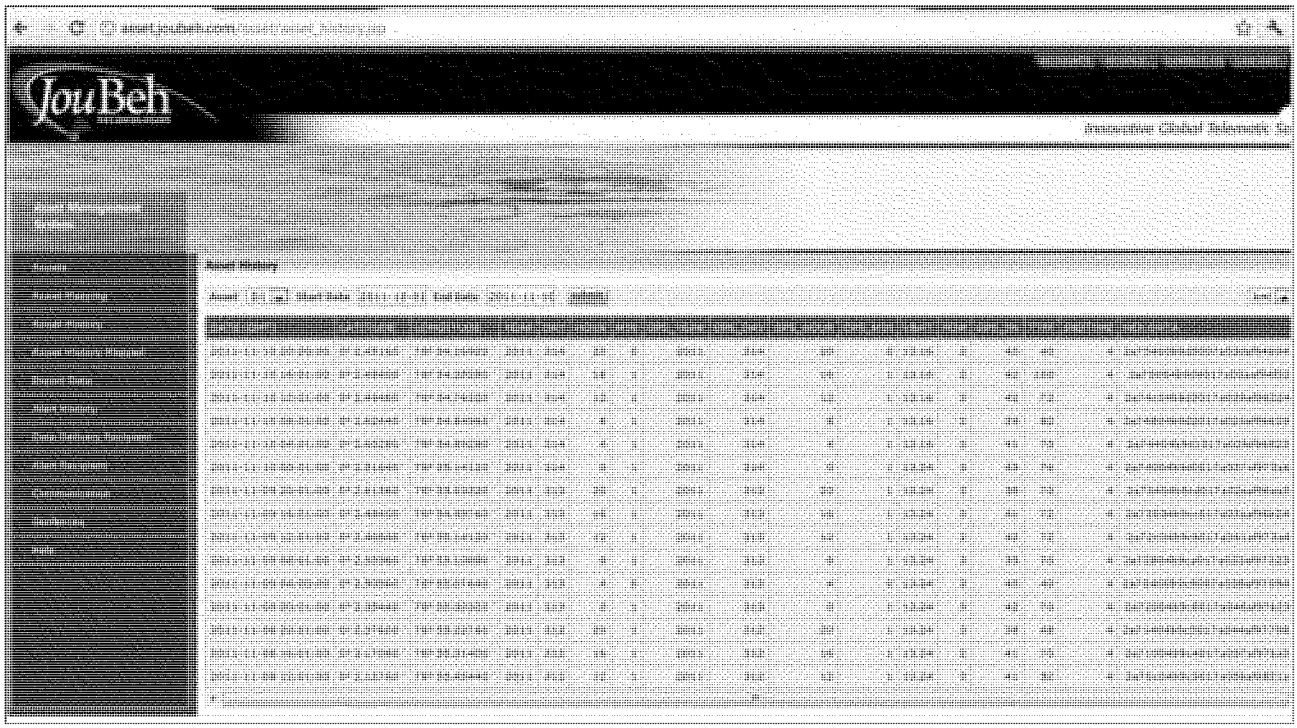


Figure C-11. Example of the iSphere data webpage.

Table C-9. Tracking buoy cost.

Acquisition Cost		
	NovaTech RF-700C2 buoys	iSphere tracking buoys
Buoy cost	$3,800 (2 buoys @ $1,900 each)	$5,600 (2 buoys @ $2,800 each)
DF-500N Direction Finder*	$2,200 (1 @ $2,200 each)*	Not applicable
Software	not required	not required
Weather Proof travel case	$250 (1 @ $250)	$400 (1 @ $200)
Total acquisition cost	**$6,250**	**$6,000**
Annual Cost		
Maintenance**	negligible**	Not applicable
JouBeh data plan	Not applicable	$350 (2 plans @ $175/yr each)***
Battery replacement and service plan	Not applicable	$750 (2 plans @ $375/yr. each)
In-house training****	$350	$350***
Total annual cost	**$350**	**$1,450**

* A single DF-500N Direction Finder can operate with multiple buoys.
** The DF-500N Direction Finder requires no periodic maintenance and the NovaTech RF-700C2 batteries are user replaceable (standard "D" cell batteries).
*** Plus $1.40 per kilobyte of data used. (One kilobyte of data represents approximately 10 hours of buoy operation.)
**** Annual training cost represents the additional cost required to add the device specific training to the existing annual SMART training curriculum.

ED_001324_00007763-00114

C.5.3 Water Parameter Measurement

In addition to fluorometry data, the SMART Protocol prescribes that water physical and chemical parameters be measured during Tier III operations. NOAA has requested that the Strike Teams develop the capability to measure and record sample depth, water temperature, conductivity, dissolved oxygen content, pH, and turbidity as part of their SMART Tier III capability. This capability is satisfied by use of a portable multi-parameter water quality sonde.

The SMART Protocol does not list specific performance criteria for multi-parameter water quality sondes, so the project team focused on instruments that are from well-established manufacturers, and that are in common use by the Oceanographic and Water Quality professions. Of those instruments, the project team identified four instruments from two different manufacturers with a good user interface, and with well documented calibration and maintenance procedures. Two of the instruments (HydroLab DS5 [Figure C-12] and YSI Model 6600 [Figure C-13]) are based on established technology, but with less user-friendly (older) interfaces. Two instruments (HydroLab HL4 (Figure C-14.) and YSI EXO 2 (Figure C-15). use newer technology with more features and better user interfaces. The instruments are all available with Luminescent Dissolved Oxygen sensors. The purpose of this sensor is to eliminate the need for a membrane, and after a short warm-up period, provide nearly instantaneous readings. All four instruments can continuously log data and display data real time on a handheld interface. All can dump data to a computer after the fact. All but the DS5 can display and log data real-time to a connected computer.

Some stakeholders suggested a fluorometry-based oil detection sensor as a valuable addition to SMART water quality data. The project team identified only one instrument, the YSI Model 6600 which is configurable with an optional crude oil fluorometry sensor. However, configuring the YSI to perform both water parameter and fluorometry SMART data collection would require the development of a towing body for the instrument along with reconfiguring the current SMART data logging software. It may also require a change to the YSI 6600 Model firmware. Overall, this may not be a worthwhile effort, considering the unit is scheduled to be taken out of production within the next few years. The project team did not identify any fluorometer that could be easily modified to measure water parameters.

The HydroLab DS5 is currently in the USCG SMART inventory but is an older generation instrument with a cumbersome user interface and difficult calibration and maintenance requirements. The recent introduction of multi-parameter sondes with better performance and user interface characteristics makes these new devices candidates for modernizing the Strike Team SMART capability. The project team was unable to test either the HydroLab HL4 or YSI EXO 2 because they are so new to the market, however based on the published specifications and discussions with the manufacturers, they appear promising. The pros and cons of all four instruments are listed below (Table C-10, Table C-11, Table C-12, and Table C-13), and Table C-14 summarizes the attributes of the four multi-parameter water quality sondes. Details for each instrument are provided below and a cost summary to equip one Strike Team is provided in Table C-15.

HydroLab DS5

Table C-10. HydroLab DS5.

Pros	Cons
Configurable to sample all the water quality parameters requested by the SMART Protocol	Older generation technology
Currently in the USCG inventory	Somewhat difficult user interface
Real time computer interface with data display	No built in GPS receiver
	Internal battery is optional
	No crude oil fluorometer integration
	Poor instrument user interface

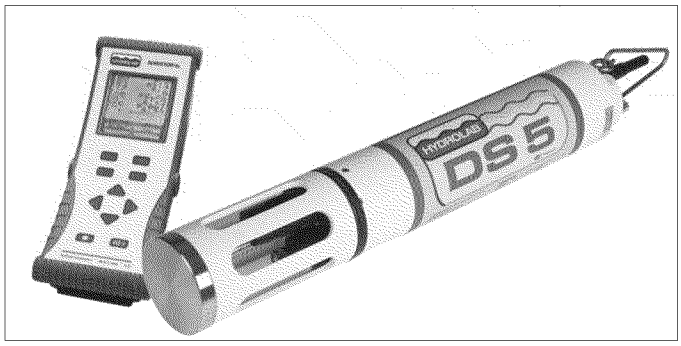


Figure C-12. HydroLab DS5 multi-parameter sonde.

YSI Model 6600

Table C-11. YSI Model 6600.

Pros	Cons
Configurable to sample all the water quality parameters requested by the SMART Protocol	Older generation technology
Optional Crude oil fluorometer integration (additional $7K)	The manufacturer is discontinuing this model mid-2015. Support is scheduled to continue for approx. 5 years after discontinuance.
Real time computer interface with data display	Built-in GPS receiver is an added cost option
Self-powered (internal battery)	

Figure C-13. YSI 6600 multi-parameter sonde.

Table C-12. HydroLab HL4.

Pros	Cons
Can be configured to sample all the water quality parameters requested by the SMART Protocol	No standard built in GPS receiver (optional GPS receiver will be available soon)
Real time computer interface with data display	No crude oil fluorometer integration
Self-testing function	Internal battery is an added cost option
Calibration self-check and warning	
Software based calibration wizard	
Automatic calibration and usage log	
Manual GPS and user notes input capability	
Good handheld user interface	
Good real time data display with internal logging	

Figure C-14. HydroLab HL4 multi-parameter sonde.

YSI EXO 2

Table C-13. YSI EXO 2 (approx. $16k).

Pros	Cons
Configurable to sample all the water quality parameters requested by the SMART Protocol	No crude oil fluorometer integration
Real time computer interface with data display	
Built in GPS receiver	
Self-powered (internal battery)	
Smart QC assisted calibration - Assisted calibration process with automatic checks for faults and errors.	
SMART sensor technology - sensors are interchangeable between instruments while maintaining calibration.	
Universal sensor ports - all sensors are interchangeable within the instrument. Allowing for multiple sensor configurations.	

Figure C-15. YSI EXO 2 Multi-parameter sonde (shown without sensor cover).

Water Parameter Sensor Summary

Table C-14. Water parameter sonde table.

Performance Criteria Water Parameter Sensors	HydroLab DS 5	YSI Model 6600	HydroLab HL 4	YSI EXO 2
SMART Performance Criteria				
Instrument Depth	✓	✓	✓	✓
Water Temperature	✓	✓	✓	✓
Conductivity	✓	✓	✓	✓
Dissolved Oxygen Content	✓	✓	✓	✓
pH	✓	✓	✓	✓
Turbidity	✓	✓	✓	✓
Other Attributes				
Currently within NSF SMART inventory	✓			
Built-in GPS Receiver		†	**	✓
Crude Oil Fluorometer Available		✓		
Instrument Weight (lb.)	8	7	5	8
Built-in Calibration Guide			✓	✓
Data download	✓	✓	✓	✓
Real Time instrument Display	✓	✓	✓	✓
Real time computer display		✓	✓	✓
Weatherproof	✓	✓	✓	✓
Portability	✓	✓	✓	✓
Internal Battery Pack	†	✓	†	✓
Computer interface	✓	✓	✓	✓
Technological Maturity			✓	✓
Windows 7 Compatibility	✓	✓	✓	✓

† Optional at added cost
** Optional GPS receiver will be available in the near future

Table C-15. Water parameter sonde cost.

Acquisition Cost				
	HydroLab DS5*	YSI Model 6600	HydroLab HL4	YSI EXO 2
Instrument cost	$10,000	$15,500	$10,700	$16,000
Software	No cost	No cost	No cost	No cost
Weather proof travel case	$300	$300	$300	$300
Total acquisition cost	**$10,300**	**$15,800**	**$11,000**	**$16,300**
Annual Cost				
Manufacturer's maintenance and service plan.	$495	$375	$495	$1,800
Calibration supplies	$500	$500	$500	$500
In-house training**	$700	$700	$700	$700
Total annual cost	**$1,695**	**$1,575**	**$1,695**	**$3,000**

* Currently within the USCG Strike Team inventory
**Annual training cost represents the additional cost required to add the device specific training to the existing annual SMART training curriculum.

C.5.4 Water Sampling

The SMART Protocol prescribes the collection of water samples during Tier II/III dispersant monitoring operations to assist in correlating instrument readings in the field to actual dispersed oil concentrations in the water column. NOAA requested the Strike Teams develop the capability to collect, store, and transport discrete water samples collected at depths ranging from 1 to 10 meters.

Water samples are very difficult to collect where surface oil slicks are present. Water samples are ideally collected through deployment of water samplers to the desired depth of sampling, rather than the use of pumps and tubing to pull water samples from depth. With pumps and tubing, there is a risk that oil droplets will adhere to the inside wall of the tubing and be released randomly, potentially contaminating future samples. When sampling in areas covered by a surface slick, extreme care is needed to "knock" the surface slick aside so that the sampling device does not become contaminated as it is lowered into the water. The sampling container should be closed as it descends through the higher oil concentrations near the surface. Then the container opens at the desired depth, fills with sample water, and closes again at the sample depth before being brought to the surface.

For sampling from shallower depths (less than 5m) a simple commercial off the shelf (COTS) "Pole Sampler" such as the CONBAR 7000 Series Telescopic Sampler should suffice. For deeper sample depths (up to 10m) the project team located only one COTS device that satisfies the closed-open-closed requirement described above. Details for the two instruments are provided below (Table C-16) and a cost summary to equip one Strike Team is provided in Table C-18.

C.5.4.1 CONBAR 7000 Series Telescopic Sampler

The CONBAR 7000 Series Telescopic Sampler (Figure C-16) is a simple and reliable device for the retrieval of 1 liter water samples from a stationary vessel. With a telescopic handle capable of extending from 7 to 24 feet in length the device is suitable for retrieving water samples from up to 5 meters below the surface. The CONBAR 7000 features a closed-open-closed sequence that minimizes the potential for contamination from near surface water. The device also accepts standard sample size bottles (1000 ml wide mouth jar) with no need to transfer the water sample from the sampler to a separate storage container. This

device satisfies the shallower water sampling requirements of the SMART Protocol. Pros and cons are listed in Table C-16.

Table C-16. CONBAR 7000 Series Telescopic Sampler.

Pros	Cons
Widely used in the water resources field and proven reliable.	At slightly over 7 ft long transport is cumbersome.
Simple deployment	Vessel must be stationary for deployment
7 ft retracted - 24 ft extended length	Sample collection depth is limited to 5 meters
No need to transfer the sample to another container for storage.	
The sampling head is designed to accept a standard 1000 ml wide mouth jar with 70-400 threads.	
Sampler head is made of chemically resistant polypropylene.	
An optional displacement plunger is available for use when sampling requirements specify a 1 inch air space between the sample and the cap.	

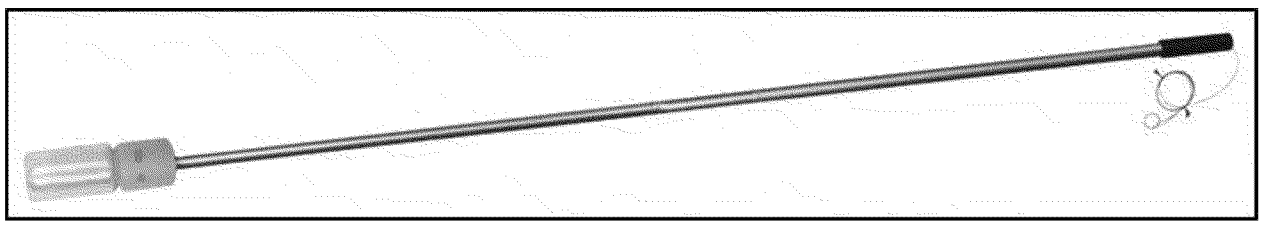


Figure C-16. CONBAR 7000 Series Telescopic Sampler.

C.5.4.2 General Oceanics GO-FLO Bottle

The General Oceanics GO-FLO sampling bottle (Figure C-17 and Figure C-18) is the only water sampling device the project team identified capable of satisfy the 5 to 10 meter water sampling requirements prescribed by the SMART Protocol. The device has a proven history in the oil spill response and oceanographic research fields and is adequate for the SMART water sampling requirements. The GO-FLO's closed-open-closed deployment sequence permits the collection of sub-surface water samples without the risk of contaminating the collection bottle as it passes to the sample depth. This is a critical feature for a SMART water sampling device since the near-surface water under an oil slick will contain more suspended oil than at deeper levels. The GO-FLO bottle is deployed in the closed position (to reduce potential contamination). A hydrostatic switch opens the bottle at both ends at approximately 10m depth. The bottle is then brought to the desired sample depth and a weighted messenger is sent down the line to close and seal the bottle. Once back on deck, the bottles are transferred into the appropriate sample storage containers. Pros and cons of the device are listed in Table C-17.

Table C-17. General Oceanics GO-FLO bottle model 108001.7T.

Pros	Cons
Sample bottle is specifically designed to avoid contamination by near surface water.	The water sample must be transferred from the GO-FLO bottle into a suitable container for storage.
Widely used in the oceanography field and proven reliable.	Deployment requires the use of additional weight or a weighted line.
Available with Teflon Lining	Vessel must be stationary for deployment
A single unit was purchased and successfully tested for SMART operations by the USCG Gulf Strike Team.	

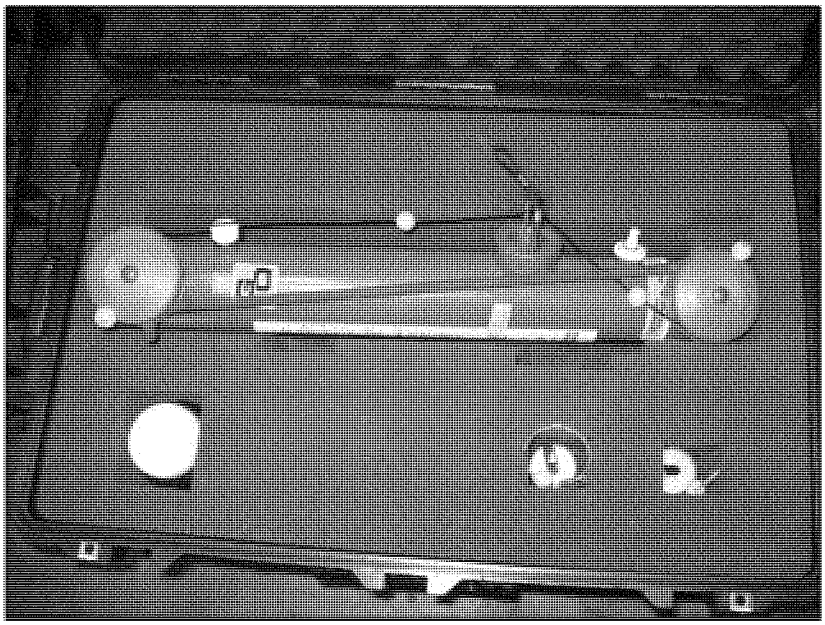


Figure C-17. GO-FLO sample bottle (USCG Gulf Strike Team package).

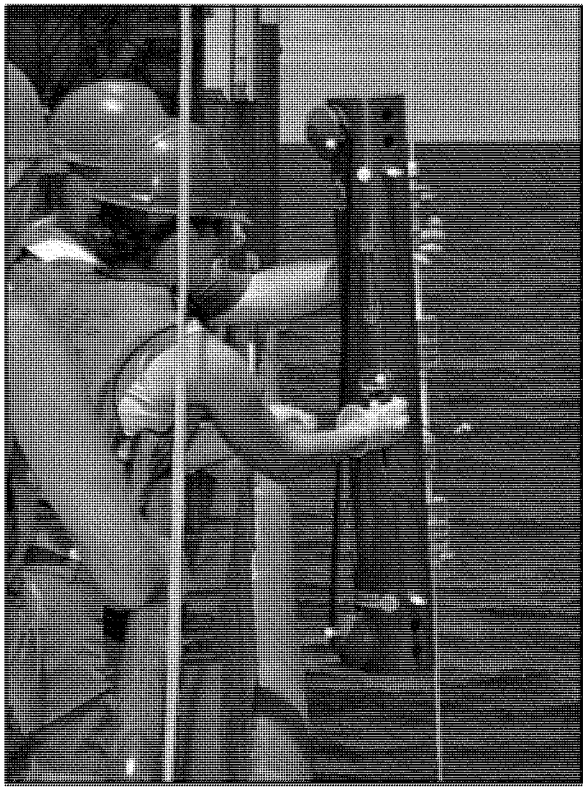


Figure C-18. Larger size GO-FLO sample bottle rigged for deployment.

Table C-18. Water sampling cost.

Acquisition Cost		
	CONBAR 7000	General Oceanics GO-FLO Sample Bottle
Instrument cost	$900 (2 units @ $450 each	$1,600 (one unit)
1 liter sample jars	$300 (48 @ $6.25 each)	$300 (48 @ $6.25 each)
Miscellaneous line and rigging		$300
Weather proof travel case	$300 (1@ $300)	$300 (1@ $300)
Total acquisition cost	**$1,500**	**$2,500**
Annual Cost		
Maintenance and service.	Negligible	$45 plus cost of any necessary repairs
In-house training*	$350	$700
Total annual cost	**$350**	**$745**

*Annual training cost represents the additional cost required to add the device specific training to the existing annual SMART training curriculum.

C.5.5 Communications Technology

SMART establishes a monitoring system for the rapid collection and reporting of real-time, scientifically based information to assist the Unified Command with decision-making during ISB or dispersant operations. Communication of monitoring results needs to flow from the field to those persons in the Unified Command who will use the data to interpret the results. Communications between the field teams

ED_001324_00007763-00122

and the command, and communications between the field teams and other response operations are key components of the SMART process.

Experience indicates that communications is one of the most challenging components of the SMART process. SMART field teams operate in vehicles, vessels, and aircraft of opportunity far from the command. As a result, field teams often find themselves in areas not covered by cellular telephone service and too far from the command for radio communication. Experience also suggests that field teams cannot rely on vessels and aircraft of opportunity to provide the communications capability necessary for SMART operations. Below, SMART communications are divided into two broad categories, communications between the field teams and the Unified Command (SMART reporting), and communications between field teams and other response operators (SMART operational communications).

C.5.5.1 SMART Reporting

C.5.5.1.1 Real-time Verbal Reports

Ideally, an initial verbal report is transmitted to the SMART Technical Specialist (TS) quickly. This should happen after the completion of monitoring activities, or as soon as the field team recognizes the need to make adjustments in the response operations, ideally in less than 1 hour. This initial report is a two-way conversation between the Field Team Leader and the TS at the Unified Command. The Field Team Leader should assess the communications capability of the vessel or aircraft before departing on the mission. If suitable communications equipment is not provided, the Field Team Leader should either make arrangements to obtain it, or develop an alternative communications plan with the SMART TS.

C.5.5.1.2 Supporting Data, Photos, and Written Reports

Digital data, photographs, and documentation collected during SMART field activities are transmitted to the SMART TS as soon as possible after a monitoring mission. Because this information requires some editing and formatting in the field, this data will not be available to the TS until sometime after data collection efforts end. However, this information is quite valuable to the TS, and every effort should be made to transmit the data as soon as possible. The capability to transmit this data directly from the field is an enormous advantage.

Considering that SMART field teams will likely be operating far from the Unified Command and possibly in areas not covered by cellular phone service, the project team investigated portable satellite communications systems with both voice and digital communication capabilities. These systems should provide the two-way voice communication capability necessary for initial verbal reports as well as the digital data capability to transmit the supporting data, photos, and written reports from the field.

SMART teams need a simple, ready-to-deploy, reliable standardized equipment package that quickly establishes communications. A satellite communication system will provide increased range and immediate availability that meets CG needs. COTS systems, known as Mobile Satellite Service (MSS) terminals, work with a laptop computer to establish data and voice communications. Key features to consider when selecting an MSS are listed in listed in Table C-19. .

Table C-19. Desirable attributes for Mobile Satellite Service (MSS) terminals.

Criteria	Description
Basic Features	• Telephone

ED_001324_00007763-00123

	Email • Internet connectivity • 2-way radio communications • Wi-Fi Hotspot • Worldwide range • GPS
Cost Effective	• Pay for only what is used • Pre-paid and post-paid plans • Service and support provided
Durability	• Ruggedized • Freezing and hot temperatures • Water resistant
Deployable	• Operable despite long shelf life • Operable on any moving vehicle, boat or other platform.
Usability	• Easy to operate
Mobility/Transportability	• One-person carry portability • Operable while mobile • Shippable • Carry on air craft and in vehicles
Power	• DC Power Port operable • Battery life • Rechargeable • Hot swappable battery • Field rechargeable • Battery expandable • Vehicle 12V power adaptable

C.5.5.2 Ground Control MCD-800

The team located one device with many of these key features, called the Ground Control MCD-800 (Figure C-19 and Figure C-20). The MCD-800 is an easy to carry and use system, connects with the satellite in one minute, and establishes a wireless hotspot for any in-range device. The following features apply to the MCD-800:

- One person portability (Figure C-20A).
- Operates for 6 hours on a single charge or continuously while plugged into a vehicle.
- DC power port or any 110 or 220 VAC wall outlet.
- Standard package comes with analog satellite phone capability.
- All-weather sealed enclosed case that remains closed during operations.
- Optional foldable solar panel ($1,100) for battery supplementation or recharging in no-power locations (Figure C-20B).
- External rechargeable and single use batteries available (Figure C-20C).

Ground Control offers an MCD-800 Demonstration System Rental program for organizations interested in evaluating the system. A one week rental currently costs $299 and a service charge of $6.99 per Megabyte,

ED_001324_00007763-00124

with $0.99 cents a minute calls to any phone with no minimum usage requirements. A cost summary to equip one Strike Team with the MCD-800 is provided in Table C-20.

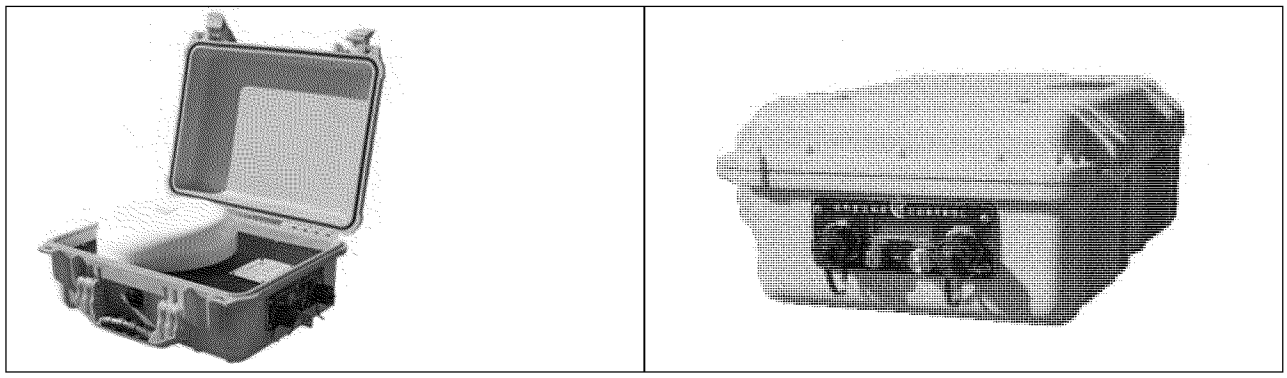
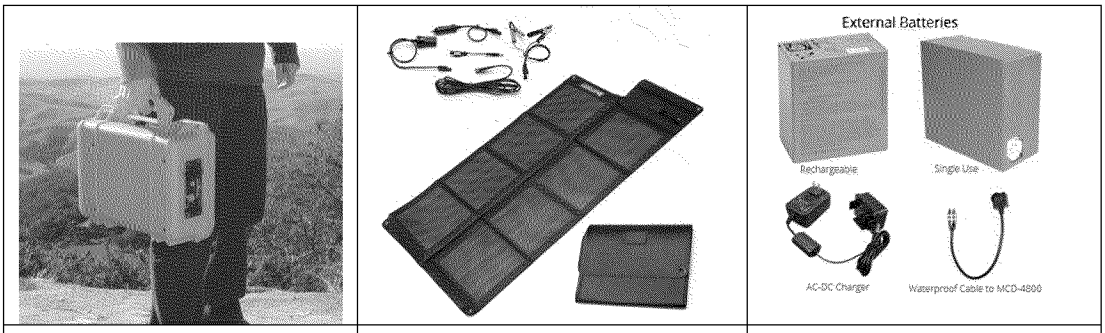


Figure C-19. Ground Control MCD-800.



A B C

Figure C-20. Features of the MCD-800.

MCD-800 Costs Factors

Table C-20. Ground Control MCD-800 cost information.

Acquisition Cost	
MCD-800	$13,000 (one unit)
Software	No cost
Total acquisition cost	**$13,000**
Annual Cost	
Satellite network access and data plan	$828*
Manufacturer's maintenance and service plan.	$175
In-house training**	$700
Total annual cost	**$1,703***

* Does not include data usage fee. Satellite network access and data plan includes an annual allowance of 30 megabytes (Mb) of data usage. After that, data usage is billed at $6.99/Mb. (A typical SMART Tier II/III data package is approximately 5Mb in size). Outgoing voice calls are billed at $0.99/minute. No charge for incoming calls. Outgoing text messaging is billed at $0.50 per text. No charge for incoming texts.
**Annual training cost represents the additional cost required to add the device specific training to the existing annual SMART training curriculum.

C.5.5.3 SMART Operational Communications

In addition to reporting to the Unified Command, the SMART field teams require the capability to communicate and coordinate with other response assets in the area of operation. This will almost certainly involve communications between aircraft and vessels. Communications capability gaps present challenging solutions because vessels and aircraft use different frequencies – aviation radios operate in the 108-137 MHz AM band while marine radios operate in the 156-162 MHz FM band. USCG experience indicates that vessels of opportunity are rarely equipped with air band radio frequency capability, and aircraft are rarely equipped with marine band radio frequency capability.

Past SMART deployments were successful using of handheld marine VHF radios and handheld aviation VHF radios for short-range communications between vessels and aircraft. These handheld radios are limited in range but considering the cost and logistics of installing permanent radios in vessels and aircraft, portable radios provide a workable solution. The project team investigated marine and aviation handheld radios suitable for SMART field operations, and found many candidates ranging from approximately $150-$500. The team did not however, find handhelds capable of communicating on both aircraft and marine VHF frequency bands. Based on this research, the project team recommends that a portable aviation VHF be provided on every vessel and a portable marine VHF radio be provided on every aircraft participating in SMART operations at the onset of a SMART mission.

C.5.6 Alternative Emerging Technology

The emerging technology described below is not associated with current gaps in the SMART program. The project team assessed it, however, as it may provide additional future capabilities for SMART operations.

C.5.6.1 Particle Size Analyzer

Some stakeholders mention particle size analyzers as complementary to the SMART capability. Although particle size measurement is not currently prescribed by the SMART Protocol, and NOAA has not requested such information, it could potentially be a future enhancement to the SMART data collection effort. The project team identified only one particle size analyzer that was portable, and therefore could potentially satisfy requirements of SMART operations.

C.5.6.1.1 Particle Size Analyzer (LISST-100X) (approx. $44k w/ laptop computer)

The Laser In-Situ Scattering and Transmissometry-100X (LISST-100X) instrument (manufactured by Sequoia Scientific) is a multi-parameter system for in-situ observations of particle size distribution and volume concentration (Figure C-21). The product name LISST is derived from the term that describes its operation.

In both laboratory and field deployments the LISST has proved to be effective in measuring the concentration of oil in sea water. The LISST, however, cannot discriminate between oil and any other particles present in the water column. To address this issue some researchers suggested that combining the particle size measurement capability of the LISST with the oil identification capability of a fluorometer would allow for the simultaneous detection and quantification of oil in the water column. The test team did not identify a COTS device combining these two capabilities. In addition, the LISST may get saturated when too much oil is present, adversely affecting sensitivity. LISST instruments are limited to diluted mixtures, below ~500 ppm, because the LISST signal saturates for more concentrated mixtures. Pros and cons are listed in Table C-21, and a cost summary to equip one Strike Team with the LISST-100X is provided in Table C-22.

Table C-21. Sequoia Scientific LISST-100X.

Pros	Cons
Measures particle size (Volume Mean Diameter) and particle concentration.	Cannot discriminate between oil and any other particles present in the water column.
	False positives in turbid water.
	Not currently configured for towing.
	No existing SMART data logging interface.
	Not currently prescribed by the SMART Protocol or requested by the NOAA SSCs
	Unreliable in oil concentrations above ~500 ppm

Table C-22. Sequoia Scientific LISST-100X cost.

Acquisition Cost	
LISST-100X	$36,250 (one unit)
Ruggedized laptop computer	$6,000
Software	No cost
Total acquisition cost	**$42,250**
Annual Cost	
Manufacturer's maintenance and service plan	$1,700
In-house training*	$1,400
Total annual cost	**$3,100**

*Annual training cost represents the additional cost required to add the device specific training to the existing annual SMART training curriculum.

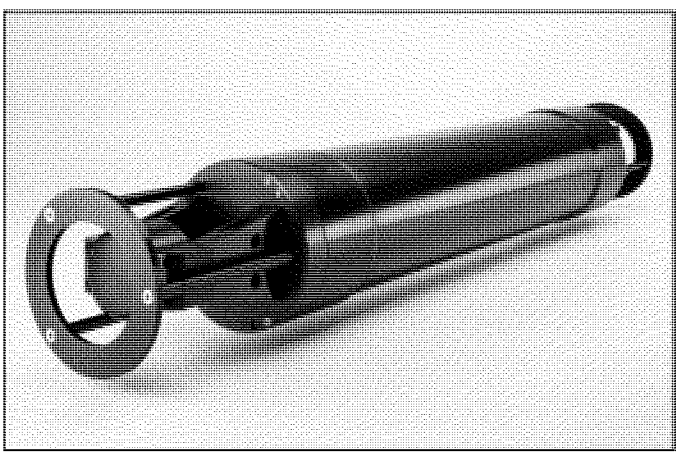


Figure C-21. Sequoia Scientific LISST-100X.

C.5.7 New Technologies Recently Added to SMART

The technology described below is not related to a current gap identified in this report, but is an example of new technology successfully used in the NSF SMART program. Recognizing the challenges associated with the SMART fluorometry data collection process, the USCG and oil spill response industry initiated an effort beginning in 2007, to update and streamline that component of the SMART program. In 2009 this resulted in a newer, more efficient fluorometer, and the development of an associated SMART fluorometry

ED_001324_00007763-00127

SOP and SMART fluorometry training module. The resulting fluorometry package was used extensively during the DWH response and proved very effective.

C.5.7.1 Fluorometry

The SMART Protocol recognizes fluorometry as the most technologically advantageous oil detection method for dispersant efficacy monitoring in an oil spill response environment. SMART does not require nor endorse a specific instrument or brand for dispersant monitoring, rather, SMART specifies performance criteria (Table C-23) and instruments meeting them as useful for monitoring.

Table C-23. SMART Fluorometer performance criteria.

Criteria	Description
Field rugged and portable	Instrument package must be able to operate from a vessel or small boat under a variety of field conditions, including air temperatures between 5 and 35°C, water temperatures between 5 and 30°C, seas to 5 feet, humidity up to 100%, drenching rain, and even drenching sea spray. The criteria for field deployment should be limited by the safety of the field monitoring team and not instrument package limitations.
Continuous operation	Instrument package must be able to operate continuously in real-time or near-real time mode by analyzing seawater either in-situ (instrument package is actually deployed in the sea) or ex-situ (seawater is continuously pumped from a desired depth).
Controllable depth	Monitoring depth must be controllable between 1 meter and 3 meters.
Oil detection	Instrument must be able to detect dispersed crude oil in seawater. No specific detection method is specified in order to allow a wide range of instruments for consideration. If fluorometry is used, the excitation and emission wavelengths monitored should be selected to enhance detection of crude oil rather than simply hydrocarbons, in order to reduce matrix effects.
Digital readout	Instrument must be able to provide a digital readout of measured values. Given that different oils that have undergone partial degradation due to oil weathering will not provide consistent or accurate concentration data, measured values reported as "raw" units are preferred for field or accurate concentration data, measured values reported as "raw" units are preferred for field operations over concentration estimations that might be misleading as to the true dispersed oil and water concentrations.
Data logging	In additional to a digital readout (as defined above), the instrument must be able to digitally log field data for post-incident analysis. Data logging must be in real-time, but downloading of achieved data are not required until after the monitoring activity, i.e., downloading the raw data to a computer once the boat returns from field operations is acceptable.
Minimum detection limit (MDL)	The instrument must have a MDL of 1 ppm of dispersed fresh crude oil in artificial seawater and provide a linear detection to at least 100 parts per million (ppm) with an error of less than 30% compared to a known standard.

C.5.7.2 Turner Designs C3 Fluorometer

The NSF Strike Teams currently utilize six Turner Designs C3 fluorometers (Figure C-22, Figure C-23). The C3 is an in-situ fluorometer with light emitting diode (LED) optics specifically tuned to detect a wide variety of crude oils in seawater. The C3 is configured specifically (the towed body and some instrument firmware optimized for SMART data logging requirements) to meet the operational needs of the SMART data collection teams. The Turner Designs C3 fluorometer SMART kit satisfies the Performance Criteria of the SMART Protocol, as well as the informational needs of the NOAA Scientific Support Coordinator (the SMART data end user) and has proven reliable and mission capable during past SMART deployments (Figure C-22, Figure C-23, Figure C-24, Figure C-25). The pros and cons of the C3 fluorometer are listed in Table C-24, and a summary of the cost to equip one Strike Team with the Turner Designs C3 is provided in Table C-25.

Table C-24. Turner Designs C3 Fluorometer.

Pros	Cons
Fluorometry is identified in the SMART Protocol as a suitable oil detection technology.	Fluorometry identifies oil but cannot measure total oil concentration
The C3 fluorometer satisfies the NOAA oil detection requirements.	Fluorometry can produce false positives in a high CDOM (colored dissolved organic matter) environment
USCG has six C3 fluorometer kits in use with proven reliability and mission capable.	
USCG training and maintenance procedures for the C3 are substantially in place.	

Figure C-22. Turner Designs C3 Fluorometer SMART response kit (USCG Gulf Strike Team).

Table C-25. Turner Designs C3 cost.

Turner Designs C3 Fluorometer	
Acquisition Cost	
Turner Designs C3 fluorometer	$18,000 (2@ $9,000 each)
Ruggedized laptop computer	$12,500 (2@ $6,250 each)

ED_001324_00007763-00129

Software	$1,100 (2@ $550 each)
SMART software configuration	$7,200 (2@ $3,600 each)
Weather proof travel case	$1,600 (2@ $800 each)
Miscellaneous line and rigging	$600 (2@ $300 each)
Total acquisition cost	**$41,000**
Annual Cost	
Manufacturer's maintenance and service plan.	Not available**
In-house training***	$1400
Total annual cost	**$1400**

Currently within the USCG Strike Team inventory
** The manufacturer considers an annual in-house inspection by the user to be sufficient.
*** C3 fluorometer operations are already fully addressed in the existing annual SMART training curriculum.

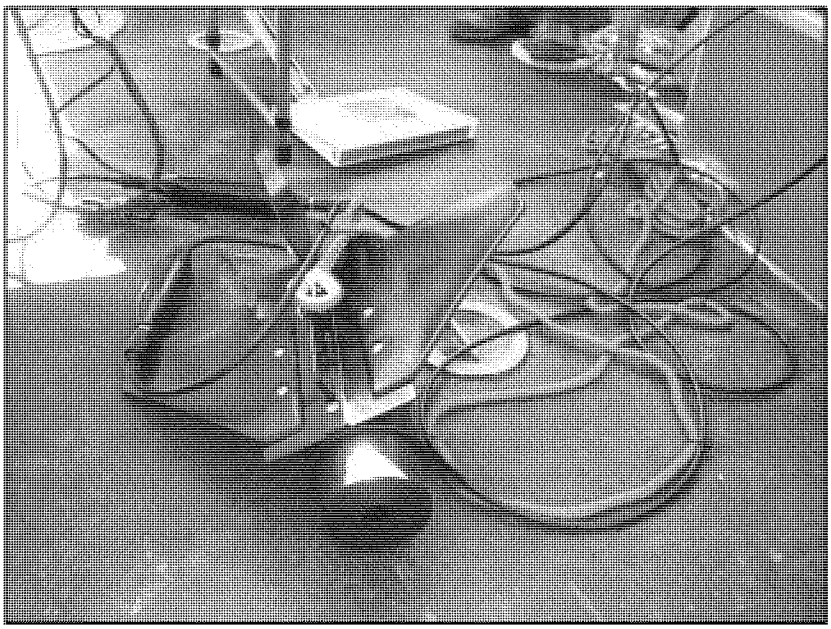


Figure C-23. Turner Designs C3 Fluorometer with tow package ready for deployment.

ED_001324_00007763-00130

Figure C-24. USCG Atlantic Strike Team setting up the SMART software during the DWH response. The C3 SMART Operator's Guide is shown in the lower right corner.

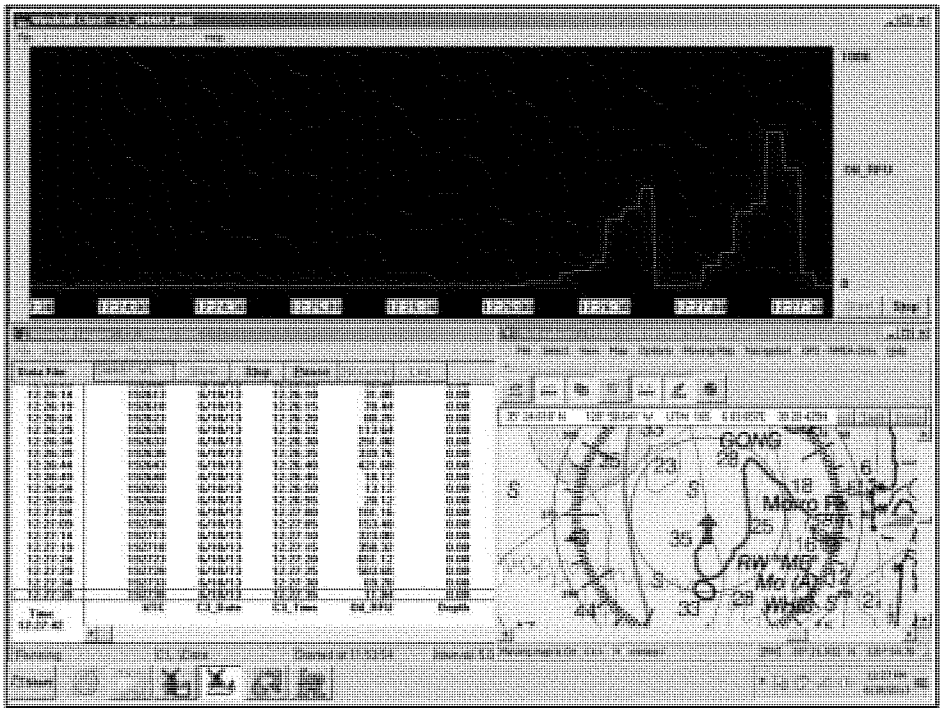


Figure C-25. SMART fluorometry user interface showing graphical and text displays along with live mapping application.

(This page intentionally left blank.)

U.S. ENVIRONMENTAL PROTECTION AGENCY

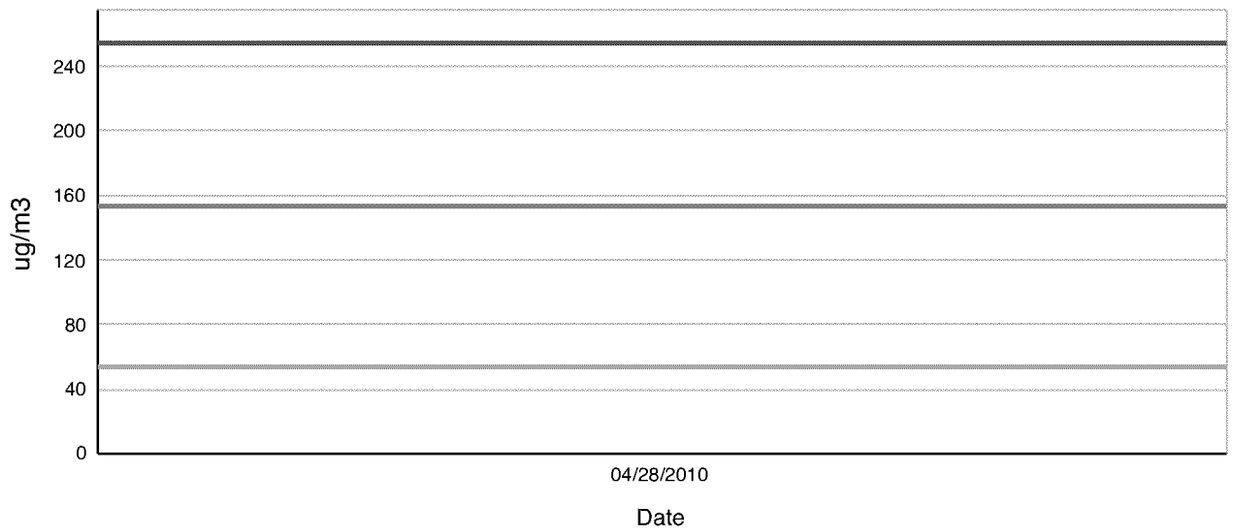
Air Particulate Matter Report

Location	V01
City, State	Venice, Louisiana
Latitude	29.27425
Longitude	-89.35406

Monitoring PM10 Daily Averages	Air Quality Index Value	Air Quality Index Levels of Health Concern	Cautionary Statements
0-54	0 to 50	Good	None
55-154	51 to 100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
155-254	101 to 150	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
255-354	151 to 200	Unhealthy	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
355-424	201 to 300	Very Unhealthy	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
425-604	301 to 500	Hazardous	People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors.

Particulate Matter 10 microns and smaller

Date	Number of Hours Averaged	Average for this day	Unit of Measure
04/28/2010	8*	0	mg/m3



* AQI daily averages are based on a minimum of 18 hours of data. On this date, at this monitoring location, there were less than 18 hours of data collected

To: William.T.Vocke@uscg.mil[William.T.Vocke@uscg.mil]
Cc: Wilson, Gregory[Wilson.Gregory@epa.gov]; Conmy, Robyn[conmy.robyn@epa.gov]
From: Principe, Vanessa
Sent: Thur 2/19/2015 8:27:06 PM
Subject: RE: Draft Minutes - ICCOPR FY2015 First Quarterly Meeting
ICCOPR FY15 1st Quarter Meeting Minutes EPA_EDITS.docx

Bill:

Attached are out comments on the draft minutes, clarifying some points on both the proposed Subpart J rule and on the permitting of oil discharges for research purposes. They are extracted in a Word file for Sections 8.h-EPA Agency Update, and 11-Permitting of Oil Simulants, on pages 8 and 11 respectively.

We sent it out to the folks that did the ASPECT presentation but have not heard back from them. Will forward any comments we receive.

By the way, chatted with Robyn and she mentioned that you were planning the next ICCOPR meeting for the first week in April. Not sure if you realize Easter is early this year, and the week of April 1st is Holy week. Food for thought.

Stay warm! See if you can stay in Houston a bit longer.

V

-----Original Message-----
From: William.T.Vocke@uscg.mil [mailto:William.T.Vocke@uscg.mil]
Sent: Wednesday, February 04, 2015 1:13 PM
To: Vocke, William CIV
Subject: Draft Minutes - ICCOPR FY2015 First Quarterly Meeting

ICCOPR Members,

Attached are the draft minutes for ICCOPR's FY2015 First Quarterly Meeting, which was conducted at Coast Guard Headquarters on January 22-23, 2015. Also attached is the USACE R&D Update, which was provided for the record after the meeting. All other enclosures were provided in earlier emails and are not enclosed due to their size.

Please review the minutes and provide any comments to me by COB February 20, 2015.

I want to thank all 34 participants for their contributions to an interesting and enlightening meeting. For those of you who attended in person, I also thank you for your patience in getting through security and navigating the maze inside the building. I welcome any feedback on using the Coast Guard Headquarters as a meeting site and what we could do to make it better.

Bill

William T. Vocke
ICCOPR Executive Director
U.S. Coast Guard - Stop 7516
2703 Martin Luther King Jr. Ave. SE
Washington, DC 20593-7516
(202) 372-2019

To: Conmy, Robyn[conmy.robyn@epa.gov]
Cc: Wilson, Gregory[Wilson.Gregory@epa.gov]
From: Principe, Vanessa
Sent: Thur 2/12/2015 8:51:35 PM
Subject: FW: Draft Minutes - ICCOPR FY2015 First Quarterly Meeting
ICCOPR FY15 1st Quarter Meeting Minutes EPA_EDITS.docx

Robyn:

Not sure if we had sent these to you already. Here is our take on the minutes for the ICCOPR first quester meeting. We ran these thru counsel because they address the permitting issue and they will be available to the public.

Do you have anything you want to add/change? Wanted to check with you before sending over to Bill.

Hope all is well, V

-----Original Message-----
From: William.T.Vocke@uscg.mil [mailto:William.T.Vocke@uscg.mil]
Sent: Wednesday, February 04, 2015 1:13 PM
To: Vocke, William CIV
Subject: Draft Minutes - ICCOPR FY2015 First Quarterly Meeting

ICCOPR Members,

Attached are the draft minutes for ICCOPR's FY2015 First Quarterly Meeting, which was conducted at Coast Guard Headquarters on January 22-23, 2015. Also attached is the USACE R&D Update, which was provided for the record after the meeting. All other enclosures were provided in earlier emails and are not enclosed due to their size.

Please review the minutes and provide any comments to me by COB February 20, 2015.

I want to thank all 34 participants for their contributions to an interesting and enlightening meeting. For those of you who attended in person, I also thank you for your patience in getting through security and navigating the maze inside the building. I welcome any feedback on using the Coast Guard Headquarters as a meeting site and what we could do to make it better.

Bill

William T. Vocke
ICCOPR Executive Director
U.S. Coast Guard - Stop 7516
2703 Martin Luther King Jr. Ave. SE
Washington, DC 20593-7516
(202) 372-2019

ANNUAL REVIEWS **Further**

Click here for quick links to Annual Reviews content online, including:

- Other articles in this volume
- Top cited articles
- Top downloaded articles
- Our comprehensive search

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

Microbial Responses to the *Deepwater Horizon* Oil Spill: From Coastal Wetlands to the Deep Sea

G.M. King,[1] J.E. Kostka,[2] T.C. Hazen,[3] and P.A. Sobecky[4]

[1]Department of Biological Sciences, Louisiana State University, Baton Rouge, Louisiana 70803; email: gkingme@gmail.com

[2]School of Biology and School of Earth and Atmospheric Science, Georgia Institute of Technology, Atlanta, Georgia 30332; email: joel.kostka@biology.gatech.edu

[3]Department of Microbiology, University of Tennessee, Knoxville, Tennessee 37996; email: tchazen@utk.edu

[4]Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama 35487; email: psobecky@as.ua.edu

Annu. Rev. Mar. Sci. 2015. 7:377–401

First published online as a Review in Advance on September 17, 2014

The *Annual Review of Marine Science* is online at marine.annualreviews.org

This article's doi: 10.1146/annurev-marine-010814-015543

Copyright © 2015 by Annual Reviews. All rights reserved

Keywords

Gammaproteobacteria, hydrocarbon degradation, methane, bacterioplankton, metagenomics

Abstract

The *Deepwater Horizon* oil spill in the northern Gulf of Mexico represents the largest marine accidental oil spill in history. It is distinguished from past spills in that it occurred at the greatest depth (1,500 m), the amount of hydrocarbon gas (mostly methane) lost was equivalent to the mass of crude oil released, and dispersants were used for the first time in the deep sea in an attempt to remediate the spill. The spill is also unique in that it has been characterized with an unprecedented level of resolution using next-generation sequencing technologies, especially for the ubiquitous hydrocarbon-degrading microbial communities that appeared largely to consume the gases and to degrade a significant fraction of the petroleum. Results have shown an unexpectedly rapid response of deep-sea Gammaproteobacteria to oil and gas and documented a distinct succession correlated with the control of the oil flow and well shut-in. Similar successional events, also involving Gammaproteobacteria, have been observed in nearshore systems as well.

ED_001324_00007779-00001

1. INTRODUCTION

nGoM: northern Gulf of Mexico

DWH: *Deepwater Horizon*

PAH: polycyclic aromatic hydrocarbon

On the night of April 20, 2010, a tragic series of events in the northern Gulf of Mexico (nGoM) led to a blowout of the Macondo oil well in Mississippi Canyon Block 252 (MC-252) (Norse & Amos 2010, Lubchenco et al. 2012). A gas explosion ensued that killed 11 members of the *Deepwater Horizon* (DWH) drilling crew and injured 17 others. The blowout released an uncontrolled, buoyant, pressurized, and heated stream of crude oil and hydrocarbon gases from a depth of approximately 1,500 m—the greatest depth at which a catastrophic well failure has occurred to date. Oil flow rates from the well have been estimated at up to 9,900 m^3 d^{-1} (62,000 barrels d^{-1}), with a total crude oil release of some 650,000–780,000 m^3 (4.1–4.9 million barrels) over an 87-day period (Crone & Tolstoy 2010, McNutt et al. 2011, Reddy et al. 2012). This spill exceeded by a factor of two or more all but the Ixtoc I oil spill, which occurred at a much shallower depth (50 m) in the southern Gulf of Mexico (the Bay of Campeche) and released approximately 30% less oil than the MC-252 well (Jernelov 2010).

Approximately 1.7–3.1 × 10^8 kg of natural gas (C_1–C_5, mostly methane) was also released during the discharge; this is comparable to the mass of liquid oil released and was a distinguishing feature of the spill. The MC-252 spill also differed from others in the extensive use of chemical dispersants: A total of 7,000 m^3 (approximately 2.1 × 10^6 gallons) of dispersants, largely Corexit EC9500A and EC9527A, was injected directly into the oil plume at the wellhead or sprayed onto surface slicks to enhance solubility and promote bacterial remediation (Lubchenco et al. 2012). Subsurface use of Corexit, which accounted for approximately 37% of the total use, had not been attempted previously, and its efficacy remains uncertain.

From the discharge source at 1,500 m, oil, gas, and dispersants rose through the water column, entraining seawater and undergoing a kinetic fractionation process that altered the plume's composition with increasing distance from the wellhead (Valentine et al. 2012). Droplets of oil and associated dispersants were found in several size classes. Neutrally buoyant droplets 10–60 μm in diameter formed an extensive, regional-scale plume at depths mostly between 1,000 and 1,200 m (Camilli et al. 2010, Valentine et al. 2012, Spier et al. 2013). However, at various times, transient currents were also observed to entrain oil and gas droplets at four other depths (Spier et al. 2013). The deep plume was characterized by elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), intermediate-length alkanes, methane, and other gases. Relative to adjacent, unaffected water masses, the plume was also characterized by lower oxygen concentrations (or oxygen anomalies), altered bacterioplankton community composition, and elevated bacterial density and activity (see Section 6).

In addition, large, positively buoyant droplets (~300 μm in diameter) with higher proportions of PAHs and heavier hydrocarbons rose to the surface, where they formed thin but extensive surface slicks (Atlas & Hazen 2011). The distinct surface and subsurface environments selected for different microbial populations in response to the released oil, even though Gammaproteobacteria dominated both surface-slick and deepwater plumes. Not surprisingly, the dynamics and impacts of surface and deep oil differed significantly from each other.

In the plume, both hydrocarbon and bacterial dynamics were strongly determined by complex interactions among biological, chemical, and physical processes, the latter of which included advection and mixing as the plume moved laterally from the wellhead (Adcroft et al. 2010, Ryerson et al. 2011, Valentine et al. 2012). Plume movement was not unidirectional, however; rather, it was affected by deep eddies and currents (DeHaan & Sturges 2005) that resulted in what appeared to be at some times a southwestward motion and at other times a sinusoidal movement to the northeast. Model analyses, which were largely consistent with observations, suggested that the plume was advected away from the wellhead but also returned to the wellhead, where it accumulated additional

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00002

oil (Valentine et al. 2012). The circulation pattern of the plume and the reintroduction of oil had profound consequences for the dynamics of plume bacteria and for the degradation of at least some hydrocarbons (see Sections 3 and 4).

Although the amount of oil and gas entrained in subsurface plumes was substantial (approximately 2×10^8 kg), a considerable fraction of the total release (at least 50%) rose to the surface (Ryerson et al. 2012, Spier et al. 2013), including liquid oil and gas that were captured directly and stored (oil) or flared (gas). Once at the surface, the oil formed extensive slicks of varying thicknesses that affected an area of up to 180,000 km^2. The distribution of surface oil was determined by interactions between winds, currents, and eddies that reflected in part the dynamics of the Loop Current (Mezic et al. 2010). Contrary to initial expectations of a westward movement, partially weathered surface oil, including dispersants, moved to the northwest and northeast and washed ashore along the easternmost coast of Texas and much of coastal Louisiana (Mezic et al. 2010). Surface oil also contaminated beaches and wetlands from Mississippi eastward to the western Florida panhandle. Although extensive efforts were made to remove oiled beach sands and clean some wetlands, tar balls continue to appear on beaches, and oil persists in many wetlands both at the soil surface and belowground (Kelly 2013). In addition to the beached oil, an unknown but considerable amount of oil appears to have been buried in shallow nearshore sediments, where it remains susceptible to resuspension and subsequent beaching. (For a discussion of interactions between oil and bacteria in nearshore and wetland systems, see Sections 4 and 5.)

Of the oil released from the MC-252 well, relatively small percentages were collected by skimming or remediated by burning (approximately 3% and 5%, respectively; Lubchenco et al. 2012) (**Figure 1**). Approximately 17% was recovered directly from the wellhead, and 25% evaporated or dissolved (presumably degraded by bacteria). The remaining 50% comprised naturally and chemically dispersed oil phases (16% and 8%, respectively) and residual oil, which consisted of surface and subsurface sheen, tar balls, and oil that washed ashore or was buried. Some of this material (e.g., tar balls and tar mats) was and continues to be removed mechanically, but the fate of most of the residual oil depends on the dynamics and mechanisms of natural attenuation, which largely involves degradation by bacteria. The remainder of this review summarizes observations on bacterial hydrocarbon transformations measured to date and the prospects for future degradation.

2. PRESPILL BACTERIOPLANKTON COMMUNITIES IN THE GULF OF MEXICO

Before the DWH disaster, relatively little was known about nGoM bacterioplankton. Earlier studies had addressed their distribution, abundance, and secondary production but placed little emphasis on diversity. King et al. (2013) used a pyrosequencing-based analysis of 16S rRNA gene amplicons to assess community composition, diversity, and phylogenetic structure in samples taken at 17 nGoM stations approximately one month before the spill.

Principal component and nonmetric multidimensional scaling analyses showed that samples from depths of ≤100 m had similar bacterioplankton compositions, but these communities differed distinctly from those in deeper samples (**Figure 2*a***). Specifically, SAR11 Alphaproteobacteria and Bacteroidetes dominated communities at depths of ≤100 m, which were characterized by Alphaproteobacteria/Gammaproteobacteria ratios of >1.7 (**Figure 2*b***). At depths of >100 m, by contrast, Thaumarchaeota, Firmicutes, and Deltaproteobacteria were more abundant, and Alphaproteobacteria/Gammaproteobacteria ratios were <1 (**Figure 2*b***). The relatively low Alphaproteobacteria/Gammaproteobacteria ratios in deeper waters are notable because Gammaproteobacteria dominated the populations that responded to the spill (e.g., Hazen et al. 2010).

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00003

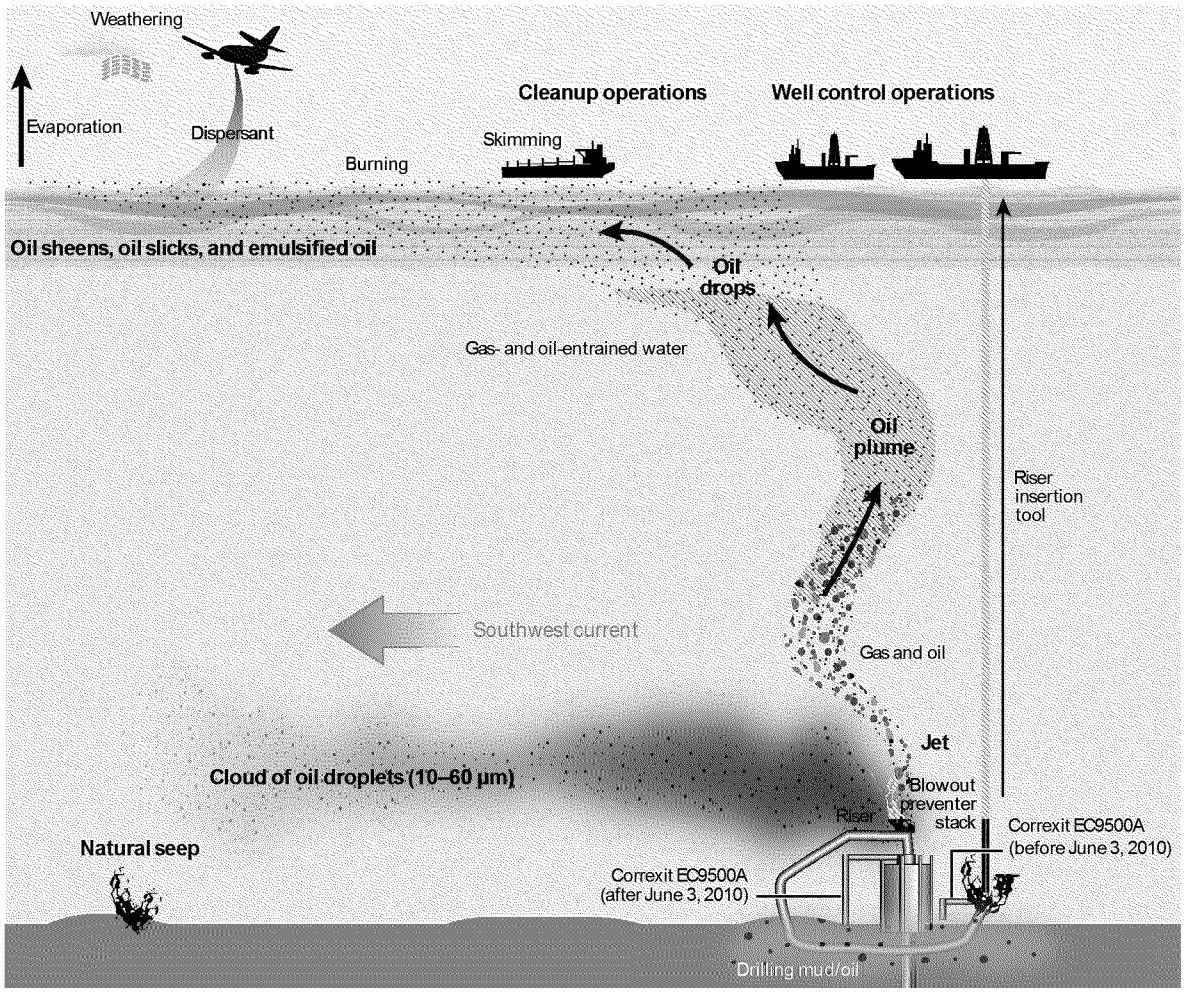


Figure 1

Schematic view of the *Deepwater Horizon* blowout, oil and gas distributions, and cleanup operations. Adapted from Atlas & Hazen (2011).

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

Given the presence of numerous active hydrocarbon seeps in the nGoM and the magnitude of nGoM oil and gas production and spill potential, the composition and distribution of hydrocarbon oxidizers are of particular interest. Results from 16S rRNA gene sequence analyses revealed 11 known hydrocarbon-oxidizing genera, including *Alcanivorax*, *Cycloclasticus*, *Marinobacter*, *Oleiphilus*, *Oleispira*, *Pseudomonas*, and *Vibrio*, and 13 methanotrophic and methylotrophic genera, including *Methylobacter*, *Methylococcus*, *Methylocystis*, *Methylohalobius*, *Methylonatrum*, *Methylophaga*, *Methylophilus*, *Methylosinus*, and *Methylovorus* (King et al. 2013). Hazen et al. (2010) and Mason et al. (2012) reported that, of these genera, *Colwellia*, *Cycloclasticus*, and an Oceanospirillales taxon related to *Oleispira* were abundant members of the plume community, and Rivers et al. (2013) described evidence for the presence of *Colwellia*, *Cycloclasticus*, *Methylobacter*, and *Methylococcus* based on sequences from a plume transcriptome. Valentine et al. (2010) and Kessler et al. (2011) identified similar taxa in a study of methane and propane respiration within the plume. Gutierrez

ED_001324_00007779-00004

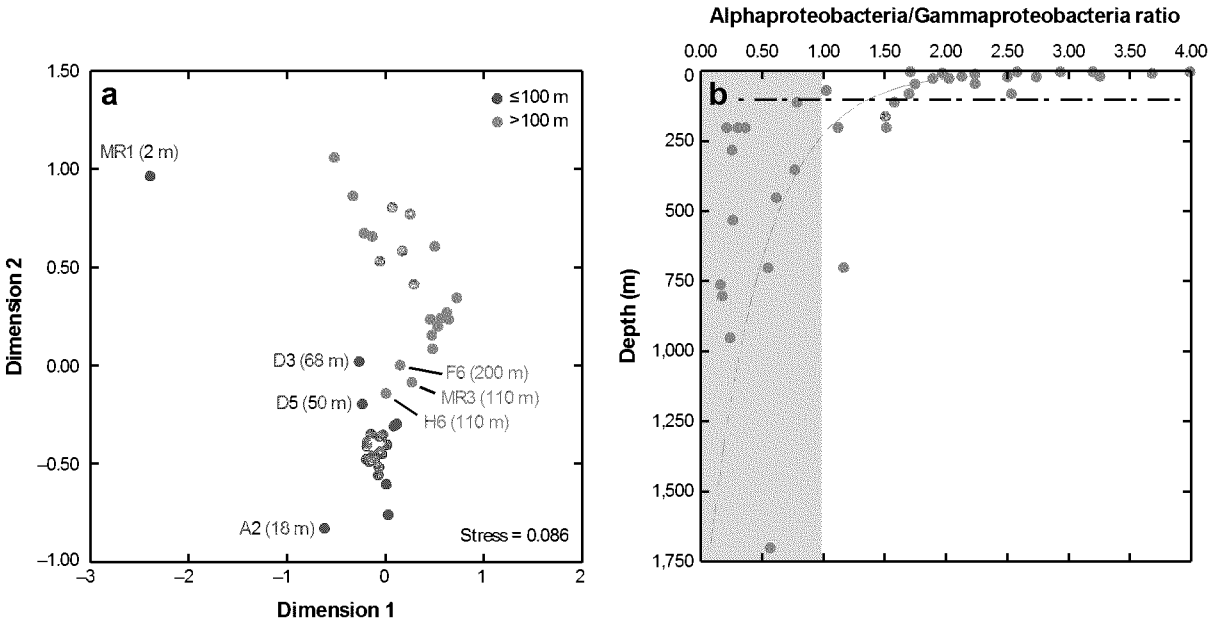


Figure 2

(*a*) Nonmetric multidimensional scaling analysis of northern Gulf of Mexico communities, indicating the structuring of composition by depth. (*b*) Alphaproteobacteria/Gammaproteobacteria ratios with depth. The shaded area indicates ratios less than 1. Adapted from King et al. (2013).

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

et al. (2013) documented additional taxa, including *Alcanivorax*, *Alteromonas*, *Halomonas*, *Marinobacter*, and *Pseudoalteromonas*, using stable isotope probing and cultivation-based approaches to analyze surface-slick and deepwater plume samples.

Colwellia was unique among the genera identified in the plume in that it was not observed in samples obtained before the spill (King et al. 2013), possibly because its prespill abundances were too low to detect. Regardless, *Colwellia* species responded rapidly to the spill, whereas *Alcanivorax* species—which were observed throughout the nGoM (King et al. 2013, Smith et al. 2013) and which have been regularly associated with hydrocarbon pollution (Harayama et al. 2004, Head et al. 2006)—were not readily detected in plume samples (e.g., Hazen et al. 2010, Mason et al. 2012, Gutierrez et al. 2013, Rivers et al. 2013). This suggests that, although the nGoM harbors a wide range of hydrocarbonoclastic taxa capable of responding to hydrocarbon inputs, the responses of specific groups might vary substantially across time and space.

Smith et al. (2013) provided additional insights into the potential for alkane degradation by analyzing partial sequences for *alkB*, one of the structural genes for alkane hydroxylase. The authors sequenced 401 *alkB* gene clones amplified from genomic extracts obtained from the samples described by King et al. (2013). In contrast to the distinct depth stratification observed using 16S rRNA gene sequences, principal component analyses of alkB operational protein units (OPUs) indicated that community composition did not vary consistently with depth or other major physical-chemical variables. Of 22 distinct OPUs, one was ubiquitous and accounted for 57% of all sequences. This OPU clustered with alkB sequences from known hydrocarbon oxidizers (e.g., *Alcanivorax* and *Marinobacter*) but did not appear to be represented in plume metagenomes or metatranscriptomes (Mason et al. 2012, Rivers et al. 2013). Likewise, none of the less abundant

ED_001324_00007779-00005

OPUs appeared to be represented in the plume community that responded to the spill. Thus, results from *alkB* and 16S rRNA gene sequence analyses indicate that *Alcanivorax* occurs widely within the Gulf of Mexico but might not compete well with other taxa for deepwater hydrocarbons. Variables that affect the hydrocarbon utilization by specific populations and that determine responses to spills remain uncertain.

3. DEGRADATION OF METHANE AND OTHER LIGHT HYDROCARBONS

C_1–C_5 hydrocarbons constituted approximately 24% of the DWH spill by mass, with methane accounting for approximately 60% of the light hydrocarbons (Reddy et al. 2012). Concentration profiles indicted that most of the light hydrocarbons that entered the water column remained at depths of >800 m (Kessler et al. 2011), which explained the low sea–air methane fluxes reported by Yvon-Lewis et al. (2011) from analyses during June 2010.

Several lines of evidence indicated that methanotrophic bacteria substantially oxidized plume methane. Methane concentrations were high and methanotrophic population densities and activities were low in the plume and near the wellhead during the early phases of the spill (e.g., in June 2010) (Hazen et al. 2010, Joye et al. 2011, Kessler et al. 2011), consistent with limited methane oxidation. Although metagenomic and metatranscriptomic data revealed some methanotrophic populations in the plume in late May and early June (Hazen et al. 2010, Rivers et al. 2013), methanotroph abundance appeared to have increased substantially later in the summer (Kessler et al. 2011). Methanotroph blooms characterized by members of the Methylococcaceae expressing particulate methane monooxygenase genes were accompanied by a return of methane concentrations to near-ambient levels, with the decline in methane mirrored in and largely accounting for the plume oxygen anomaly (Kessler et al. 2011). There were initial concerns about long-term and deleterious effects of large methane releases in the deep sea (Joye et al. 2011), but a community of methanotrophs responded robustly and consumed the methane relatively rapidly, with no known adverse impacts.

Other gases (e.g., ethane and propane) were also oxidized rapidly in the plume. Valentine et al. (2010) documented the consumption of both during early stages of microbial responses. They suggested that ethane, propane, and possibly butane supported some of the dominant plume populations, including *Colwellia* and taxa related to *Cycloclasticus*, and that respiration of ethane and propane accounted for up to 70% of the observed June 2010 plume oxygen anomalies. In addition, results from ex situ incubations and stable isotope probing showed that *Colwellia*, and possibly the Oceanospirillales observed in the plume, likely used both ethane and propane (Redmond & Valentine 2012).

These observations were consistent with the results of metagenomic and metatranscriptomic analyses, which showed significant expression of alkane monooxygenase genes that are related most closely to homologs of the particulate methane monooxygenase genes coding for ethane and propane monooxygenases (Mason et al. 2012, Rivers et al. 2013). Rivers et al. (2013) used phylogenetic analyses of particulate monooxygenase sequences to infer putative functions. The sequences clustered into four clades, one of which included particulate methane monooxygenase gene sequences found in methanotrophic Gammaproteobacteria; this is consistent with results from 16S rRNA gene sequence analyses, which showed enrichments of this group (Hazen et al. 2010, Valentine et al. 2010). Two other clades, which accounted for 42% of the monooxygenase reads, contained sequences related most closely to genes coding for ethane and propane monooxygenases, whereas a fourth clade, which accounted for most of the monooxygenase

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00006

reads (50%), contained sequences for which no function could be inferred. The fact that these sequences were relatively highly expressed suggests a role in alkane degradation that should be assessed further.

OTU: operational taxonomic unit

4. HYDROCARBON IMPACTS AT MESOPELAGIC DEPTHS OFFSHORE

Owing to the unique nature of the MC-252 oil spill, considerable attention has been focused on the offshore water column; detailed analyses have been performed of hydrocarbon and dispersant degradation, bacterioplankton community composition and activity, trophic interactions, and connections between the water column and sediment. One somewhat surprising finding from these observations was the robust response of the cold, deepwater bacterial community, which appeared to use hydrocarbons with little or no lag and with no nutrient additions, thereby partially attenuating the contamination (see below for details). Rapid responses were also observed in offshore surface waters, even though they were considered phosphorus limited (Edwards et al. 2011, Ziervogel et al. 2012). In this sense, the MC-252 spill was very different from the *Exxon Valdez* spill, degradation of which appeared to be hindered by the cold conditions in Prince William Sound, Alaska, and for which a variety of bioremediation efforts were attempted (Prince 2010, Atlas & Hazen 2011).

4.1. Hydrocarbon Effects on Bacterial Community Structure Within the Deep-Sea Plume

Hazen et al. (2010) showed that bacterial densities in deep-sea plume samples collected between May 25 and June 2, 2010 (5.5×10^4 cells cm^{-3}), were elevated relative to those in adjacent nonplume samples (2.7×10^4 cells cm^{-3}). Sixteen members of the Gammaproteobacteria were significantly enriched in the plume samples, one of which constituted >90% of 16S rRNA gene sequences recovered from plume DNA extracts (Hazen et al. 2010, Mason et al. 2012). Clone library analysis revealed that the closest cultured relatives of this operational taxonomic unit (OTU) were *Spongiispira norvegica* (95% similarity) and *Oceaniserpentilla haliotidis* (94% similarity), both of which are members of the Oceanospirillales. This same OTU accounted for <3% of sequences in nonplume samples and samples taken in the same area at similar depths one month before the spill (Mason et al. 2012, Dubinsky et al. 2013, King et al. 2013). Many of the other abundant plume sample OTUs were closely related to psychrophilic hydrocarbon degraders (Hazen et al. 2010), which is consistent with in situ temperatures (4–5°C).

Metagenomic and metatranscriptomic analyses revealed both functional potential and community structure (Hazen et al. 2010), in that a single Oceanospirillales OTU was documented as the dominant community member between May 26 and June 3 (Mason et al. 2012), with Oceanospirillales sequences accounting for >60% of all plume metagenomic reads and 49–69% of all plume transcripts. In addition, Rivers et al. (2013) found that 95% of the 16S rRNA gene sequences in their samples were from only four families: Colwelliaceae, Methylococcaceae, Oceanospirillaceae, and Piscirickettsiaceae. Their metatranscriptomic results also indicated that Alteromonadales, Deltaproteobacteria, Pseudomonadales, and SAR86 were active but more limited members of the plume. Results from 16S rRNA gene sequences were consistent with transcript annotations, which revealed relatively few active plume community members; most of the transcripts binned to only six reference genomes. The metatranscriptomic analysis showed that, even though *Colwellia* species were only minor constituents of the 16S rRNA gene libraries from samples collected at this time, they were present and active in the plume, with Alteromonadales comprising 8–11% of recovered transcripts (Mason et al. 2012).

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00007

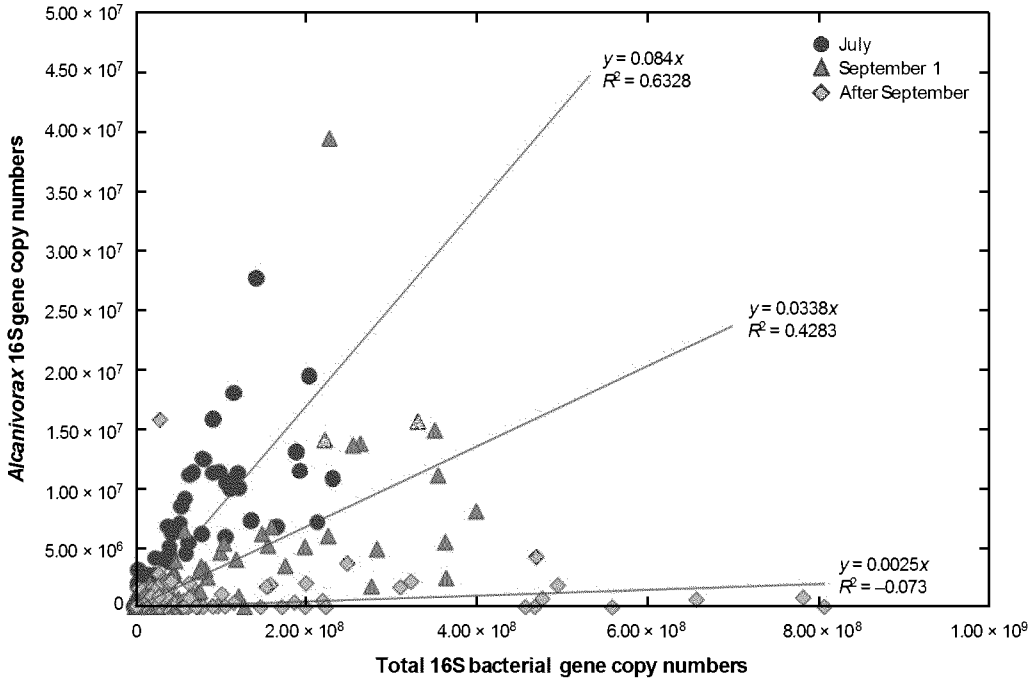


Figure 3

Alcanivorax succession over time plotted as abundance of *Alcanivorax* 16S rRNA gene sequence copy numbers versus total 16S rRNA gene sequence copy numbers for samples collected in summer and fall 2010. Adapted from Kostka et al. (2011).

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

Samples collected later during the course of the spill (June 2010) revealed a succession in community membership (**Figure3**), with *Colwellia* (Alteromonadales) and *Cycloclasticus* (Thiotrichales) emerging as the dominant genera (Redmond & Valentine 2012). *Colwellia* also increased in abundance during ex situ enrichments of deep-sea water with crude oil at 4°C (Redmond & Valentine 2012). Stable isotope probing revealed that *Colwellia* consumed propane and ethane, whereas *Cycloclasticus* likely consumed benzene-toluene-ethylbenzene-xylene (BTEX) compounds. Results from a later sampling (September 2010) showed additional shifts in plume community composition, with high abundances of methylotrophic bacteria and low abundances of Oceanospirillales, *Colwellia*, and *Cycloclasticus* (Kessler et al. 2011). Although the bacterial community in the plume changed rather dramatically over time and space, the archaeal community remained fairly constant (Redmond & Valentine 2012), even though archaea account for a significant fraction of deep nGoM bacterioplankton (King et al. 2013). This is consistent with the fact that, although some evidence indicates that archaea degrade hydrocarbons (e.g., Al-Mailem et al. 2013), the majority of previous work suggests that many archaeal taxa are either unaffected or adversely affected by oil spills (e.g., Roling et al. 2004, Urakawa et al. 2012).

BTEX: benzene-toluene-ethylbenzene-xylene

To explain microbial community succession in the plume, Valentine et al. (2012) developed a simulation model that combined horizontal circulation and mixing in the deep Gulf of Mexico with hydrocarbon inputs, which fed bacterial metabolism and growth. The model output suggested that as bacteria were exposed to oil, hydrocarbon-degrading taxa bloomed until their preferential substrate was depleted, at which point they declined in abundance and were replaced by bacteria growing on different substrates. The model also indicated that deepwater circulation near the

ED_001324_00007779-00008

MC-252 well resulted in repeated exposures to fresh oil for given parcels of water. Repeated exposure led to increased degradation rates because the standing stock of hydrocarbon degraders was elevated owing to prior exposure.

Changes in the composition and quantity of hydrocarbons over time and space undoubtedly contributed to community succession (Dubinsky et al. 2013). Community structure was correlated with three distinct spill phases: uncontrolled oil flow (April 25–June 4), partial hydrocarbon capture (June 5–July 14), and well shut-in (July 15 onward). During the period of uncontrolled flow, Oceanospirillales and *Pseudomonas* dominated the plume community (Hazen et al. 2010, Mason et al. 2012, Dubinsky et al. 2013). Redmond & Valentine (2012) and Dubinsky et al. (2013) found that, during the period of partial hydrocarbon capture, the community shifted to dominance by *Colwellia*, *Cycloclasticus*, *Pseudoalteromonas*, *Methylomonas*, and *Thalassomonas*. After well shut-in, Flavobacteria (*Tenacibaculum* and *Polaribacter*), Alteromonadaceae, and Rhodobacteraceae dominated the community at plume depths in the persistent dissolved oxygen anomaly (Dubinsky et al. 2013). These groups have been reported to degrade high-molecular-weight organics and dissolved organic matter (DeLong et al. 1993, Kirchman 2002, McCarren et al. 2010, Teeling et al. 2012). Thus, many of the populations that proliferated after well shut-in most likely scavenged organic matter and cell biomass from the decaying hydrocarbon degrader bloom.

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

4.2. Functional Responses of Deepwater Plume Microbial Communities to Hydrocarbons

Microarray- and sequencing-based approaches revealed dramatic increases in the presence and expression of genes related to hydrocarbon metabolism within the plume (Lu et al. 2012, Mason et al. 2012, Rivers et al. 2013). Microarrays showed that gene diversity was greater within the plume than outside of it and that microbial community functional structure differed significantly between plume and nonplume samples (Lu et al. 2012). Microarray data also showed that 1,600 genes involved in hydrocarbon metabolism, including genes for alkane and PAH degradation, occurred at higher abundances within the plume. In addition, microarray analyses revealed strong shifts in biogeochemical cycling genes, including assimilatory nitrogen reduction, ammonia assimilation, and sulfate reduction (*dsrA/B* and *AprA*) genes that were enriched in plume samples. A large number of cytochrome *c* genes were also observed, suggesting that hydrocarbon-coupled metal reduction may have occurred in the deep-sea plume. Finally, genes encoding proteins involved in organic phosphorus release [exopolyphosphatase (ppx) for inorganic polyphosphate degradation and phytase for phytate degradation] were stimulated in the plume, which might have been a response to phosphorus limitation.

Metagenomic data for the plume during the latter part of the uncontrolled flow period revealed all of the genes required for *n*-alkane degradation and a nearly complete cyclohexane degradation pathway (Mason et al. 2012). Alkane 1-monooxygenase genes (*alkB*) were also identified throughout the water column in samples taken before the spill (Smith et al. 2013) and by microarray analyses of plume samples (Lu et al. 2012). In addition, metatranscriptomic analyses showed that *alkB* sequences accounted for a modest fraction ($>10^{-4}$) of gene transcripts overall (Rivers et al. 2013). Although these genes have been assumed to reflect alkane degradation, some uncertainty exists about their function and substrate specificity (Smith et al. 2013).

Genes for PAH degradation were also enriched within the plume. However, they accounted for a much smaller relative abundance than genes for alkane degradation. This is consistent with the composition of the oil, which contained <2% PAHs (Reddy et al. 2012). These results also suggest that PAHs were not preferentially degraded relative to alkanes with small to intermediate chain lengths.

ED_001324_00007779-00009

Gene transcripts mapping to genes of the dominant Gammaproteobacteria that responded to the spill were enriched by up to two orders of magnitude in the plume relative to samples taken outside of it (Rivers et al. 2013). However, expression analyses based on comparisons of gene and gene transcript abundance indicated that a large number of taxa within the plume were unaffected by the presence of oil, and only a small percentage (5%) appeared to have been inhibited (Rivers et al. 2013). These findings suggested that much of the natural background community existed within the plume at their prebloom levels and that only a few responded positively or negatively.

To better understand the characteristics of the Oceanospirillales that dominated plume samples early during the spill (Hazen et al. 2010), genome sequences were obtained from single cells with >95% 16S rRNA gene similarity to the dominant OTU observed by Mason et al. (2012) and 99% similarity to the Oceanospirillales clone observed by Redmond & Valentine (2012). Based on 16S rRNA gene sequences, the closest cultured representatives to these single cells were *Oleispira antarctica* (Yakimov et al. 2003, Kube et al. 2013) and *Thalassolituus oleivorans* (97% for both). The single-cell genomes encoded cyclohexane degradation and alkane degradation genes similar to those found in metagenomes and metatranscriptomes from plume samples. The single-cell genomes also contained genes for chemotaxis and nutrient acquisition, which suggested that some hydrocarbon degraders sense and swim toward oil droplets. Results from synchrotron radiation-based Fourier-transform infrared spectromicroscopy provided additional support for this possibility (Mason et al. 2012).

4.3. Dispersant Effects

To better understand dispersant effects on oil biodegradation in the Gulf of Mexico and to determine the potential for dispersant degradation, Baelum et al. (2012) assessed enriched microbial communities in water samples amended with high concentrations of oil and dispersants (100 ppm oil and 60 ppm Corexit EC9500A). Uncontaminated water from 1,100 m was treated with a combination of oil, Corexit EC9500A, and iron and incubated at 5°C. Oil degradation was measured as losses of total petroleum hydrocarbons. Twenty-five percent of the dissolved oil was degraded in the oil-only microcosms in the first 5 days, but not much more oil degradation was observed in the following 16 days. By contrast, 60% of the oil was degraded in samples with oil plus dispersant after 21 days. This demonstrated that even at very high concentrations, dispersants likely did not inhibit oil biodegradation in the deep waters of the Gulf of Mexico. Although this study reported only total petroleum hydrocarbon loss, the authors attributed changes predominantly to *n*-alkane degradation.

The fate of dispersants in the nGoM remains a concern because persistent concentrations of dispersant components were found at plume depths after dispersant application had ceased (Oper. Sci. Advis. Team 2010, Kujawinski et al. 2011, Chakraborty et al. 2012). Corexit EC9500A comprises three major components: hydrocarbons (50%), glycols (40%), and the anionic surfactant dioctyl sodium sulfosuccinate (DOSS) (10%). Baelum et al. (2012) showed that the hydrocarbon fraction of Corexit EC9500A degrades rapidly in microcosms with nGoM water from 1,100 m, whereas glycols and DOSS are metabolized very slowly. By contrast, glycols were degraded rapidly by sediment collected near the MC-252 wellhead (Mason et al. 2014). Baelum et al. (2012) also observed the formation at later time points of large flocs in oil- and oil-plus-dispersant-containing microcosms. These flocs were composed of degraded hydrocarbons and macromolecules of microbial origin, such as proteins and extracellular polymeric substances. *Colwellia* constituted more than 70% of the floc community, and Methylococcaceae constituted an additional 16%.

Campo et al. (2013) compared the degradation of dispersed oil in surface water at 25°C with that in water from 1,240 m at 5°C. They used a lower dispersant-to-oil ratio than Baelum et al.

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00010

(2012) (1:25 compared with 1:1.67). Campo et al. (2013) found that >99% of the DOSS was degraded after 8–14 days at 25°C, but at lower temperatures (5°C), there was a 28-day lag before degradation was observed. In the absence of crude oil, 98% of DOSS was degraded at 5°C after 42 days; in the presence of crude oil, only 61% of the DOSS was degraded at 5°C after 42 days. Campo et al. (2013) also observed that alkane degradation rates for South Louisiana crude oil were much faster at 25°C than at 5°C, and that Corexit accelerated degradation at 25°C. However, 7% of the alkanes remained after day 42 of the 5°C incubations, regardless of the presence of Corexit.

By contrast, PAH degradation occurred only after 42 days at 25°C with or without Corexit EC9500A, but began after 14 days at 5°C for dispersed crude oil. Campo et al. (2013) concluded that the difference in behavior between alkanes and PAHs at cold temperatures was due to the solubility of the PAHs and the physical state of the alkanes. These studies indicated that oil biodegradation in the Gulf of Mexico was not inhibited by dispersants and that Corexit EC9500A can increase the extent of oil degradation under some circumstances for some hydrocarbon classes. Furthermore, many of the components of Corexit EC9500A appeared to be relatively labile depending on conditions (i.e., temperature and water column or sediment).

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

4.4. Hydrocarbon Effects on Deep-Sea Sediment Microbial Communities

Oil from the MC-252 well affected microbial communities in deep-sea sediments (Kimes et al. 2013, Mason et al. 2014). Results from metagenomic analyses revealed increases in the functional repertoires of contaminated sediments relative to those of adjacent sediments. Both hydrocarbon and inorganic nitrogen concentrations were important determinants of community structure for surface sediments, in which the dominant organisms were closely related to uncultured Gammaproteobacteria and *Colwellia* OTUs present in the deepwater plume (Mason et al. 2014). Increases in *Colwellia* could have been due to their very broad substrate range, which includes gaseous hydrocarbons (Redmond & Valentine 2012) and PAHs (Gutierrez et al. 2013).

Genes involved in cycloalkane, aromatic hydrocarbon, and BTEX degradation were significantly enriched in metagenomes from contaminated cores, which included a complete pathway for cyclohexane degradation related most closely to the pathway described from *Brachymonas petroleovorans*, an isolate from a petroleum refinery (Mason et al. 2014). Microcosm incubations with ^{14}C-labeled model substrates also showed that propylene glycol (a component of dispersants) was mineralized rapidly by sediment communities (Mason et al. 2014), whereas alkane degradation was faster than toluene and phenanthrene degradation. Thus, at least some components of dispersed oil appeared to be relatively labile in deep-sea sediments.

Metagenomic analyses also indicated that pathways involved in nitrogen cycling were significantly altered in contaminated samples (Mason et al. 2014). Using both metagenomic and geochemical data, Mason et al. (2014) proposed that nitrogen fixation, together with mineralization, might have resulted in higher ammonium concentrations in oil-impacted sediments, and that nitrate might have been consumed via denitrification. Evidence supporting the latter conclusion was drawn from metagenomic annotations of the major genes for denitrification, which might have been the dominant process for nitrogen loss.

Genes and metabolites involved in anaerobic hydrocarbon degradation were identified in a metagenomic study of cores collected near the MC-252 wellhead (Kimes et al. 2013). Many of the reads from these metagenomes were related to sequences from known anaerobic hydrocarbon degraders, e.g., *Desulfatibacillum alkenivorans* AK-01. Thus, sulfate-reducing, hydrocarbon-degrading Deltaproteobacteria (Kniemeyer et al. 2007, Jaekel et al. 2013) likely responded to hydrocarbon inputs, with consequences for both local nitrogen and sulfur cycling (Kimes et al. 2013).

ED_001324_00007779-00011

5. HYDROCARBON IMPACTS AND MICROBIAL METABOLISM IN THE NEARSHORE WATER COLUMN, SEDIMENTS, AND BEACHES

PB: Pensacola Beach

During the MC-252 discharge, concern for understudied deep-sea habitats led to a surge of research on offshore systems surrounding the wellhead. By contrast, coastal response efforts centered on economically valuable beaches and ecologically valuable salt marshes (Hayworth et al. 2011, Oper. Sci. Advis. Team 2011, Wang & Roberts 2013). MC-252 oil had a pronounced impact on indigenous, benthic microbial communities in intertidal and inland ecosystems, but much less information is available on the responses of planktonic and subtidal microbial communities on the continental shelf (<200-m water depth).

Although microbial responses to oiling in beach ecosystems were documented extensively prior to 2010, these studies were limited by methodological constraints. The DWH spill is the first major event in which next-generation sequencing approaches have been applied to illustrate with high resolution the dramatic changes in the abundance, structure, and metabolic potential of oiled beach and sediment microbial communities (Kostka et al. 2011, Bik et al. 2012, Newton et al. 2013, Lamendella et al. 2014).

A time-series study conducted at municipal Pensacola Beach (PB), Florida, where total petroleum hydrocarbons reached 11,000 mg kg^{-1}, revealed a bloom of bacteria during the first four months after oil came ashore, with the microbial abundance in oiled sands exceeding that in clean sands by one to four orders of magnitude (Kostka et al. 2011). Geochemical evidence confirmed that bacterial degradation of weathered oil took place concurrently with the formation of the bloom (Aeppli et al. 2012, Ruddy et al. 2014). As observed in planktonic ecosystems offshore (Hazen et al. 2010), Gammaproteobacteria—including many bacterial groups known to degrade hydrocarbons—were enriched in oiled beach sands. The abundance of the known hydrocarbonoclastic groups *Alcanivorax* and *Marinobacter* increased dramatically in response to oil contamination, and a comparison of ribosome abundance in RNA extracts indicated that these groups were active within the bacterial community (**Figure 4**).

Oil acts as a strong selective force on the ecology of indigenous microbial communities in marine ecosystems (Head et al. 2006). For example, it has been hypothesized that nutrient availability

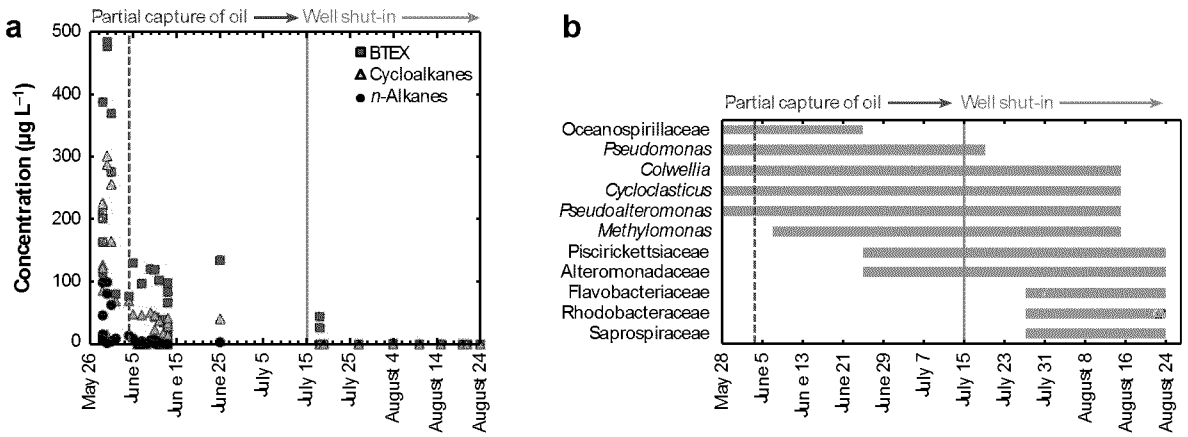


Figure 4

(*a*) Plume hydrocarbon composition [sums of benzene-toluene-ethylbenzene-xylene (BTEX), cycloalkanes, and *n*-alkanes] as a function of sampling date after the initiation of oil discharge. (*b*) Changes in dominant members of plume bacterioplankton communities as a function of sampling date after the initiation of oil discharge. Adapted from Dubinsky et al. (2013).

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00012

controls selection for different strains or ecotypes of *Alcanivorax*, which have been proposed to outcompete other bacteria for hydrocarbons by utilizing both branched- and straight-chain alkane compounds (Head et al. 2006). Analyses of PB sands and sediment have supported the hypothesis that alkane degradation is a species-specific trait, because two distinct *Alcanivorax* phylotypes were observed during the early stages of hydrocarbon degradation. Sequence evidence has also pointed to a succession of microbial populations related to the utilization of different hydrocarbon compound classes. Whereas the Oceanospirillales were dominant in sequence libraries within the first few months after oil came ashore, a shift toward the Alphaproteobacteria (Rhodobacteraceae) and gram-positive (*Bacillus*) groups took place in subsequent months. Thus, microbial community succession occurred in both deep nGoM water column and nearshore systems (see also Section 4). Gammaproteobacteria were prominent in early successional stages in all systems, but the mix of taxa varied considerably. In particular, *Alcanivorax* species were significant members of nearshore communities but minor members of the plume community, suggesting that *Alcanivorax* might be more competitive in benthic rather than planktonic systems.

Studies have examined both the taxonomic and functional diversity of microbial communities in a time series of 12 metagenomes constructed from oiled and clean sands sampled at PB in 2010 and 2011. The succession of microbial populations recorded by 16S rRNA gene amplicon sequencing (Kostka et al. 2011) was in general supported by the metagenome results (Rodriguez-R. et al. 2014). For example, taxonomic diversity largely decreased in oiled sands and then rebounded one year after oil came ashore. An increase in the metabolic potential for petroleum hydrocarbon catabolism and nutrient acquisition was also detected in the metagenomes of oiled sands as a large and statistically significant increase in the relative abundances of genes associated with these pathways. In contrast to the results for taxonomic diversity, the metagenomes revealed an increase in functional diversity in response to disturbance by MC-252 oil, consistent with observations in deep-sea sediments (Mason et al. 2012). Moreover, a functional transition was observed from generalist populations (within four months after oil came ashore) to specialists (a year later, when oil was undetectable), thereby supporting the specialization-disturbance hypothesis (Rodriguez-R. et al. 2014).

Studies conducted at other beaches over the same period in 2010 generally corroborated observations from PB. Lamendella et al. (2014) investigated the impacts of oil contamination on microbial communities at Elmer's Beach in Louisiana. They observed successional changes in the microbial populations in parallel with partial degradation of the oil present and reported elevated abundances of Alpha- and Gammaproteobacteria. Metatranscriptome results revealed that PAH, *n*-alkane, and toluene degradation genes were expressed in oiled sediments (Lamendella et al. 2014). Whereas *Alcanivorax* dominated in oiled sands at PB, *Marinobacter* dominated over the active hydrocarbon-degrading microbial communities at Elmer's Beach. In addition, Newton et al. (2013) searched for microbial indicators of ecosystem disturbance in microbial communities at seven beaches from Mississippi to Florida. Although the presence of oil appeared to be outweighed by the influence of other selective forces on community patterns, the relative abundances of known hydrocarbon degraders (e.g., *Alcanivorax*, *Alteromonas*, and *Marinobacter*) increased in oiled sands, consistent with the results of other studies.

The warm, shallow waters of the nGoM shelf represent a favorable environment for bacterial growth, as evinced by the fact that many of the predominant microbial groups detected in oiled sands by gene sequencing could be cultivated in the laboratory. Isolates were obtained from a variety of hydrocarbon-oxidizing genera (*Alcanivorax*, *Acinetobacter*, *Bacillus*, *Marinobacter*, and *Pseudomonas*), and the cultivation of multiple strains of the same species (*Alcanivorax dieselolei*, *Marinobacter hydrocarbonoclasticus*, and *Marinobacter vinifirmus*) will allow for further testing of the role of genotype in biodegradation (Hamdan & Fulmer 2011, Kostka et al. 2011). Initial physiological testing of oil-degrading strains indicated niche specialization in carbon and major

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00013

nutrient metabolism (Kostka et al. 2011). Whereas *Acinetobacter*, *Marinobacter*, and *Vibrio* strains all utilized a fairly broad range of carbon substrates, the substrate range of *Alcanivorax* was relatively limited, corroborating previous work (Yakimov et al. 2007).

Overholt et al. (2013) further explored the relationship between genotype and metabolic potential by sequencing the genomes of 10 bacterial isolates from oiled PB sands. Based on comparisons of genome assemblies and numbers of hydrocarbon degradation genes in strains of the same genus (*Alcanivorax* or *Marinobacter*), they proposed strain-specific differences in hydrocarbon degradation potential. In addition, they described the genome of the first known *Labrenzia* (Alphaproteobacteria) isolate capable of growth on crude oil. Multiple studies of oil-contaminated marine environments have detected environmental sequences with high sequence identity to *Labrenzia*, and closely related isolates have been shown to degrade hydrocarbons in the laboratory (Lai et al. 2010, Kostka et al. 2011, Al-Awadhi et al. 2012, Liu & Liu 2013). Collectively, these results advance understanding of how native microbial communities respond to crude oil perturbation in beach ecosystems and provide biomarkers for the chemical evolution of oil hydrocarbons during degradation and weathering.

Clearly, hydrocarbons act as a strong selective force on nearshore sedimentary microbial communities in the nGoM. However, in addition to serving as a carbon and energy source, some components of crude oil and dispersants used during response efforts might adversely affect the ecosystem services provided by specific microbial groups. Hamdan & Fulmer (2011) enriched for hydrocarbon-degrading bacteria in oiled sands collected from the Louisiana shoreline closest to the DWH wellhead, using a minimal medium supplemented with hexadecane and the dispersant Corexit EC9500A. Somewhat surprisingly, Corexit was toxic to hydrocarbon-degrading bacteria in a dose-dependent manner. For example, pure cultures of *Marinobacter* were particularly sensitive, showing a nearly 100% reduction in viability as a result of exposure to concentrations likely to be encountered during the DWH spill. In addition, Urakawa et al. (2012) and Radniecki et al. (2013) reported that oil hydrocarbons and Corexit EC9500A inhibit nitrifying bacteria and archaea. However, it should be noted that these studies used levels of Corexit that greatly exceed concentrations that were detected in seawater during DWH response efforts (Kujawinski et al. 2011). Further studies are needed to determine whether toxic effects observed in the laboratory can be extrapolated to responses in situ.

Nearly all previous work on the microbial response to the DWH spill has targeted bacteria and archaea. However, microbial eukaryotes, specifically fungi, are known to degrade hydrocarbons (Head et al. 2006), and fungal communities appeared to thrive at the expense of metazoans in response to oil contamination from the MC-252 discharge (Bik et al. 2012). Bik et al. (2012) also observed a dramatic change in the community structure of microbial eukaryotes in oiled sediments collected from Louisiana and Alabama beaches from May to September 2010.

Relatively few studies have explored the fate of crude oil–derived hydrocarbons or the impacts of the MC-252 discharge on coastal nGoM planktonic ecosystems. Bianchi et al. (2011) examined bacterioplankton in Barataria Bay, Louisiana, in July and September 2010. Although some Barataria Bay salt marshes had been oiled, the authors found no evidence for MC-252 oil in the water column during the sampling periods and no evidence for bacterioplankton community responses to oil; instead, the bacterioplankton community structure appeared to have been determined largely by the massive freshwater diversion through the bay that had been undertaken in an unsuccessful attempt to limit oiling. Likewise, in spite of predictions in the scientific community and news media that MC-252 oil might lead to blooms of pathogenic *Vibrio parahaemolyticus*, no evidence for such blooms was observed, and Smith et al. (2011) showed that coastal isolates had no capacity to grow using PAHs or oil. By contrast, Tao et al. (2011) showed that pathogenic *Vibrio vulnificus* was substantially enriched in tar balls.

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00014

A single study of MC-252 oil impacts on bacterioplankton community structure has been conducted on two surface water and two oil mousse samples collected in the nearshore nGoM off Louisiana (Liu & Liu 2013). As observed in other oiled nGoM environments, Gammaproteobacteria and Alphaproteobacteria (including *Alcanivorax*, *Alteromonas*, a n d*Marinobacter*) dominated the bacterial communities. Consistent with the PB time series, a high relative abundance of *Rhodovulum* and *Stappia*/*Labrenzia* (Rhodobacteraceae) was associated with the more weathered oil components of surface mousse, implicating these genera in the degradation of higher-molecular-weight aliphatic and aromatic compounds. In a study of seawater mesocosms, Ortmann et al. (2012) showed that dispersants employed during DWH response efforts short-circuited the planktonic microbial food web. Amendment of dispersant or dispersed oil resulted in an increase in the biomass of heterotrophic prokaryotes but a significant inhibition of ciliates, suggesting reductions in grazing and in the transfer of carbon to higher trophic levels. However, on the continental shelf, where most nGoM elemental biogeochemical cycling occurs, specific impacts of the DWH spill on the ecology (abundance, distribution, structure, and activity) of in situ planktonic communities remain largely unknown.

By contrast, using Microtox and QwikLite assays, Paul et al. (2013) showed that seawater samples collected in the northeastern Gulf of Mexico in August 2010 were toxic to indicator bacteria and phytoplankton. These assays also indicated that the degree of toxicity was correlated with total petroleum hydrocarbon concentrations. However, Prince & Parkerton (2014) commented that, in the Paul et al. (2013) study, the reported toxicity and mutagenicity in field samples were limited in extent, and the study provided little evidence of toxicity gradients or causality. Furthermore, Prince & Parkerton (2014) pointed out that particulates in the unfiltered water samples tested by Paul et al. (2013) could have confounding effects on bioluminescence attenuation, which is the basis for toxicity detection.

Isotope geochemistry has provided further evidence for the impacts of petroleum hydrocarbons on nGoM planktonic food webs. Carbon isotope ratios in seawater and particulate organic matter indicate the extent to which petrocarbon enters the food web, because petroleum hydrocarbons are depleted in ^{13}C and ^{14}C (radiocarbon) relative to recent photosynthetically derived carbon. In a study conducted in the nGoM near Mobile Bay, Alabama, Graham et al. (2010) determined the stable carbon isotopic composition in filtered samples of small suspended particles (1–200 μm in diameter) and larger particles (i.e, mesozooplankton, 0.2–2 mm in diameter). Carbon isotope depletion was coincident with the arrival of surface oil slicks to the nGoM, whereas terrestrial carbon sources, which also show a depleted carbon isotope signal, were ruled out.

^{14}C provides an even more sensitive indication of oil incorporation into planktonic food webs because crude oil is essentially ^{14}C free. Chanton et al. (2012) observed that ^{14}C was much more depleted relative to dissolved inorganic carbon in samples from the same site visited by Graham et al. (2010), and there was a linear correlation between the ^{14}C and ^{13}C content of particulates. Furthermore, using a carbon isotope mass balance approach, Chanton et al. (2012) concluded that more methane than petroleum was incorporated into the planktonic food web, suggesting that carbon from methanotrophic bacteria enters the food web through the microbial loop.

6. HYDROCARBON IMPACTS AND MICROBIAL METABOLISM IN COASTAL WETLANDS

The coastlines of the nGoM encompass approximately 15.6 million hectares of wetland habitats that provide critical ecosystem services (Corn & Copeland 2010), including support for a large fraction of US seafood production (Engle 2011, Gulf Coast Ecosyst. Restor. Task Force 2011). Thus, the impacts of oiling remain a major concern. Unlike the more uniform conditions of

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00015

shelf and mesopelagic waters, coastal wetlands experience highly variable physical and chemical conditions that alter biogeochemical patterns, primarily through changes in oxidation-reduction regimes (Mitsch et al. 2009). Hydrologic regimes also affect oxygen availability, nutrient levels, salinity, pH, and temperature, which in turn affect patterns and rates of microbial metabolism and hydrocarbon degradation. In this context, it is notable that a large fraction of wetland soil is anoxic, because hydrocarbon degradation proceeds at a much faster rate under oxic conditions than it does under anoxic conditions.

Although various forms of oil (e.g., mousse and tar balls) heavily affected numerous nGoM marshes, surprisingly little is known about microbial responses to the impact in these areas. We consider here the effects of oiling on saline, brackish, and freshwater marshes of the nGoM dominated by *Spartina alterniflora*, *Juncus roemarianus*, *Avicennia germinans*, *Phragmites australis*, and *Sagittaria lancifolia* (Beazley et al. 2012, Mendelssohn et al. 2012, Natter et al. 2012, Tao & Yu 2013).

The DWH spill affected nGoM wetlands from Louisiana to Florida, with most of the impacts occurring in Louisiana (60.6% of the total; oiled shorelines in Florida, Mississippi, and Alabama accounted for 16.1%, 14.6%, and 8.7% of the total, respectively). Approximately 690 km of marsh shoreline was oiled, with more than 280 km (41%) receiving heavy or moderate oiling (Michel et al. 2013). In contrast to the *Exxon Valdez* and Ixtoc I spills in other regions, oil arriving in nGoM wetlands was extensively weathered by a combination of physical, chemical, and biological processes (Beazley et al. 2012, Mendelssohn et al. 2012, Reddy et al. 2012, Anderson 2013). Weathered oil, mousse, tar mats, and tar balls reported at multiple locations in Alabama, Florida, Louisiana, and Mississippi were characterized by increases in heavier (less volatile) oil fractions (Beazley et al. 2012, Natter et al. 2012). For example, tar mats and tar balls collected from Point aux Pins, Alabama, and Bay Jimmy, Louisiana, contained increased relative abundances of long-chain hydrocarbons (elevated C_{17}–C_{30} and elevated C_{23}–C_{35}, respectively) (Beazley et al. 2012, Natter et al. 2012). They were also enriched in asphaltenes, resins, and complex PAHs. For example, oil mousse collected from Marsh Point, Mississippi, contained increased abundances of C_{14}–C_{38} alkanes and PAHs dominated by the four-ring chrysene. The ratio of phenanthrene to chrysene (0.1) indicated that physical, chemical, and biological processes degraded the lighter components of the crude oil.

Weathered oil remnants are considered more toxic than unweathered emulsions, and they persist for much longer (i.e., decades) owing to their degradation resistance. Increased toxicity can be attributed in part to the presence in tar balls of environmentally persistent free radicals. For example, Kiruri et al. (2013) reported a known asphaltene radical species and a newly discovered radical species (Kiruri et al. 2013) in Gulf Coast tar balls. These observations are important because in aqueous systems, environmentally persistent free radicals generate potent reactive oxygen species that can cause damage to a wide range of eukaryotic cellular systems. The impacts on bacteria and hydrocarbon degradation are uncertain, however.

The responses of wetland microbial communities to oil contamination depend on numerous factors, including the physical state of the oil (i.e., weathered), temperature, salinity, nutrient and oxygen availability, and presence of hydrocarbonoclastic microbes (Atlas 1991, Venosa & Zhu 2003, Head et al. 2006, DeLaune & Wright 2011). However, what distinguishes coastal wetlands from other aquatic systems is the presence of vegetation, sediment deposition, and recurring inundation by saline and sometimes fresh water, all of which can collectively contribute to either enhanced oil degradation or subsurface oil sequestration (Lin & Mendelssohn 1998, Hester & Mendelssohn 2000, Beazley et al. 2012).

Previous field and mesocosm studies have determined that the effects of nutrient addition on heavy crude oil biodegradation in salt marshes depend on the type of nutrient used, the

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00016

temperature, and the inundation frequency of the site (Wright et al. 1997, Jackson & Pardue 1999). Wright et al. (1997) demonstrated that an average of 56% of oil hydrocarbons were degraded during winter (17–30°C), whereas 72% were degraded in comparable treatments in summer (27–42°C). The increased degradation in summer was naturally attributed to increased microbial metabolism (Leahy & Colwell 1990), but increases in temperature also reduce crude oil viscosity, which can enhance bioavailability and degradation rates. Nonetheless, even in the most active remediation treatments, 30% of the oil remained (Wright et al. 1997). In a more recent study, Tate et al. (2011) showed that nutrient additions had little effect on crude oil degradation in a Louisiana marsh, largely because the background pore water ammonium concentrations were high enough to preclude nitrogen limitation.

Previous studies have also shown that oil can persist for decades in wetlands (Oudot & Chaillan 2010), and results from a recent study by Natter et al. (2012) indicated that elevated levels of organic carbon in soils and pore water are likely to persist in heavily oiled Louisiana marshes. Although high levels of oil contamination were observed in Louisiana salt marsh sediments, oiling was generally restricted to the periphery of the marsh (within 10 m of the shoreline) (Silliman et al. 2012). Lighter hydrocarbons were rapidly degraded by microbes in marsh sediments, whereas heavier fractions persisted (Natter et al. 2012). Natural-abundance ^{14}C analysis of microbial phospholipid fatty acids provided direct evidence for biodegradation and the incorporation of petrocarbon into microbial biomass at impacted sites several months after oil intrusion, when the highest concentrations of oil were present (Mahmoudi et al. 2013). Although relatively minor shifts in overall bacterial community composition occurred in sediments from oiled sites in comparison with reference sites, higher relative abundances of bacterial groups from known hydrocarbon-degrading taxa (Rhodobacterales and Sphingomonadales) were found in impacted sediments (Mahmoudi et al. 2013). Natter et al. (2012) also noted that elevated total organic carbon and dissolved organic carbon were associated with elevated sulfate-reducing bacteria numbers and higher pore water sulfide concentrations, indicating that dissimilatory sulfate reduction likely was coupled directly or indirectly to hydrocarbon degradation.

Hydrocarbon degradation has long been known to occur more rapidly under oxic conditions than it does under anoxic conditions (Ward et al. 1980, Atlas 1981), even though some alternative terminal electron acceptors (e.g., nitrate and sulfate) support the degradation of some hydrocarbons (Kniemeyer et al. 2007, Widdel et al. 2010, Zedelius et al. 2011). The rhizospheres of marsh vegetation, including *Spartina alterniflora*, *Spartina patens*, *Juncus maritimus*, and *Juncus roemarianus* (Lin & Mendelssohn 2009, Ribeiro et al. 2011, Lin & Mendelssohn 2012), can enhance oil degradation by increasing soil aeration and releasing exudates that act as primers (Beazley et al. 2012, Natter et al. 2012, Mahmoudi et al. 2013). Macrofaunal burrows, particularly those of fiddler crabs, can also increase aeration, enhance hydrocarbon biodegradation, and alter bacterial community composition and structure (Gribsholt et al. 2003, Stauffert et al. 2013).

However, at depths below the rooting zone, anoxic conditions prevail, and hydrocarbon turnover depends almost entirely on anaerobic processes. Microcosm studies have shown that mixed electron acceptors, including sulfate and nitrate, significantly enhance anaerobic biodegradation (Boopathy et al. 2012), and Natter et al. (2012) reported moderate increases in sulfate-reducing bacteria numbers in oiled marsh sediment samples obtained from Louisiana. These results are consistent with the fact that numerous sulfate-reducing bacteria degrade hydrocarbons (Bose et al. 2013).

Soil surface samples from wetlands affected by the DWH spill have consistently shown increased relative abundances of bacteria that degrade lighter crude oil components (Beazley et al. 2012, Natter et al. 2012, Mahmoudi et al. 2013). Beazley et al. (2012) reported increases in the relative abundances of hydrocarbon-degrading Proteobacteria, Actinobacteria, and Bacteroidetes

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00017

when oil concentrations were highest in Point aux Pins, Alabama, during June and July 2010, shortly after the period of moderate oiling in May and June. In addition, analyses of salt marsh soils indicated that Gammaproteobacteria abundance increased as oil reached field sites in June and that Actinomycetaceae, Dietziaceae, Rhizobiaceae, Xanthobacteraceae, Nocardioidaceae, Erythrobacteraceae, and Aeromonadaceae increased in relative abundance in June and July. Mortazavi et al. (2013) further reported that alkane and PAH degraders such as *Hydrocarboniphaga*, *Pseudomonas*, and *Pseudoxanthomonas* dominated in oil-amended intertidal sandy sediments collected from Dauphin Island, Alabama, and Horel et al. (2012) reported significant increases in hydrocarbon biodegradation rates following the addition of organic matter to these sediments.

Collectively, these studies show that coastal marshes in Alabama harbored indigenous hydrocarbon-degrading populations that contributed to crude oil degradation and natural attenuation. Similarly, Mahmoudi et al. (2013) observed biodegradation in oil-impacted marsh soils from Barataria Bay, Louisiana, as well as increases in the relative abundances of hydrocarbon-degrading Rhodobacterales and Sphingomonadales. Mahmoudi et al. (2013) also showed that the class Dothideomycetes dominated fungal communities in impacted marshes. Previous reports have shown that members of Dothideomycetes are often enriched in polluted environments and are capable of hydrocarbon degradation. For example, Bik et al. (2012) detected two Dothideomycetes genera, *Cladosporium* and *Alternaria*, in beach sediments impacted by MC-252 oil, indicating an important and little-investigated role of fungal populations in natural attenuation in nGoM coastal marshes.

SUMMARY POINTS

1. Based on high-resolution next-generation sequencing technologies, extensive analyses of northern Gulf of Mexico (nGoM) bacterial communities support the hypothesis that known hydrocarbon-degrading taxa, especially Gammaproteobacteria, are ubiquitous and that their response to oil is largely determined by physical-chemical conditions in the surrounding environment. However, the rapid and robust response of nGoM microbial communities to oil might reflect adaptations to the extensive hydrocarbon seepage that occurs there, raising the possibility that the observed responses might be somewhat unusual and not necessarily applicable to other ocean basins.
2. Evidence from the nGoM indicates that, although oil acts as a selective force to stimulate hydrocarbon-degrading bacteria and generalist heterotrophs, ecosystem services may be adversely affected through the toxic effects of oil and dispersants on specific microbial groups.
3. Substantial and rapid changes occurred in nearshore to deep-sea microbial communities affected by oil from the Macondo well in Mississippi Canyon Block 252. In general, populations of Gammaproteobacteria formed blooms, the composition of which shifted over time and space in an ecological succession as the oil discharge rate was reduced and in response to physical-chemical conditions and the evolution of oil composition.
4. Hydrocarbon degraders in the deep-sea plume were dominated by members of the Oceanospirillales (Gammaproteobacteria) that were related most closely to *Oleispira* and by members of *Colwellia*, *Cycloclasticus*, and several methanotrophs. By contrast, members of the ubiquitous hydrocarbon-degrading *Alcanivorax* genus (also Gammaproteobacteria) appeared to be more abundant in coastal systems and in sea surface oil.

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00018

5. Dissolved propane might have provided a readily metabolized substrate that fueled blooms of the early hydrocarbon-degrading populations, in essence acting as a primer for biodegradation.
6. Dissolved methane was consumed almost entirely by methanotrophs within the water column, thus limiting exchange across the air-sea interface. Methane and oil consumption collectively accounted for a relatively small oxygen anomaly that dissipated over time.
7. Corexit (a dispersant) likely enhanced oil degradation, and its components were degraded as well. However, Corexit may have affected carbon flow pathways in the water column owing to the inhibition of protozoan grazers, and it might also have inhibited some biogeochemically significant bacterial populations.
8. Hydrocarbon-degrading fungi increased in abundance in oiled salt marshes and beach sands, suggesting that they may contribute significantly to hydrocarbon turnover in some systems. However, the potential roles of fungi in oil remediation are largely unknown.

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

FUTURE ISSUES

1. To what extent do naturally occurring hydrocarbon inputs potentiate the response of benthic and planktonic microbial communities to marine oil spills?
2. How do the impacts of dispersants on microbial communities and biogeochemical processes vary among systems (e.g., water column versus sediment, salt marshes versus deep sea) and with temperature and nutrient availability?
3. What determines the specific composition of microbial communities that respond to hydrocarbon inputs? To what extent do community compositions reflect stochastic as opposed to deterministic processes?
4. To what extent do low-molecular-mass hydrocarbon gases (C_1–C_5) serve as primers for higher-molecular-mass alkane and polycyclic aromatic hydrocarbon degradation? How does the ratio of hydrocarbon gases to crude oil affect the rates and patterns of crude oil degradation?
5. What determines the rates and patterns of hydrocarbon degradation in mousses and emulsions? Are these forms of oil more or less resistant to decomposition, and to what extent do populations of hydrocarbon degraders within them differ from those in oiled water column or sediment systems?

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENTS

We collectively acknowledge support from our multiple funders: the National Science Foundation Rapid Response Research (RAPID) program, the Gulf of Mexico Research Initiative (GoMRI),

ED_001324_00007779-00019

LSU-GoMRI, and the Department of Energy. We are grateful for the support of our many colleagues, research associates, postdoctoral associates, and graduate and undergraduate students who have participated in numerous field campaigns, conducted laboratory analyses, and contributed substantially to data analysis and interpretation. We also acknowledge the many men and women who work in the Gulf of Mexico's oil and gas fields, their families, and those who lost their lives or were injured during the DWH explosions and sinking.

LITERATURE CITED

Adcroft A, Hallberg R, Dunne JP, Samuels BL, Galt JA, et al. 2010. Simulations of underwater plumes of dissolved oil in the Gulf of Mexico. *Geophys. Res. Lett.* 37:L18605

Aeppli C, Carmichael CA, Nelson RK, Lemkau KL, Graham WM, et al. 2012. Oil weathering after the *Deepwater Horizon* disaster led to the formation of oxygenated residues. *Environ. Sci. Technol.* 4616:8799–807

Al-Awadhi H, Al-Mailem DM, Dashti N, Khanafer M, Radwan SS. 2012. Indigenous hydrocarbon-utilizing bacterioflora in oil-polluted habitats in Kuwait, two decades after the greatest man-made oil spill. *Arch. Microbiol.* 194:689–705

Al-Mailem DM, Eliyas M, Radwan SS. 2013. Bioremediation of oily hypersaline soil and water via potassium and magnesium amendment. *Can. J. Microbiol.* 59:837–44

Anderson CJ. 2013. Degradation and composition of polycyclic aromatic hydrocarbons (PAHs) following oil exposure in experimental salt marshes. *Water Air Soil Pollut.* 224:1608

Atlas RM. 1981. Microbial degradation of petroleum hydrocarbons: an environmental perspective. *Microbiol. Rev.* 45:180–209

Atlas RM. 1991. Microbial hydrocarbon degradation-bioremediation of oil spills. *J. Chem. Technol. Biotechnol.* 52:149–56

Atlas RM, Hazen TC. 2011. Oil biodegradation and bioremediation: a tale of the two worst spills in U.S. history. *Environ. Sci. Technol.* 45:6709–15

Baelum J, Borglin S, Chakraborty R, Fortney JL, Lamendella R, et al. 2012. Deep-sea bacteria enriched by oil and dispersant from the Deepwater Horizon spill. *Environ. Microbiol.* 14:2405–16

Beazley MJ, Martinez RJ, Rajan S, Powell J, Piceno YM, et al. 2012. Microbial community analysis of a coastal salt marsh affected by the *Deepwater Horizon* oil spill. *PLoS ONE* 7:e41305

Bianchi TS, Cook RL, Perdue EM, Kolic PE, Green N, et al. 2011. Impacts of diverted freshwater on dissolved organic matter and microbial communities in Barataria Bay, Louisiana, USA. *Mar. Environ. Res.* 72:248–57

Bik HM, Halanych KM, Sharma J, Thomas WK. 2012. Dramatic shifts in benthic microbial eukaryote communities following the Deepwater Horizon oil spill. *PLoS ONE* 76:e38550

Boopathy R, Shields S, Nunna S. 2012. Biodegradation of crude oil from the BP oil spill in the marsh sediments of southeast Louisiana, USA. *Appl. Biochem. Biotechnol.* 167:1560–68

Bose A, Rogers DR, Adams MM, Joye SB, Girguis PR. 2013. Geomicrobiological linkages between short-chain alkane consumption and sulfate reduction rates in seep sediments. *Front. Microbiol.* 4:386

Camilli R, Reddy CM, Yoerger DR, Van Mooy BAS, Jakuba MV, et al. 2010. Tracking hydrocarbon plume transport and biodegradation at Deepwater Horizon. *Science* 330:201–4

Campo P, Venosa AD, Suidan MT. 2013. Biodegradability of Corexit 9500 and dispersed south Louisiana crude oil at 5 and 25 °C. *Environ. Sci. Technol.* 47:1960–67

Chakraborty R, Borglin SE, Dubinsky EA, Andersen GL, Hazen TC. 2012. Microbial response to the MC-252 oil and Corexit 9500 in the Gulf of Mexico. *Front. Microbiol.* 3:357

Chanton JP, Cherrier J, Wilson RM, Sarkodee-Adoo J, Bosman S, et al. 2012. Radiocarbon evidence that carbon from the Deepwater Horizon spill entered the planktonic food web of the Gulf of Mexico. *Environ. Res. Lett.* 7:045303

Corn ML, Copeland C. 2010. *Deepwater Horizon oil spill: coastal wetland and wildlife impacts and response.* CRS Rep. Congr. R41311, Congr. Res. Serv., Washington, DC

Crone TJ, Tolstoy M. 2010. Magnitude of the 2010 Gulf of Mexico oil leak. *Science* 330:634

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00020

DeHaan CJ, Sturges W. 2005. Deep cyclonic circulation in the Gulf of Mexico. *J. Phys. Oceanogr.* 35:1801–12

DeLaune RD, Wright AL. 2011. Projected impact of Deepwater Horizon oil spill on U.S. Gulf Coast wetlands. *Soil Sci. Soc. Am. J.* 75:1602–12

DeLong EF, Franks DG, Alldredge AL. 1993. Phylogenetic diversity of aggregate-attached versus free-living marine bacterial assemblages. *Limnol. Oceanogr.* 38:924–34

Dubinsky EA, Conrad ME, Chakraborty R, Bill M, Borglin SE, et al. 2013. Succession of hydrocarbon-degrading bacteria in the aftermath of the Deepwater Horizon oil spill in the Gulf of Mexico. *Environ. Sci. Technol.* 47:10860–67

Edwards BR, Reddy CM, Camilli R, Carmichael CA, Longnecker K, Van Mooy BAS. 2011. Rapid microbial respiration of oil from the *Deepwater Horizon* spill in offshore surface waters of the Gulf of Mexico. *Environ. Res. Lett.* 6:035301

Engle VD. 2011. Estimating the provision of ecosystem services by Gulf of Mexico coastal wetlands. *Wetlands* 31:179–93

Graham WM, Condon RH, Carmichael RH, D'Ambra I, Patterson HK, et al. 2010. Oil carbon entered the coastal planktonic food web during the Deepwater Horizon oil spill. *Environ. Res. Lett.* 5:045301

Gribsholt B, Kostka JM, Kristensen E. 2003. Impact of fiddler crabs and plant roots on sediment biogeochemistry in a Georgia saltmarsh. *Mar. Ecol. Prog. Ser.* 259:237–51

Gulf Coast Ecosyst. Restor. Task Force. 2011. *Gulf of Mexico regional ecosystem restoration strategy.* Rep., Gulf Coast Ecosyst. Restor. Task Force. **http://www.epa.gov/gulfcoasttaskforce/pdfs/GulfCoastReport_Full_12-04_508-1.pdf**

Gutierrez T, Singleton DR, Berry D, Yang T, Aitken MD, Teske A. 2013. Hydrocarbon-degrading bacteria enriched by the Deepwater Horizon oil spill identified by cultivation and DNA-SIP. *ISME J.* 7:2091–104

Hamdan LJ, Fulmer PA. 2011. Effects of COREXIT® EC9500A on bacteria from a beach oiled by the Deepwater Horizon spill. *Aquat. Microb. Ecol.* 63:101–9

Harayama S, Kasai Y, Hara A. 2004. Microbial communities in oil-contaminated seawater. *Curr. Opin. Biotechnol.* 15:205–14

Hayworth JS, Clement TP. 2011. BP's Operation Deep Clean—could dilution be the solution to beach pollution? *Environ. Sci. Technol.* 45:4201–2

Hayworth JS, Clement TP, Valentine JF. 2011. Deepwater Horizon oil spill impacts on Alabama beaches. *Hydrol. Earth Syst. Sci.* 15:3639–49

Hazen TC, Dubinsky EA, DeSantis TZ, Andersen GL, Piceno YM, et al. 2010. Deep-sea oil plume enriches indigenous oil-degrading bacteria. *Science* 330:204–8

Head IM, Jones DM, Roling WFM. 2006. Marine microorganisms make a meal of oil. *Nat. Rev. Microbiol.* 4:173–82

Hester MW, Mendelssohn IA. 2000. Long-term recovery of a Louisiana brackish marsh plant community from oil spill impact: vegetation response and mitigating effects of marsh surface elevation. *Mar. Environ. Res.* 49:233–54

Horel A, Mortazavi B, Sobecky PA. 2012. Responses of microbial community from northern Gulf of Mexico sandy sediments following exposure to Deepwater Horizon crude oil. *Environ. Toxicol. Chem.* 315:1004–11

Jackson WA, Pardue JH. 1999. Potential for intrinsic and enhanced crude oil biodegradation in Louisiana's freshwater marshes. *Wetlands* 19:28–34

Jaekel U, Musat N, Adam B, Kuypers M, Grundmann O, Musat F. 2013. Anaerobic degradation of propane and butane by sulfate-reducing bacteria enriched from marine hydrocarbon cold seeps. *ISME J.* 7:885–95

Jernelov A. 2010. The threats from oil spills: now, then, and in the future. *Ambio* 39: 353–66

Joye SB, MacDonald IR, Leifer I, Asper V. 2011. Magnitude and oxidation potential of hydrocarbon gases released from the BP oil well blowout. *Nat. Geosci.* 4:160–64

Kelly J. 2013. *Oily gunk found on Louisiana shore surges three years after BP spill.* Thomson Reuters, Oct. 19. **http://uk.reuters.com/article/2013/10/18/uk-bp-spill-idUKBRE99H0RM20131018**

Provides an analysis of changes in microbial community composition and function over time resulting from changes in the composition of oil within the plume.

Provides an initial metagenomics-based analysis of bacterial responses to oil in the plume and documents novel Oceanospirillales as major members of the hydrocarbon-degrading communities.

Provides the most recent definitive review of the ecology of aerobic hydrocarbon-degrading microorganisms in marine environments.

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00021

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

Kessler JD, Valentine DL, Redmond MC, Du M, Chan EW, et al. 2011. A persistent oxygen anomaly reveals the fate of spilled methane in the deep Gulf of Mexico. *Science* 331:312–15

Presents an analysis of the fate of methane released into the nGoM and its impact on dissolved oxygen at depth.

Kimes NE, Callaghan AV, Aktas DF, Sunner J, Golding BT, et al. 2013. Metagenomic analysis and metabolite profiling of deep-sea sediments from the Gulf of Mexico following the Deepwater Horizon oil spill. *Front. Microbiol.* 4:50

King GM, Smith CB, Tolar B, Hollibaugh JT. 2013. Analysis of composition and structure of coastal to mesopelagic bacterioplankton communities in the northern Gulf of Mexico. *Front. Microbiol.* 3:438

Provides the first detailed analysis of nGoM bacterioplankton structure across the shelf and to depths of 1,700 m using samples obtained approximately one month prior to the oil discharge.

Kirchman DL. 2002. The ecology of Cytophaga-Flavobacteria in aquatic environments. *FEMS Microbiol. Ecol.* 39:91–100

Kiruri LW, Dellinger B, Lomnicki S. 2013. Tar balls from Deep Water Horizon oil spill: environmentally persistent free radicals (EPFR) formation during crude weathering. *Environ. Sci. Technol.* 479:4220–26

Kniemeyer O, Musat F, Sievert SM, Knittel K, Wilkes H, et al. 2007. Anaerobic oxidation of short-chain hydrocarbons by marine sulphate-reducing bacteria. *Nature* 449:898–901

Kostka JE, Prakash O, Overholt WA, Green SJ, Freyer G, et al. 2011. Hydrocarbon-degrading bacteria and the bacterial community response in Gulf of Mexico beach sands impacted by the Deepwater Horizon oil spill. *Appl. Environ. Microbiol.* 77:7962–74

Provides evidence from next-generation sequencing, cultivation, and biogeochemistry indicating that indigenous microbial communities are drastically affected by oil hydrocarbons in beach sands impacted by the MC-252 oil discharge.

Kube M, Chernikova TN, Al-Ramahi Y, Beloqui A, Lopez-Cortez N, et al. 2013. Genome sequence and functional genomic analysis of the oil-degrading bacterium *Oleispira antarctica*. *Nat. Commun.* 4:2156

Kujawinski EB, Kido Soule MC, Valentine DL, Boysen AK, Longnecker K, Redmond MC. 2011. Fate of dispersants associated with the Deepwater Horizon oil spill. *Environ. Sci. Technol.* 45:1298–306

Lai Q, Qiao N, Wu C, Sun F, Yuan J, Shao Z. 2010. *Stappia indica* sp. nov., isolated from deep seawater of the Indian Ocean. *Int. J. Syst. Evol. Microbiol.* 60:733–36

Lamendella R, Strutt S, Borglin SE, Chakraborty R, Tass N, et al. 2014. Assessment of the Deepwater Horizon oil spill impact on Gulf Coast microbial communities. *Front. Microbiol.* 5:130

Leahy JG, Colwell RR. 1990. Microbial degradation of hydrocarbons in the environment. *Microbiol. Rev.* 54:305–15

Lin Q, Mendelssohn IA. 1998. The combined effects of phytoremediation and biostimulation in enhancing habitat restoration and oil degradation of petroleum contaminated wetlands. *Ecol. Eng.* 10:263–74

Lin Q, Mendelssohn IA. 2009. Potential restoration and phytoremediation with *Juncus roemerianus* for diesel-contaminated coastal wetlands. *Ecol. Eng.* 33:85–91

Lin Q, Mendelssohn IA. 2012. Impacts and recovery of the *Deepwater Horizon* oil spill on vegetation structure and function of coastal salt marshes in the northern Gulf of Mexico. *Environ. Sci. Technol.* 46 7:3737–43

Liu Z, Liu J. 2013. Evaluating bacterial community structures in oil collected from the sea surface and sediment in the northern Gulf of Mexico after the *Deepwater Horizon* oil spill. *MicrobiologyOpen* 2:492–504

Lu Z, Deng Y, Van Nostrand JD, He Z, Voordeckers J, et al. 2012. Microbial gene functions enriched in the Deepwater Horizon deep-sea oil plume. *ISME J.* 6:451–60

Lubchenco J, McNutt MK, Dreyfus G, Murawski SA, Kennedy DM, et al. 2012. Science in support of the *Deepwater Horizon* response. *Proc. Natl. Acad. Sci. USA* 109:20212–21

Mahmoudi N, Porter TM, Zimmerman A, Fulthorpe R, Kasozi GN, et al. 2013. Rapid degradation of *Deepwater Horizon* spilled oil by indigenous microbial communities in Louisiana salt marsh sediments. *Environ. Sci. Technol.* 47:13303–12

Mason OU, Hazen TC, Borglin S, Chain PS, Dubinsky EA, et al. 2012. Metagenome, metatranscriptome and single-cell sequencing reveal microbial response to Deepwater Horizon oil spill. *ISME J.* 6:1715–27

Documents both metagenomic and metatranscriptomic responses of microbial communities in the plume and provides insights from single-cell sequencing of the dominant members.

Mason OU, Scott NM, Gonzalez A, Robbins-Pianka A, Bælum J, et al. 2014. Metagenomics reveals sediment microbial community response to Deepwater Horizon oil spill. *ISME J.* 8:1464–75

McCarren J, Becker JW, Repeta DJ, Shi YM, Young CR, et al. 2010. Microbial community transcriptomes reveal microbes and metabolic pathways associated with dissolved organic matter turnover in the sea. *Proc. Natl. Acad. Sci. USA* 107:16420–27

ED_001324_00007779-00022

McNutt MK, Camilli R, Crone TJ, Guthrie GD, Hsieh PA, et al. 2011. Review of flow rate estimates of the *Deepwater Horizon* oil spill. *Proc. Natl. Acad. Sci. USA* 109:20260–67

Mendelssohn IA, Andersen GL, Baltz DM, Caffey RH, Carman KR, et al. 2012. Oil impacts on coastal wetlands: implications for the Mississippi River Delta ecosystem after the *Deepwater Horizon* oil spill. *BioScience* 626:562–74

Mezic I, Loire S, Fonoberov VA, Hogan P. 2010. A new mixing diagnostic and Gulf oil spill movement. *Science* 330:486–89

Michel J, Owens EH, Zengel S, Graham A, Nixon Z, et al. 2013. Extent and degree of shoreline oiling: *Deepwater Horizon* oil spill, Gulf of Mexico, USA. *PLoS ONE* 86:e65087

Mitsch WJ, Gosselink JG, Anderson CJ, Zhang L. 2009. *Wetland Ecosystems*. Hoboken, NJ: Wiley & Sons

Mortazavi B, Horel A, Beazley MJ, Sobecky PA. 2013. Intrinsic rates of petroleum hydrocarbon biodegradation in Gulf of Mexico intertidal sandy sediments and its enhancement by organic substrates. *J. Hazard. Mat.* 244:537–44

Natter M, Keevan J, Wang Y, Keimowitz AR, Okeke BC, et al. 2012. Level and degradation of Deepwater Horizon spilled oil in coastal marsh sediments and pore-water. *Environ. Sci. Technol.* 4611:5744–55

Newton RJ, Huse SM, Morrison HG, Peake CS, Sogin ML, McLellan SL. 2013. Shifts in the microbial community composition of Gulf Coast beaches following beach oiling. *PLoS ONE* 89:e74265

Norse E, Amos J. 2010. Impacts, perception, and policy implications of the Deepwater Horizon oil and gas disaster. *Environ. Law Rep.* 11:11058–73

Oper. Sci. Advis. Team. 2010. *Summary report for sub-sea and sub-surface oil and dispersant detection: sampling and monitoring*. Rep., US Coast Guard, US Dep. Homel. Secur., Washington, DC

Oper. Sci. Advis. Team. 2011. *Summary report for fate and effects of remnant oil in the beach environment*. Rep., US Coast Guard, US Dep. Homel. Secur., Washington, DC

Ortmann J, Anders NS, Gong L, Moss AG, Condon RH. 2012. Dispersed oil disrupts microbial pathways in pelagic food webs. *PLoS ONE* 7:e2548

Oudot J, Chaillan F. 2010. Pyrolysis of asphaltenes and biomarkers for the fingerprinting of the Amoco Cadiz oil spill after 23 years. *C. R. Chim.* 13:548–52

Overholt WA, Green SJ, Marks KP, Venkatraman R, Prakash O, Kostka JE. 2013. Draft genome sequences for oil-degrading bacterial strains from beach sands impacted by the Deepwater Horizon oil spill. *Genome Announc.* 1:e01015–13

Paul JH, Hollander D, Coble P, Daly KL, Murasko S, et al. 2013. Toxicity and mutagenicity of Gulf of Mexico waters during and after the Deepwater Horizon oil spill. *Environ. Sci. Technol.* 47:9651–59

Prince RC. 2010. Bioremediation of marine oil spills. In *Handbook of Hydrocarbon and Lipid Microbiology*, ed. KN Timmis, pp. 2617–30. Berlin: Springer

Prince RC, Parkerton TF. 2014. Comment on "Toxicity and mutagenicity of gulf of Mexico waters during and after the Deepwater Horizon oil spill." *Environ. Sci. Technol.* 48:3591–92

Radniecki TS, Schneider MC, Semprini L. 2013. The influence of Corexit 9500A and weathering on Alaska North Slope crude oil toxicity to the ammonia-oxidizing bacterium, *Nitrosomonas europea*. *Mar. Pollut. Bull.* 68:64–70

Reddy CM, Arey JS, Seewald JS, Sylva SP, Lemkau KL, et al. 2012. Composition and fate of gas and oil released to the water column during the *Deepwater Horizon* oil spill. *Proc. Natl. Acad. Sci. USA* 10950:20229–34

Provides a comprehensive analysis of the composition of the oil and gas that were released and the evolution of their composition during transport.

Redmond MC, Valentine DL. 2012. Natural gas and temperature structured a microbial community response to the *Deepwater Horizon* oil spill. *Proc. Natl. Acad. Sci. USA* 109:20292–97

Ribeiro H, Mucha AP, Almeida CM, Bordalo AA. 2011. Hydrocarbon degradation potential of salt marsh plant-microorganism associations. *Biodegradation* 22:729–39

Rivers AR, Sharma S, Tringe SG, Martin J, Joye SB, Moran MA. 2013. Transcriptional response of bathypelagic marine bacterioplankton to the Deepwater Horizon oil spill. *ISME J.* 7:2315–29

Rodriguez-R LM, Overholt W, Huettel M, Kostka JE, Konstantinidis KT. 2014. Succession in the indigenous intertidal sand microbial communities of Florida in response to the Deepwater Horizon oil spill. *ISME J.* In review

Roling WF, de Brito Couto IR, Swannell RP, Head IM. 2004. Response of archaeal communities in beach sediments to spilled oil and bioremediation. *Appl. Environ. Microbiol.* 70:2614–20

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00023

Ruddy BM, Huettel M, Kostka JE, Lobodin VV, Bythell BJ, et al. 2014. Targeted petroleomics: analytical investigation of Macondo well oil oxidation products from Pensacola Beach. *Energy Fuels* 28:4043–50

Ryerson TB, Aikin KC, Angevine WM, Atlas EL, Blake DR, et al. 2011. Atmospheric emissions from the Deepwater Horizon spill constrain air-water partitioning, hydrocarbon fate, and leak rate. *Geophys. Res. Lett.* 38:L07803

Ryerson TB, Camilli R, Kessler JD, Kujawinski EB, Reddy CM, et al. 2012. Chemical data quantify *Deepwater Horizon* hydrocarbon flow rate and environmental distribution. *Proc. Natl. Acad. Sci. USA* 109:20246–53

Silliman BR, van de Koppel J, McCoy MW, Diller J, Kasozi GN, et al. 2012. Degradation and resilience in Louisiana salt marshes after the BP–*Deepwater Horizon* oil spill. *Proc. Natl. Acad. Sci. USA* 10928:11234–39

Smith CB, Johnson CN, King GM. 2011. Assessment of polyaromatic hydrocarbon degradation by potentially pathogenic environmental *Vibrio parahaemolyticus* isolates from coastal Louisiana, USA. *Mar. Pollut. Bull.* 64:138–43

Smith CB, Tolar BB, Hollibaugh JT, King GM. 2013. Alkane hydroxylase gene (*alkB*) phylotype composition and diversity in northern Gulf of Mexico bacterioplankton. *Front. Microbiol.* 4:370

Spier C, Stringfellow WT, Hazen TC, Conrad M. 2013. Distribution of hydrocarbons released during the 2010 MC252 oil spill in deep offshore waters. *Environ. Pollut.* 173:224–30

Stauffert M, Cravo-Laureau C, Jézéquel R, Barantal S, Cuny P, et al. 2013. Impact of oil on bacterial community structure in bioturbated sediments. *PLoS ONE* 86:e65347

Tao R, Yu K. 2013. Nitrate addition has minimal effect on anaerobic biodegradation of benzene in coastal saline salt, brackish and freshwater marsh sediments. *Wetlands* 33:759–67

Tao Z, Bullard S, Arias C. 2011. High numbers of *Vibrio vulnificus* in tar balls collected from oiled areas of the north-central Gulf of Mexico following the 2010 BP *Deepwater Horizon* oil spill. *EcoHealth* 8:507–11

Tate PT, Shin WS, Pardue JH, Jackson WA. 2011. Bioremediation of an experimental oil spill in a coastal Louisiana salt marsh. *Water Air Soil Pollut.* 223:1115–23

Teeling H, Fuchs BM, Becher D, Klockow C, Gardebrecht A, et al. 2012. Substrate-controlled succession of marine bacterioplankton populations induced by a phytoplankton bloom. *Science* 336:608–11

Urakawa H, Garcia JC, Barreto PD, Molina GA, Barreto JC. 2012. A sensitive crude oil bioassay indicates that oil spills potentially induce a change of major nitrifying prokaryotes from the Archaea to the Bacteria. *Environ. Pollut.* 164:42–45

Valentine DL, Kessler JD, Redmond MC, Mendes SD, Heintz MB, et al. 2010. Propane respiration jump-starts microbial response to a deep oil spill. *Science* 330:208–11

Valentine DL, Mezić I, Maćešić S, Črnjarić-Žic N, Ivić S, et al. 2012. Dynamic autoinoculation and the microbial ecology of deep water hydrocarbon irruption. *Proc. Natl. Acad. Sci. USA* 109:20286–91

Venosa AD, Zhu X. 2003. Biodegradation of crude oil contaminating marine shorelines and freshwater wetlands. *Spill Sci. Technol. Bull.* 8:163–78

Wang P, Roberts TM. 2013. Distribution of surficial and buried oil contaminants across sandy beaches along NW Florida and Alabama coasts following the Deepwater Horizon oil spill in 2010. *J. Coast. Res.* 304:144–55

Ward DM, Atlas RM, Boehm PD, Calder JA. 1980. Microbial biodegradation and chemical evolution of oil from the Amoco Spill. *Ambio* 9:277–83

Widdel F, Knittel K, Galushko A. 2010. Anaerobic hydrocarbon-degrading microorganisms: an overview. In *Handbook of Hydrocarbon and Lipid Microbiology*, ed. KN Timmis, pp. 1998–2021. Berlin: Springer

Wright AL, Weaver RW, Webb JW. 1997. Oil bioremediation in salt marsh mesocosms as influenced by N and P fertilization, flooding, and season. *Water Air Soil Pollut.* 95:179–91

Yakimov MM, Giuliano L, Gentile G, Crisafi E, Chernikova TN, et al. 2003. *Oleispira antarctica* gen. nov., sp nov., a novel hydrocarbonoclastic marine bacterium isolated from Antarctic coastal sea water. *Int. J. Syst. Evol. Microbiol.* 53:779–85

Yakimov MM, Timmis KN, Golyshin PN. 2007. Obligate oil-degrading marine bacteria. *Curr. Opin. Biotechnol.* 18:257–66

Provides results from a model analysis that uses deep circulation patterns to determine the response patterns of hydrocarbon degraders to multiple exposures to oil.

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00024

Yvon-Lewis SA, Hu L, Kessler J. 2011. Methane flux to the atmosphere from the Deepwater Horizon oil disaster. *Geophys. Res. Lett.* 38:L01602

Zedelius J, Rabus R, Grundmann O, Werner I, Brodkorb D, et al. 2011. Alkane degradation under anoxic conditions by a nitrate-reducing bacterium with possible involvement of the electron acceptor in substrate activation. *Environ. Microbiol. Rep.* 31:125–35

Ziervogel K, McKay L, Rhodes B, Osburn C L, Dickson-Brown J, et al. 2012. Microbial activities and dissolved organic matter dynamics in oil-contaminated surface seawater from the Deepwater Horizon oil spill site. *PLoS ONE* 7:e34816

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00025

Annual Review of
Marine Science

Volume 7, 2015

Contents

Reflections on My Career as a Marine Physical Chemist, and Tales of the Deep
Frank J. Millero ... 1

Regional Ocean Data Assimilation
Christopher A. Edwards, Andrew M. Moore, Ibrahim Hoteit, and Bruce D. Cornuelle ... 21

Oceanic Forcing of Coral Reefs
Ryan J. Lowe and James L. Falter ... 43

Construction and Maintenance of the Ganges-Brahmaputra-Meghna Delta: Linking Process, Morphology, and Stratigraphy
Carol A. Wilson and Steven L. Goodbred Jr. ... 67

The Dynamics of Greenland's Glacial Fjords and Their Role in Climate
Fiamma Straneo and Claudia Cenedese ... 89

The Role of the Gulf Stream in European Climate
Jaime B. Palter ... 113

Long-Distance Interactions Regulate the Structure and Resilience of Coastal Ecosystems
Johan van de Koppel, Tjisse van der Heide, Andrew H. Altieri, Britas Klemens Eriksson, Tjeerd J. Bouma, Han Olff, and Brian R. Silliman ... 139

Insights into Particle Cycling from Thorium and Particle Data
Phoebe J. Lam and Olivier Marchal ... 159

The Size-Reactivity Continuum of Major Bioelements in the Ocean
Ronald Benner and Rainer M.W. Amon ... 185

Subsurface Chlorophyll Maximum Layers: Enduring Enigma or Mystery Solved?
John J. Cullen ... 207

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

Cell Size as a Key Determinant of Phytoplankton Metabolism and Community Structure
Emilio Marañón 241

Phytoplankton Strategies for Photosynthetic Energy Allocation
Kimberly H. Halsey and Bethan M. Jones 265

Techniques for Quantifying Phytoplankton Biodiversity
Zackary I. Johnson and Adam C. Martiny 299

Molecular Mechanisms by Which Marine Phytoplankton Respond to Their Dynamic Chemical Environment
Brian Palenik 325

The Molecular Ecophysiology of Programmed Cell Death in Marine Phytoplankton
Kay D. Bidle 341

Microbial Responses to the *Deepwater Horizon* Oil Spill: From Coastal Wetlands to the Deep Sea
G.M. King, J.E. Kostka, T.C. Hazen, and P.A. Sobecky 377

Denitrification, Anammox, and N_2 Production in Marine Sediments
Allan H. Devol 403

Rethinking Sediment Biogeochemistry After the Discovery of Electric Currents
Lars Peter Nielsen and Nils Risgaard-Petersen 425

Mussels as a Model System for Integrative Ecomechanics
Emily Carrington, J. Herbert Waite, Gianluca Sarà, and Kenneth P. Sebens 443

Infectious Diseases Affect Marine Fisheries and Aquaculture Economics
Kevin D. Lafferty, C. Drew Harvell, Jon M. Conrad, Carolyn S. Friedman, Michael L. Kent, Armand M. Kuris, Eric N. Powell, Daniel Rondeau, and Sonja M. Saksida 471

Diet of Worms Emended: An Update of Polychaete Feeding Guilds
Peter A. Jumars, Kelly M. Dorgan, and Sara M. Lindsay 497

Fish Locomotion: Recent Advances and New Directions
George V. Lauder 521

There and Back Again: A Review of Residency and Return Migrations in Sharks, with Implications for Population Structure and Management
Demian D. Chapman, Kevin A. Feldheim, Yannis P. Papastamatiou, and Robert E. Hueter 547

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

ED_001324_00007779-00027

Whale-Fall Ecosystems: Recent Insights into Ecology, Paleoecology, and Evolution
Craig R. Smith, Adrian G. Glover, Tina Treude, Nicholas D. Higgs, and Diva J. Amon 571

Errata

An online log of corrections to *Annual Review of Marine Science* articles may be found at http://www.annualreviews.org/errata/marine

Annu. Rev. Marine. Sci. 2015.7:377-401. Downloaded from www.annualreviews.org
Access provided by U.S. EPA - RTP on 01/28/15. For personal use only.

Aquatic Toxicology 152 (2014) 335–340

Contents lists available at ScienceDirect

Aquatic Toxicology

journal homepage: www.elsevier.com/locate/aquatox

Chemical dispersants used in the Gulf of Mexico oil crisis are cytotoxic and genotoxic to sperm whale skin cells

Catherine F. Wise[a,b], James T.F. Wise[a,b], Sandra S. Wise[a,b,c], W. Douglas Thompson[b,c], John Pierce Wise Jr.[a,b], John Pierce Wise Sr.[a,b,c,*]

[a] Wise Laboratory of Environmental and Genetic Toxicology, Portland, ME 04103, USA
[b] Maine Center for Toxicology and Environmental Health, Portland, ME 04103, USA
[c] Department of Applied Medical Science, University of Southern Maine, Portland, ME 04103, USA

article info

Article history:
Received 6 March 2014
Received in revised form 12 April 2014
Accepted 16 April 2014
Available online 25 April 2014

Keywords:
Gulf of Mexico
Chemical dispersant
Deepwater Horizon oil spill
Genotoxicity
Corexit
Sperm whale

abstract

The 2010 Deepwater Horizon oil rig explosion in the Gulf of Mexico drew attention to the need for toxicological studies of chemical dispersants. We are still learning the effects these spills had on wildlife. Little is known about the toxicity of these substances in marine mammals. The objective of this study was to determine the toxicity of the two dispersants (Corexit 9500 and 9527). Corexit 9500 and 9527 were both cytotoxic to sperm whale skin fibroblasts. Corexit 9527 was less cytotoxic than 9500. S9 mediated metabolism did not alter cytotoxicity of either dispersant. Both dispersants were genotoxic to sperm whale skin fibroblasts; S9 mediated metabolism increased Corexit 9527 genotoxicity.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

In 2010, the Deepwater Horizon oil rig exploded unleashing uncontrolled amounts of crude oil into the Gulf of Mexico. To combat the spill, unprecedented amounts of chemical dispersants were used. It is estimated that about 8 million liters (converted from gallons to liters) of dispersants were applied beneath the ocean surface at the depth of the well head leak as well as on the surface (Kujawinski et al., 2011). These agents were applied despite the fact that little was known about their potential toxicological impact to marine mammals; a shortcoming that continues to exist as, in general, most of the toxicology studies that are available are limited to LC50-type acute lethality endpoints in non-mammalian species. Thus, there is wide concern about the potential toxicity of these dispersants for both human and wildlife health.

Two types of dispersants, Corexit 9500 and Corexit 9527, were used to combat the oil spill. Limited data suggests these agents can be toxic, but experimental outcomes were generally limited to lethality. For example, a recent review summarized the available data for the toxicity of the two dispersants and found LC50s for Corexit 9500 in crustaceans, mollusks and fish, and for Corexit 9527 in daphnia, anemones, coral, crustaceans, mollusks, starfish, fish and birds (Wise and Wise, 2011). Remarkably, only one study considered effects in a mammal and reported impacts on body weights and intestinal flora in rats (George et al., as cited in Wise and Wise, 2011). More recently, the impact of dispersants on mammalian model systems have been considered in two human cell culture models. Corexit 9500 and Corexit 9527 induced cytotoxicity and oxidative stress in human HepG2/C3A hepatocytes (Bandele et al., 2012) and induced cytotoxicity in the immortalized human bronchial cell line, BEAS-2B (Shi et al., 2013). These data suggest a significant concern for dispersant toxicity and indicate the need for further study.

One major concern in the Gulf of Mexico is the potential impact of these dispersants on marine mammals. In particular, there are two resident populations of large whale species in the Gulf of Mexico: Sperm whales (Physeter macrocephalus) with a population of about 1600 individuals and Bryde's whales (Balaenoptera edeni) with a population of about 15 individuals (Waring et al.,

* Corresponding author at: Wise Laboratory of Environmental and Genetic Toxicology, University of Southern Maine, 478 Science Building, 96 Falmouth Street, Portland, Maine 04103, USA. Tel.: +1 207 228 8050; fax: +1 207 228 8518.
E-mail addresses: catherine.wise@maine.edu (C.F. Wise), jamestwise@gmail.com (J.T.F. Wise), sandra.wise@maine.edu (S.S. Wise), dougt@usm.maine.edu (W.D. Thompson), wise19@purdue.edu (J.P. Wise Jr.), john.wise@usm.maine.edu (J.P. Wise Sr.).

http://dx.doi.org/10.1016/j.aquatox.2014.04.020
0166-445X/© 2014 Elsevier B.V. All rights reserved.

2009, 2010). The loss or impairment of just a few reproductively productive animals in these small populations could result in their ultimate loss from the Gulf. Of note, the sperm whales are known to reside in the areas most affected by the spill (Waring et al., 2009, 2010). Indeed, anecdotal reports indicate that these whales were often observed by workers on the Deepwater Horizon rig and the National Oceanic and Atmospheric Administration (NOAA) and Unified Command received numerous reports of sperm whales swimming in oiled water after the spill (Warren, 2010). Thus, it is highly likely that these animals were exposed to the dispersants. We were unable to locate any data concerning the toxicity of these dispersants in any marine mammals or marine mammal cell cultures. Therefore, to address this concern, we investigated the cytotoxic and genotoxic effects of Corexit 9500 and Corexit 9527 in cultured sperm whale skin cells.

2. Materials and methods

2.1. Materials

All plasticware was purchased from BD Falcon. Dulbecco's Phosphate-Buffered Saline (DPBS), Dulbecco's Modified Eagle's Medium: Nutrient Mixture F-12 (DMEM/F-12) and Glutagro supplement were purchased from Corning. Nicotinamide adenine dinucleotide phosphate (NADPH) solutions were purchased from BD Gentest. S9 and fractions were purchased from Celsis In Vitro Technologies. Potassium chloride, demecolcine and sodium chromate were purchased from Sigma/Aldrich. Crystal violet, methanol and acetic acid were purchased from JT Baker. Microscope slides were purchased from Thermo scientific. Giemsa stain was manufactured by Rica Chemical Co. Gurr's buffer, trypsin, penicillin-streptomycin and sodium pyruvate was purchased from GIBCO Invitrogen Corporation. Cosmic calf serum was purchased from Hyclone.

2.2. Cell culture

Primary skin fibroblast cells were obtained from a free ranging sperm whale biopsy that was taken prior to the Deepwater Horizon oil spill as previously described (Wise et al., 2011). Cells were cultured in DMEM/F-12 (50:50 mixture of Modified Eagle's Medium and Ham's F-12) supplemented with 15% Cosmic calf serum, 2 mM l-glutamine, 100 U/ml penicillin, 100 ffig/ml streptomycin, and 0.1 mM sodium pyruvate. Cells were maintained in a humidified incubator with 5% CO_2 at 33 °C (estimated whale body temperature). Cells were allowed to grow to near confluence as a monolayer. They were fed three times a week and expanded weekly (Wise et al., 2011).

2.3. Chemical and S9 fraction preparation

The dispersants used (Corexit EC9500A and Corexit EC9527A) were generously provided by the Nalco Holding Company. Treatment dilutions were prepared under dark conditions using the 100% stock solution and sterile water. Sodium chromate was dissolved in water and was filter sterilized. This was used as a positive control for all experiments.

Although the metabolism of the dispersants is unknown, we also considered phase 1 metabolism to determine if there is a difference in toxicity between the metabolite and the parent compound. S9 fractions were used to induce phase 1 metabolism because fibroblast cells often do not express cytochrome P450 enzymes. S9 fractions were added at the time of treatment, and made using 1× Tris buffer, NADPH regenerating system solution A (451220), NADPH regenerating system solution B (451200), and liver S9 fractions. These were prepared and applied at the time of chemical treatment.

2.4. Cytotoxicity

We used a clonogenic assay based on our published methods to determine the cytotoxicity of each dispersant (Wise et al., 2011). Briefly, cells were seeded into two 6 well tissue culture plates and allowed 48 h to resume normal log phase growth. Then they were treated with either Corexit 9500 or Corexit 9527 for 24 h. All treatment doses were done with and without S9 fractions. After the treatment time cells were reseeded into gelatin coated 100 mm tissue culture dishes at colony forming density. Once adequate cell colonies formed (~2 weeks) dishes were rinsed twice with 1× phosphate-buffered saline (PBS) then fixed in methanol for 20 min. After the methanol was removed the dishes were stained with crystal violet stain for 30 min. Dishes were analyzed for number of cell colonies then averaged per dose and divided by the average number of colonies in the negative control.

2.5. Clastogenicity

We used a chromosomal aberration assay to determine the clastogenicity of each dispersant, based on our published methods (Wise et al., 2011). Briefly, cells were seeded into 100 mm tissue culture dishes for 48 h. Then they were treated with either Corexit 9500 or Corexit 9527 for 24 h. All treatment doses were done with and without S9 fractions. Five hours prior to the end of the treatment period cells were arrested in metaphase using 0.1 g/ml demecolcine. After the full 24 h treatment period, cells were resuspended in a potassium chloride hypotonic solution (KCl) for 17 min then fixed with 3:1 methanol:acetic acid. After two changes of fixative, cells were dropped onto microscope slides and stained with 5% Giemsa stain in Gurr's Buffer. Slides were analyzed for chromosome aberrations in 100 metaphases per treatment concentration according to our published methods (Wise et al., 2011).

2.6. Statistics

The statistical difference between values for cytotoxicity and genotoxicity were evaluated using t-test and multiple regression analysis with dispersant, concentration, and S9 as the three independent variables. No adjustment was made for multiple comparisons, because all of the comparisons were made of a priori substantive interest.

3. Results

3.1. Corexit 9500 and 9527 Cytotoxicity in Sperm Whale Skin Cells

Corexit 9500 induced a concentration dependent increase in cytotoxicity to sperm whale skin cells (Fig. 1). Concentrations of 0.005, 0.025, 0.05 and 0.1% 9500 induced 82, 67, 25 and 3% relative survival, respectively. S9 mediated metabolism did not significantly alter the cytotoxicity of Corexit 9500 (Fig. 1). Concentrations of 0.005, 0.025, 0.05 and 0.1% 9500 with S9 fractions induced 91, 72, 37 and 3% relative survival, respectively.

Corexit 9527 also induced a concentration dependent increase in cytotoxicity (Fig. 2). Concentrations of 0.005, 0.025, 0.05 and 0.1% 9527 induced 86, 79, 70 and 26% relative survival, respectively. S9 mediated metabolism resulted in a similar dose response (Fig. 2). Concentrations of 0.005, 0.025, 0.05 and 0.1% 9527 with S9 fractions induced 86, 77, 70 and 42% relative survival, respectively.

Comparison of Corexit 9500 and Corexit 9527 parent compounds shows that 9500 is more toxic than 9527 (Fig. 3). For

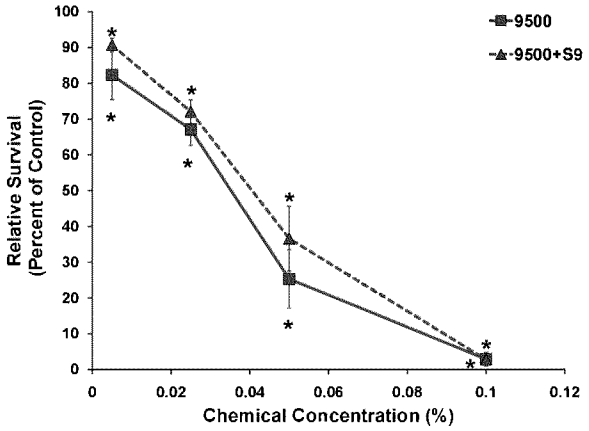


Fig. 1. Corexit 9500 is cytotoxic to sperm whale skin cells. This figure shows that Corexit 9500 was cytotoxic to sperm whale skin cells after a 24 h exposure and S9 mediated metabolism did not alter cytotoxicity (measured as cell survival relative to the control). The overall dose-response is highly significant ($p < 0.0001$). There was no statistical difference observed between 9500 and 9500+S9 ($p = 0.19$). Data represent 3–4 experiments ± the standard error of the mean. Asterisk (*) indicates doses that are significantly different from control ($p < 0.05$).

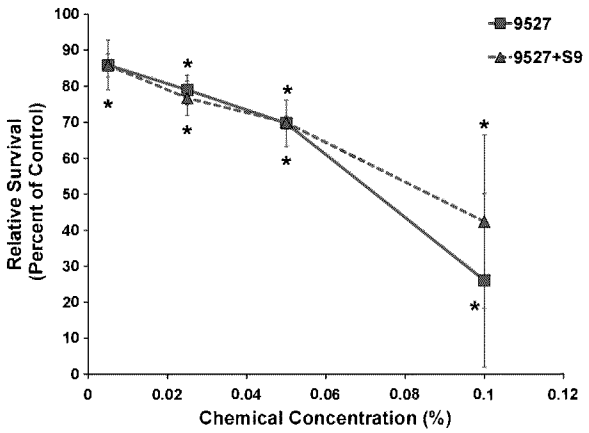


Fig. 2. Corexit 9527 is cytotoxic to sperm whale skin cells. This figure shows Corexit 9527 was cytotoxic to sperm whale skin cells in a concentration dependent manner after a 24 h. Cytotoxicity is measured as cell survival relative to the control. There was no statistical difference observed between 9527 and 9527+S9 ($p > 0.05$). Data represent 3 experiments ± the standard error of the mean. Asterisk (*) indicates doses that are statistically significant from control ($p < 0.05$).

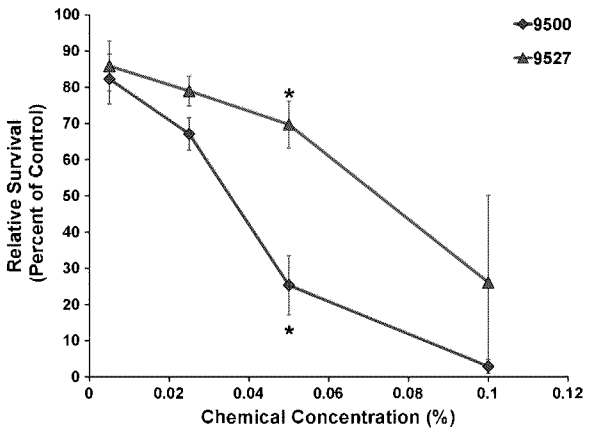


Fig. 3. Corexit 9500 is more cytotoxic than Corexit 9527. This figure compares the cytotoxicity of Corexit 9500 and Corexit 9527 after a 24 h exposure. Sperm whale cells were more sensitive to Corexit 9500 than Corexit 9527 ($p = 0078$). Asterisk (*) indicates doses that were significantly different from each other ($p < 0.05$).

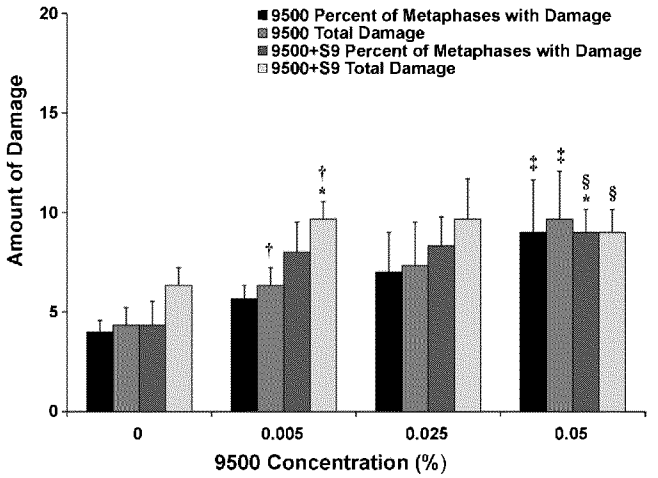


Fig. 4. Corexit 9500 is not strongly genotoxic to sperm whale skin cells. This figure shows Corexit 9500 was not substantially and generally not statistically significantly genotoxic to sperm whale skin cells after a 24 h exposure both with and without S9-mediated metabolism. Data are expressed as the average percent of metaphase with damage and total aberrations in 100 metaphases. Data represent 3 experiments ± the standard error of the mean. Symbol (†) indicates that 9500 is statistically significant from 9500 + S9 ($p < 0.05$). Asterisk (*) indicates doses that are significantly different from control ($p < 0.05$). Symbol (‡) indicates that in one experiment only 68 metaphases could be scored. Symbol (§) indicates that in one experiment only 86 metaphases could be scored.

example, there is a 3-fold increase in toxicity at 0.05% concentration ($p = 0.0002$).

3.2. Corexit 9500 and 9527 clastogenicity in sperm whale skin cells

Corexit 9500 induced a minimal increase in genotoxicity in sperm whale skin cells (Fig. 4). S9 mediated metabolism had no effect on the genotoxicity of Corexit 9500 (Fig. 4). Specifically, concentrations of 0.005, 0.025 and 0.05% 9500 damaged 1.7, 3 and 5.3% of metaphases and induced 2.3, 3 and 5.7 total aberrations per 100 metaphases, respectively (minus the control levels). S9 mediated metabolism damaged 3.7, 4 and 4.7% of metaphases and induced 3.3, 3.3 and 2.7 total aberrations per 100 metaphases, respectively (minus the control levels).

By contrast, Corexit 9527 induced a concentration-dependent increase in genotoxicity after 24 h exposure in sperm whale cells (Fig. 5). Specifically, concentrations of 0.005, 0.025, 0.05 and 0.1% 9527 damaged 3, 4.3, 8 and 10.6% of metaphases and induced 4, 5, 9.3 and 12.7 total aberrations per 100 metaphases, respectively (minus the control values). S9 mediated metabolism increased this effect damaging chromosomes in 4, 8, 11 and 19.5% of metaphases and induced 4, 8.7, 14.3 and 25 total aberrations per 100 metaphases, respectively (Fig. 5; minus the control values). The spectrum of chromosome aberrations for both compounds consisted of mostly chromatid lesions (Table 1).

Comparing of Corexit 9500 and 9527 shows that 9257 is more genotoxic than 9500 (Fig. 6). Corexit 9527 with S9 fractions was the most genotoxic condition, inducing the most total chromosome damage. Corexit 9527 had a higher amount of isochromatid lesions than 9500. Corexit 9500 had a higher amount of dicentric chromosomes and double minutes. The double minutes only occurred in the S9 treated cells. There were few chromatid exchanges in both compounds. Double minutes, dicentrics and chromatid exchanges were not present in any of the controls (Table 1).

4. Discussion

In the aftermath of the Deepwater Horizon explosion, two dispersants Corexit 9500 and Corexit 9527 were sprayed on oil at the

Table 1
Spectrum of chromosome aberrations.[a].

Concentration	Chromatid lesions	Isochromatid lesions	Chromatid exchanges	Rings	Double minutes	Acentric fragments	Dicentrics
Corexit 9500							
0	3	0	0	0	0	0	0
0.005	5	0	1	0	0	0	0
0.025	2	0	0	0	0	0	1
0.05	11	1	0	0	0	0	1
0 + S9	1	0	0	0	4	0	1
0.005 + S9	6	0	0	0	1	0	1
0.025 + S9	5	0	0	0	1	0	0
0.05 + S9	8	1	0	0	0	0	0
Corexit 9527							
0	3	0	0	0	0	0	0
0.005	2	6	0	0	0	0	0
0.025	12	0	0	0	0	0	0
0.05	17	0	1	0	0	0	0
0 + S9	3	4	0	0	0	0	0
0.005 + S9	10	1	0	0	0	0	0
0.025 + S9	20	2	0	0	0	0	0
0.05 + S9	31	0	0	0	0	0	0

surface of the Gulf of Mexico and injected into the wellhead in an effort to reduce the impact of the crude oil as quickly as possible. Little is known about the toxicity and environmental fate of these chemicals and there is significant concern about their potential long term health effects. Our data are the first assessment of Corexit 9500 and Corexit 9257 toxicity in a marine mammal model system and the first data to evaluate the ability of these agents to induce chromosome damage in any species. Our data show that Corexit 9527 is indeed genotoxic to sperm whale skin cells. Such an outcome raises concern about the impact of this agent on reproduction, development and potentially carcinogenesis in marine mammals and in other species.

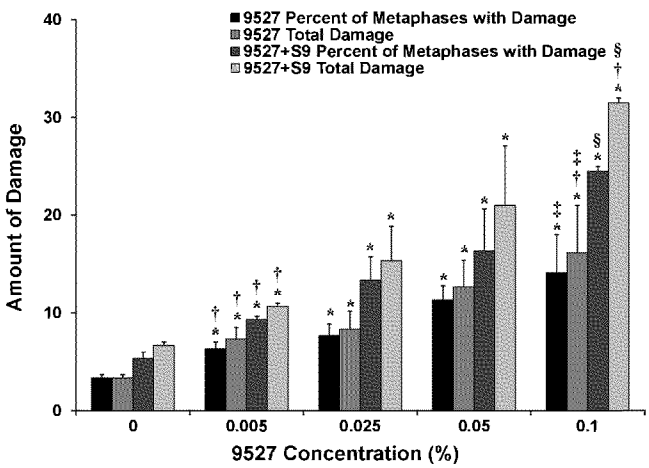


Fig. 5. Corexit 9527 is genotoxic to sperm whale skin cells. This figure shows Corexit 9527 induces a concentration-dependent increase in genotoxicity in sperm whale skin cells after a 24 h exposure. S9 mediated metabolism increases genotoxicity. Data are expressed as the average percent of metaphase with damage and total aberrations in 100 metaphases. The effect for S9 increased with concentration ($p = 0.0005$ for interaction based on percent damage and $p = 0.0003$ for interaction based on total damage). The effect for concentration without S9-mediated metabolism was significant for both percent damage ($p = 0.002$) and for total damage ($p = 0.011$). When evaluated in a multivariate regression and at a concentration of 0.05%, the effect for S9 was significant for both percent damage and total damage ($p < 0.0001$). Data represent 3 experiments ± the standard error of the mean. 0.1% 9500 with and without S9 was not done for the third experiment because at these concentrations not enough metaphases could be obtained due to cell cycle arrest. Asterisk (*) indicates doses that were significantly different from control ($p < 0.05$). Symbol (†) indicates that 9527 was significantly different from 9527 + S9 ($p < 0.05$). Symbol (‡) indicates that in one experiment only 88 could be scored. Symbol (§) indicates that in one experiment only 54 metaphases could be scored respectively.

Our data showed that Corexit 9527 induced an increase in metaphases with chromosome damage and an increase in the total numbers of aberrations in a concentration-dependent manner in sperm whale skin cells. If genotoxicity occurs during essential stages of reproduction or embryogenesis it could cause loss of the offspring or affect individual calf development (El-Makawy et al., 2006; Keshava and Ong, 1999; Nayak et al., 1989). If these outcomes were to affect the ability of an affected individual to survive or reproduce successfully then there could be detrimental effects to the population which is small in number and endangered.

Our genotoxicity results differ from the only other previous report to consider the genotoxic effects of dispersants in mammals. Specifically, the other study reported that, in Fischer 344 rats, a 5 week exposure to Corexit 9527 did not induce hepatic DNA adducts (George et al., 2001). Such an outcome is not inconsistent with our findings, it is simply different. DNA adducts, while a lesion on the DNA, and a genotoxic event, are not necessarily related to chromosomal aberrations. In other words, while an adduct may lead to a chromosome aberration, there are other mechanisms to cause aberrations. Thus, it is reasonable for a chemical mixture like Corexit

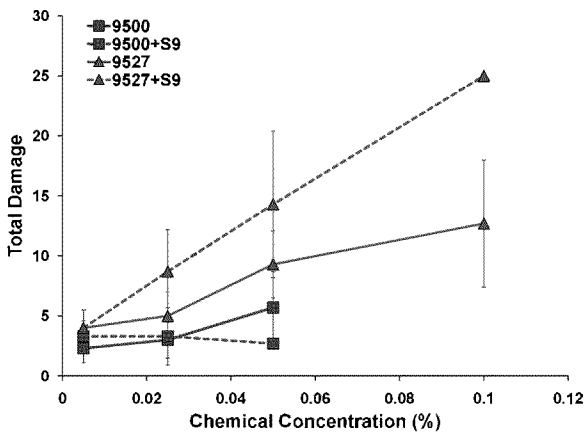


Fig. 6. Corexit 9527 induces more total chromosome damage than Corexit 9500. This figure shows the comparison of the total chromosome damage induced by Corexit 9500 and 9527 with and without S9 fractions after a 24 h exposure. Based on a multiple regression model, there was a significant 3-way interaction involving dispersant, concentration and S9 ($p = 0.023$). When evaluated at a concentration of 0.05 percent, Corexit 9527 was significantly more genotoxic than 9500 with S9 fractions ($p < 0.001$) but not without S9 fractions ($p = 0.33$). Data represent the aberrations in 100 metaphases shown in Figs. 4 and 5 minus their respective negative control levels.

9527 to induce aberrations and not induce adducts. By contrast, Corexit 9500 was only genotoxic at the highest dose 0.05%. At this dose we were unable to score 100 metaphases due to cell cycle arrest for each experiment, so it is unclear if there is a genotoxic effect or another cellular process occurring to arrest the cells. We could not find any literature regarding the genotoxicity of Corexit 9500.

We also found that both Corexit compounds were cytotoxic to sperm whale cells. Extensive cytotoxicity can lead to fibrosis and impair organ function. There are no published reports of Corexit cytotoxicity in whale cells, but our Corexit 9500 cytotoxicity results are consistent with other studies of Corexit 9500 in human cells. Specifically, Corexit cytotoxicity has only been measured in three other studies (Bandele et al., 2012; Shi et al., 2013; Zheng et al., 2014). One study considered bronchial airway cells (BEAS-2B) and used the MTT assay to determine cell viability (Shi et al., 2013). They found Corexit 9500 doses of 0.02 and 0.03% (reported in the study as 200 and 300 ppm) induced 50% and 90% cell loss. These outcomes are similar to our findings, using a clonogenic assay, that 0.025% Corexit 9500 induced 67% cell survival.

The second study measured Corexit 9500 cytotoxicity in human HepG2 hepatocytes using Hoechst 33258 fluorescence (Bandele et al., 2012). In that system, Corexit 9500 doses of 0.02 and 0.03% (inferred from the figure presenting the data) resulted in relative cell viability of 80 and 50%, respectively. Our finding that Corexit 9500 induced 67% cell survival fits right in between those previous outcomes.

The third study used the MTT assay to determine cell viability in 5 different established mammalian cell lines exposed to Corexit 9500, 1 mouse, 1 rat and 3 human cell lines. After being treated with 0.02% Corexit 9500 for 48 h they found a range of about 35–80% cell viability. These data are consistent with the 67% cell survival in sperm whale skin cells that we reported.

Our Corexit 9527 cytotoxicity data was similar to one, but differed from another of these two human cell studies. We found 0.025% Corexit 9527 was not particularly cytotoxic, resulting in 79% relative cell survival. Similarly, 0.02 and 0.03% Corexit 9527 induced 90 and 40% relative cell viability in human HepG2/C3A cells. However, in BEAS-2B cells, 0.02 and 0.03% Corexit 9527 resulted in no cell survival. The underlying explanation for why the sperm whale cells were more resistant then BEAS-2B cells to Corexit 9527 is uncertain, especially when the results for 9500 were similar. The most likely explanation, albeit untested is that 9527 has the additional ingredient of 2-butoxyethanol (Wise and Wise, 2011), thus, the whale cells may be responding differently to this chemical.

One of the concerns raised in both scientific and public circles was to determine which Corexit dispersants was the more toxic of the two. Our data shows the challenge in answering that question in a meaningful way. We found that Corexit 9500 is more cytotoxic than Corexit 9527; however, Corexit 9527 is more genotoxic than 9500. Thus, the answer would be different depending on which outcome is considered. It is curious that 9527 is more genotoxic and less cytotoxic. The underlying mechanisms that explain this difference is uncertain. It might be due to the 2-butoxyethanol in the 9527, or, perhaps, one or more metabolite of 2-butoxyethanol inducing chromosome aberrations while inhibiting cell death pathways. However, studies in rodent and human cells show that 2-butoxyethanol does not induce chromosomal aberrations specifically, and is generally negative in other genotoxic assays (Elliott and Ashby, 1997; NTP, 2000). Of course, it is possible that whale cells may simply respond differently to 2-butoxyethanol than rodent and human cells. Alternatively, it may represent some unanticipated interaction of 2-butoxyehthanol with another Corexit ingredient.

Of course an important, but difficult to address question is to determine how our laboratory exposures relate to actual exposures in the Gulf. There is no known accurate method to measure the amount of whale exposure to dispersants. In the Gulf of Mexico Deepwater Horizon oil spill a final ratio of about 1:63 dispersant to oil was used, i.e. a final concentration of about 1.6% (calculated based on a total applied dispersant amount of approximately 8,000,000 L, reported in Kujawinski et al., 2011 and a total released crude oil amount of 500,000,000 L of crude oil data from Crone and Tolstoy as cited in Joung and Shiller, 2013). Corexit dispersants were sprayed aerially and injected at depth. While some whales may have avoided any exposure, given the locations of the oil and the spraying and the whales, it is highly likely some whales were indeed exposed to dispersants. Thus, the spectrum of dispersant concentrations the Gulf whales might have encountered would have ranged from very high (i.e. 100%) if the whale was directly exposed to the dispersant spray or stream as it entered the gulf; to moderate (i.e. 1–50%) if the whale was exposed as the dispersant became mixed with oil and water; to something much lower (i.e. <0.1%) if the whale was exposed after the dispersant mixture dispersed through the water column or food sources. Given these scenarios and the final ration of dispersant applied, our doses of 0.005, 0.025, 0.05 and 0.1% certainly seem plausible.

In sum, our data show both Corexit 9500 and 9527 are cytotoxic and Corexit 9527 is genotoxic to sperm whale skin cells. Recent reports show that cetaceans in the Gulf of Mexico are suffering from reproductive, respiratory and other health issues in the aftermath of this crisis (Schwacke et al., 2014). Given the DNA damaging potential of the chemicals used in the crisis, care should be taken to monitor the populations for further long term health effects.

Acknowledgements

We would like to thank Louis Falank, Jr. for technical support, Shouping Huang for administrative support and Christy Gianios, Jr. for information technology support. We would also like to thank David Giddings from Nalco for the dispersants. Marine mammal cell line development and use by the Wise Laboratory for Environmental and Genetic Toxicology is performed under NMFS Permit # 16305-00.

This work was supported by the Prince William Sound Regional Citizens Advisory Council (PWSRCAC) and the Maine Center for Toxicology and Environmental Health [955.12.02].

This paper was also developed under GRO Fellowship Assistance Agreement No. [MA-91739301-0] awarded by the U.S. Environmental Protection Agency (EPA). It has not been formally reviewed by EPA. The views expressed in this paper are solely those of the authors, and EPA does not endorse any products or commercial services mentioned in this paper.

References

Bandele, O.J., Santillo, M.F., Ferguson, M., Wiesenfeld, P.L., 2012. In vitro toxicity screening of chemical mixtures using HepG2/C3A cells. Food Chem. Toxicol. 50 (5), 1653, http://dx.doi.org/10.1016/j.fct.2012.02.016 .

El-Makawy, A., Radwan, H.A., Ghaly, I.S., El-Raouf, A.A., 2006. Genotoxical, teratological and biochemical effects of anthelmintic drug oxfendazole Maximum Residue Limit (MRL) in male and female mice. Reprod. Nutr. Dev. 46, 139–156.

Elliott, B.M., Ashby, J., 1997. Review of the genotoxicity of 2-butoxyethanol. Mutat. Res. Rev. Mutat. Res. 387, 89–96.

George, S.E., Nelson, G.M., Kohan, M.J., Warren, S.H., Eischen, B.T., Brooks, L.R., 2001. Oral treatment of Fischer 344 rats with weathered crude oil and a dispersant influences intestinal metabolism and microbiota. J.Toxicol. Environ. Health, Part A 63 (4), 297–316, PubMed PMID: 11437062.

Joung, D., Shiller, A.M., 2013. Trace element distributions in the water column near the deepwater horizon well blowout. Environ. Sci. Technol. 47 (5), 2161–2168.

Keshava, N., Ong, T., 1999. Occupational exposure to genotoxic agents. Mutat. Res., Rev. Mutat. Res. 437, 175–194.

Kujawinski, E.B., Kido Soule, M.C., Valentine, D.L., Boysen, A.K., Longnecker, K., Redmond, M.C., 2011. Fate of dispersants associated with the deepwater horizon oil spill. Environ. Sci. Technol. 45 (4), 1298–13006.

Nayak, B.N., Ray, M., Persaud, T.V., Nigli, M., 1989. Relationship of embrytoxicity to genotoxicity of lead nitrate in mice. Exp. Pathol. 36 (2), 65–73.

NTP (National Toxicology Program), 2000. Toxicology and Carcinogenesis Studies of 2-Butoxyethanol (CAS NO. 111-76-2) in F344/N Rats and B6C3F1 Mice (Inhalation Studies). NTP Technical Report. U.S. Department of Health and Human Sciences. NTP TR 484.

Schwacke, L.H., Smith, C.R., Townsend, F.I., Wells, R.S., Hart, L.B., Balmer, B.C., Collier, T.K., De Guise, S., Fry, M.M., Guillette Jr., L.J., Lamb, S.V., Lane, S.M., McFee, W.E., Place, N.J., Tumlin, M.C., Ylitalo, G.M., Zolman, E.S., Rowles, T.K., 2014. Health of common bottlenose dolphins (Tursiops truncatus) in Barataria Bay, Louisiana following the deepwater horizon oil spill. Environ. Sci. Technol. 48 (1), 93–103.

Shi, Y., Roy-Engel, A.M., Wang, H., 2013. Effects of corexit dispersants on cytotoxicity parameters in a cultured human bronchial airway cells, BEAS-2B. J. Toxicol. Environ. Health Part A 76 (13), 827–835.

Waring, G.T., Josephson, E., Maze-Foley, K., Rosel, P.E., 2009. "U.S. Atlantic and Gulf of Mexico marine mammal stock assessments. (NOAA Tech Memo NMFS NE 213, 2009; http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2009whbr-gmxn.pdf).

Waring, G.T., Josephson, E., Maze-Foley, K., Rosel, P.E., 2010. "U.S. Atlantic and Gulf of Mexico marine mammal stock assessments. (NOAA Tech Memo NMFS NE 219, 2011; http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2010whsp-gmxn.pdf).

Warren, B., 2010. First dead whale found in Gulf since BP rig explosion and oil spill. The Times. Picayune. June 2010. http://www.nola.com/news/gulf-oil-spill/index.ssf/2010/06/first_dead_whale_found_in_gulf.html (accessed January, 2014).

Wise, J., Wise Sr., J.P., 2011. A review of the toxicity of chemical dispersants. Rev. Environ. Health. 26 (4), 281–300, Review.

Wise, J.P., Wise, S.S., LaCerte, C., Wise, J.P., Aboueissa, A., 2011. The genotoxicity of particulate and soluble chromate in sperm whale (Physeter macrocephalus) skin fibroblasts. Environ. Mol. Mutagen. 52 (1), 43–49.

Zheng, M., Ahuja, M., Bhattacharya, D., Clement, T.P., Hayworth, J.S., Dhanasekaran, M., 2014. Evaluation of differential cytotoxic effects of the oil spill dispersant Corexit 9500. Life Sci. 95 (2), 108.