GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Interim Remedial Measure
Pre-Design Investigation Work Plan

Fulton Municipal Works Former Manufactured Gas Plant Site

Brooklyn, New York
NYSDEC AOC Index No. A2-0552-0606
Site No. 224051

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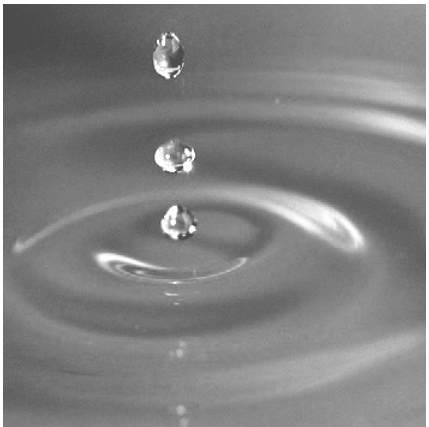

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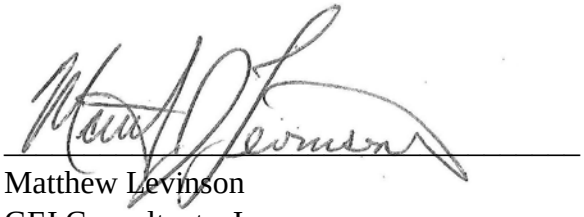
Professional Engineer's Certification

The undersigned on behalf of National Grid and GEI Consultants, Inc. certifies: that I am currently a [NYS registered professional engineer or Qualified Environmental Professional as defined in 6 NYCRR Part 375] and that this Report [Final IRM Pre-Design Investigation Work Plan] was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).



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Abbreviations and Acronyms

AWQS	Ambient Water Quality Standards
AOC	Administrative Order on Consent
BASE	Building Assessment and Survey Evaluation
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BUG	The Brooklyn Union Gas Company
CAMP	Community Air-Monitoring Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CPT	Cone Penetration Tests
CSO	Combined Sewer Overflow
DER-10	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
FHWA	Federal Highway Administration
FS	Feasibility Study
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
ID	Inner Diameter
IDW	Investigation-Derived Waste
IRM	Interim Remedial Measure
KeySpan	KeySpan Corporation
MGP	Manufactured Gas Plant
NAPL	Non-Aqueous Phase Liquid
NAVD	North American Vertical Datum
NPL	National Priorities List
NYC	New York City
NYCDOB	New York City Department of Buildings
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDI	Pre-Design Investigation
PDI WP	Pre-Design Investigation Work Plan
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objectives
RCNY	Rules of the City of New York
RI	Remedial Investigation

ROW	Right of Way
SC	Site Characterization
SCG	Standards, Criteria and Guidance
SCO	Soil Cleanup Objective
SCOPGQ	Soil Cleanup Objective to Protect Groundwater Quality
SPTs	Stand Penetration Tests
SVI	Soil Vapor Intrusion
SVOC	Semivolatile Organic Compound
µg/L	micrograms per liter
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Executive Summary

On behalf of National Grid, GEI Consultants, Inc. (GEI) has prepared this Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan for the Fulton Municipal Works Former Manufactured Gas Plant (MGP) site (the Site).

In a letter dated January 18, 2012, the New York State Department of Environmental Conservation (NYSDEC) requested that National Grid complete an IRM to prevent potentially mobile MGP-related material from migrating into the Gowanus Canal. The NYSDEC recommended that the IRM consist of the installation of a subsurface barrier and dense non-aqueous phase liquid (DNAPL) collection system.

The Site is covered under an Order on Consent and Administrative Settlement (AOC) #A2-0552-0606, which was entered into by KeySpan Corporation, the predecessor to National Grid, and the NYSDEC.

IRM Summary

The goal of this IRM is to prevent, to the extent practical, potentially mobile MGP-related source material (from the Site) from migrating through the subsurface and into the Gowanus Canal. The main components of the IRM are a subsurface barrier wall and support system with DNAPL recovery behind the barrier, as appropriate.

Scope of Work

The scope of work for the Final IRM Pre-Design Investigation (PDI) includes:

- Environmental and Geotechnical Investigation – Enhanced delineation of the extent of MGP tar along the wall alignment and acquisition of geotechnical information for the design of the barrier wall and support system
- Development of a site-specific Groundwater Model – The existing Gowanus Canal groundwater model will be refined with information collected during the PDI; potential effects of the impervious barrier wall on groundwater hydraulics will be evaluated
- Background Noise and Vibration Investigation – A site survey will be conducted to document background noise and vibration levels, and evaluate potential mitigation measures that may be needed during construction activities
- Utility Survey and Subsurface Infrastructure Investigation – Utilities and other subsurface structures in the IRM area will be documented for potential physical conflicts with IRM design components

- Evaluation of Adjacent Buildings, Bulkheads, and Foundations– A survey will be performed to evaluate the surrounding buildings with respect to IRM activities and their potential to interfere with building foundations and/or other structural components
- DNAPL Delineation for Future Recovery – The potential for DNAPL Recovery will be evaluated as a part of the overall IRM. Information collected during the PDI will help determine the feasibility and location of a recovery system

Schedule

The implementation of the PDI is dependent upon private property access. We believe that the entire boring program can be completed in 45 field days, in the summer of 2012, if access agreements are secured. The adjacent building evaluations and utility survey can be completed within the same general timeframe.

1. Introduction

On behalf of National Grid, GEI Consultants, Inc. (GEI) has prepared this Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan at the Fulton Municipal Works Former Manufactured Gas Plant (MGP) site (the Site). The Site is covered under an Order on Consent and Administrative Settlement (AOC) #A2-0552-0606, which was entered into by KeySpan Corporation (KeySpan), the predecessor to National Grid, and the New York State Department of Environmental Conservation (NYSDEC) in 2007. National Grid has conducted a Remedial Investigation (RI) at the Site. A Draft RI Report was submitted to the NYSDEC in December 2011. This Pre-Design Investigation Work Plan (PDI WP) has been developed concurrently with the finalization of the RI Report.

1.1 Work Plan Organization

This work plan has been prepared in general accordance with the NYSDEC Division of Environmental Remediation (*DER-10) Technical Guidance for Site Investigation and Remediation* (DER-10), dated May 3, 2010. The work plan has been organized as follows:

- Section 1 Introduction
- Section 2 Nature and Extent of Contamination
- Section 3 IRM Goals and Objectives
- Section 4 PDI Scope of Work
- Section 5 Community and Environmental Response Plan
- Section 6 Restoration Plan

1.2 Site Description and History

The Fulton Municipal Works Former MGP Site is located in the Gowanus neighborhood of Brooklyn, New York. The Site location is shown in **Figure 1**. The Fulton MGP operated from circa 1879 to 1929. It began as the Fulton Municipal Gas Company and merged with six other MGP facilities to form the Brooklyn Union Gas Company (BUG), which incorporated in 1895. BUG operated the MGP until its decommissioning in 1929. Following decommissioning, BUG sold the properties. The former facility currently consists of five separate property parcels (herein designated Parcels I through V). Three other off-site parcels (Parcels VI through VIII) have been identified in the RI Report. Parcel identification and historical MGP structures are shown in **Figure 2**. The Site and adjacent areas are currently zoned for manufacturing use.

Parcel I is located at 270 Nevins Street (Block 425, Lot 1). During manufactured gas production Parcel I housed MGP production facilities including an oil/naphtha tank, generator/retort house,

condenser/blower house, coal shed, engine house, gasoline house, and generators. Recent property use included warehouse storage which is currently being converted into a movie studio.

Parcel II is located at 225 Nevins Street (Block 419, Lot 1). During manufactured gas production Parcel II housed production facilities including three oil tanks, one hydrogen tank, six gas oil naphtha tanks, nine unknown tanks, a paint shop, blacksmith shop, carpenter shop, pipe shop, garage, and several sheds. The property is currently Thomas Greene Park and includes a playground, swimming pool, wading pool, and handball courts.

Parcel III is located at 537 Sackett Street (Block 426, Lot 1). During manufactured gas production Parcel III housed production facilities including a gas holding tank, purifying houses, oxidizing sheds, coal bin, scrubbers, meter house, governors house, and offices. The property is currently used as a textbook warehouse and parking lot.

Parcel IV is located at 560 Degraw Street (Block 426, Lot 27). During manufactured gas production Parcel IV housed production facilities including a gas holding tank and a coal shed. The property is currently used for storage of roll-off bins, truck maintenance equipment, and construction materials.

Parcel V is located at 191 3rd Street aka 575 Degraw Street (Block 420, Lot 1). During manufactured gas production Parcel V housed facilities including a gas holding tank (storage only), water tank, engines/blowers, and coal shed. The property is currently used as a rock climbing gym and warehouse. National Grid, in the Draft RI report, has requested that NYSDEC separate Parcel V from the rest of the Site; impacts there are minimal and not MGP-related, and remedial measures do not appear necessary.

Three additional parcels were identified in the Draft RI Report that were not part or the former MGP footprint.

- Parcel VI located at 242 Nevins Street (Block 418, Lot1). The property is currently used for truck repair with a small office and truck parking.
- Parcel VII located at 228 Nevins Street (Block 411, Lot 24). The property is currently used for truck repair.
- Parcel VIII located at 479 Degraw Street (Block 417, Lot 21). The property is currently used for movie equipment rental and parking.

The Site is located adjacent to the Gowanus Canal. The approximately one and a half mile canal was created in the mid-1800s by channelizing Gowanus Creek and filling the adjacent wetlands complex from the bay to Butler Street for the development of South Brooklyn. The canal and surrounding area have supported industrial and commercial activities for approximately 150 years.

1.2.1 Site Geology

According to published information, the Fulton Municipal Works Former MGP is underlain by the following geologic materials, presented in stratigraphic order (deepest to shallowest):

- Fordham Gneiss
- Gardiners Clay
- Jameco Gravel
- Glacial outwash sands with discontinuous silt and till lenses
- Alluvial/Marsh deposits
- Fill

The descriptions below define the geologic layers and where each was found during the RI.

Bedrock encountered beneath the Site is the Fordham Gneiss, which is described as a metamorphosed, medium- to coarse-grained igneous rock unit of Precambrian Age (Brock and Brock, 2001). Sandy lean clay with the same color characteristics and relocked layers as the Fordham Gneiss, likely weathered bedrock was encountered at a depth of approximately 151 feet below ground surface (bgs) [elevation -142 feet]. Bedrock was observed at a depth of 159 feet bgs [approximately elevation -150 feet].

Within Kings County, bedrock is generally overlain by lagoonal marine deposits (Gardiners Clay) (Cartwright, 2002). The Gardiners Clay was not encountered during the RI. However, a 1.5-foot-thick layer of grayish-brown silty-sand that contained approximately 50 percent shells was encountered at one boring at a depth consistent with the Gardiners Clay unit observed during investigations at the Citizens Gas Works MGP, approximately 0.5 mile to the south.

The Jameco Gravel consists of dark coarse sand and gravel with cobbles and boulders ranging in thickness from absent in some locations to approximately 200 feet thick in Queens County (Cartwright, 2002). The Jameco Gravel was encountered from approximately 124 feet to 160 feet bgs [approximately elevation -115.3 to -153 feet].

Glacial deposits in the vicinity of the Site consist of poorly sorted mixtures of clay, silt, sand, gravel, and boulders, and glacio-fluvial outwash deposits consisting of moderately to well-sorted sands and gravels (Cartwright, 2002). The glacial outwash unit generally extended to the top of the Jameco Gravel, which was present between approximately 125 and 145 feet bgs. Isolated layers of glacial till are present within the glacial outwash. The glacial till represents a brown to red-brown, poorly-sorted unit consisting of silt and fine to coarse sand. Layers of glacial till were not continuous and were primarily encountered to the northeast of the Site and to the west of the Gowanus Canal. The layers were encountered as deep as 122 feet. The thickness of the glacial till ranged from 0.4 to 34 feet.

Holocene age marsh deposits consist of sand, silt, and organic material along stream channels and marshes (Busciolano, 2002). The marsh deposits were encountered throughout the investigation area with the exception of locations near 3rd Avenue and within Parcel I. The marsh deposits were found at the approximate elevation (approximately -11 feet) of the anticipated bottom of the former Gowanus Creek. This elevation is consistent with a former active stream depositional system and an associated lower energy marsh environment. The thickness of the marsh deposits ranged from 0.25 feet to 17 feet. The deposits were observed as shallow as 4 feet bgs [elevation 1.79 feet] and extended to a maximum depth of 39.5 feet bgs [elevation -20.08 feet].

Fill is defined as soil or rock used to raise the surface of the ground (New York State Geological Survey, 2011). Fill was encountered throughout the Site and primarily consisted of loose, non-cohesive sand and silty-sand with some gravel mixed with brick, concrete, coal fragments, wood, ash, metal fragments, and debris. Fill ranged from approximately 5-feet to 30-feet thick.

1.2.2 Site Hydrogeology

Two regional groundwater aquifers are present in the vicinity of the Site, the shallower Upper Glacial Aquifer and the deeper Jameco Aquifer. Tidal effects were observed in both the Upper Glacial Aquifer and the Jameco Aquifer during the RI. The Upper Glacial Aquifer has been subdivided into shallow, intermediate, and deep groundwater zones.

The shallow, water table zone resides in fill and alluvial/marsh deposits. Elevations of well screen intervals within the shallow zone ranged between approximately 11 to –13 feet. Water table elevations ranged from -1.76 feet to 8.03 feet North American Vertical Datum (NAVD) 1988 during a RI gauging event conducted on the May 19, 2011. Tidal fluctuations ranged from no change to 1.66 feet, with the greatest tidal fluctuations generally observed in monitoring wells located adjacent to the Gowanus Canal bulkhead. The shallow groundwater flows toward the canal. On the east side of the canal, groundwater generally flows westward while shallow groundwater on the west side of the canal flows to the east and south. Overall, the average hydraulic gradient of the shallow groundwater aquifer ranged from 0.0017 foot/foot to 0.024 foot/foot.

The intermediate groundwater zone resides in glacial outwash deposits. The well screens were installed approximately 5-feet below the elevation of the accumulated sediment/native materials interface within the adjacent Gowanus Canal. Elevations of screen intervals ranged from -17 to -36 feet. Intermediate groundwater elevations ranged from 0.87 to 3.06 feet during the May 19, 2011 RI gauging event. Under high tide conditions groundwater in the intermediate zone generally flows toward the Gowanus Canal and converges on a southerly flow path in the vicinity of Parcel I. At low tide conditions, groundwater flow is more southeasterly. Tidal fluctuations within the intermediate zone of the Upper Glacial Aquifer during the May 19, 2011 RI gauging event ranged from 0.04 to 1.03 feet. The average hydraulic gradient of the

intermediate groundwater zone ranged between 0.0018 foot/foot to 0.0020 foot/foot. Upward and downward head potentials were measured. The upward head potentials between the shallow and intermediate zones ranged from 0.001 to 0.097 foot/foot and the downward head potentials ranged from -0.009 to -0.151 foot/foot. The downward vertical head potentials are a result of the meadow mat materials creating a mounded water condition in the shallow zone at Parcel II and potentially in other areas where the meadow mat materials are present.

The deep groundwater zone consists of glacial outwash deposits. Well screens were installed approximately 5 feet above the anticipated elevation of Gardiners Clay. Elevations of screen intervals ranged from -103 to -110 feet. Deep groundwater zone elevations ranged from 2.51 to 3.46 feet during the May 19, 2011 RI gauging event. Groundwater flow direction in the deep groundwater zone of the Upper Glacial Aquifer cannot be determined because only two deep wells were installed within the study area; however, flow data from nearby sites and the regional groundwater flow direction suggest that the flow in the deep zone should be southwesterly toward Gowanus Bay. There is an upward head potential between the intermediate and deep zones ranging from 0.009 to 0.011 foot/foot.

The Jameco Aquifer zone consists of Jameco gravel. Well screens were installed within the top 5 feet of the Jameco Gravel layer. Elevations of screen intervals ranged from -133 to -145 feet. Groundwater elevations within this zone ranged from 3.88 to 3.90 feet during the May 19, 2011 RI gauging event with tidal fluctuations ranging from 0.02 to 0.37 feet. Groundwater flow directions could not be directly determined because only two wells were installed in the Jameco Aquifer; however, flow direction is expected to be southerly based upon regional groundwater flow information. There is an upward head potential between the deep zone of the Upper Glacial Aquifer and the Jameco Aquifer ranging from 0.042 to 0.08 foot/foot.

1.3 Project Organizational Structure and Responsibility

National Grid will coordinate with the NYSDEC, New York State Department of Health (NYSDOH), and local regulatory agencies to conduct the proposed PDI activities. Approval of this work plan by NYSDEC will be obtained prior to commencement of any PDI activities. We expect that NYSDEC and/or NYSDOH will have representatives on Site periodically during the PDI activities.

Data collected during the PDI activities will be summarized and presented in a draft IRM Work Plan, which will also evaluate wall concepts, recommend a wall system, and outline the design steps. The draft IRM Work Plan will be submitted to the NYSDEC and we anticipate subsequently meeting with the NYSDEC to discuss the plan and identify any modifications that will facilitate approval.

The following are key personnel or agencies involved with the IRM program:

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2. Nature and Extent of Contamination

A summary of findings and the current conceptual site model is provided as follows. These sections focus on soil, groundwater, and air impacts on or adjacent to the Site.

2.1 Previous Site Investigations

Previous environmental investigations have been conducted at and adjacent to the Site. The findings of these investigations are summarized below.

2.1.1 NYSDEC Site Characterization-September 2007

The NYSDEC conducted a Site Characterization (SC) of the Fulton former MGP in 2007. The findings were presented in the September 2007 report: *Site Characterization Report, Fulton Former Manufactured Gas Plant, Brooklyn, Kings County, New York, Site No. 2-24-051*.

The SC included the installation of 29 soil borings (KSF-SB-1 through KSF-SB-29) and seven monitoring wells (MW-1 through MW-7) within Thomas Greene Playground and public street right of ways (ROWs) and sidewalks of Degraw, Sackett and Nevins Streets.

The NYSDEC collected thirteen soil samples for volatile organic compound (VOC) and semivolatile organic compound (SVOC) analysis. Groundwater analytical samples were collected from the seven monitoring wells. Concentrations of VOCs and SVOCs exceeded the established soil standards and New York State Ambient Water Quality Standards, Criteria and Guidance Values (NYS AWQSs).

Based on the findings of the SC investigation, the NYSDEC recommended that a RI/Feasibility Study (FS) be completed to determine the full nature and extent of contamination at the Fulton former MGP.

2.1.2 Gowanus Canal Investigations

2.1.2.1 KeySpan Gowanus Canal Investigation 2009

On behalf of KeySpan (National Grid), GEI conducted an investigation to assess the environmental conditions within the Gowanus Canal. National Grid undertook this work in response to a NYSDEC AOC (Index # A2-0523-0705) [Settlement Agreement]. The investigation was initiated pertaining to another site; however, data were gathered adjacent to the Fulton Site during the Canal investigation. Findings adjacent to the former Fulton MGP from the Canal investigation were utilized in evaluating the nature and extent of contamination.

The investigation was also performed to evaluate potential impacts to the Gowanus Canal from the numerous former industries that lined the canal, as well as, current and former urban discharges to the canal. As a result, GEI evaluated sediment, surface water, and outfall discharges along the entire length of the canal. GEI also reviewed and interpreted biological data collected on behalf of the United States Army Corps of Engineers (USACE).

The findings of the Gowanus Canal Investigation are provided in the following NYSDEC-approved reports:

- Gowanus Canal Investigation Executive Summary Report, AOC Index No. A2-0523-0705, GEI Consultants, Inc., December 2009.
- Remedial Investigation Technical Report, Gowanus Canal, Brooklyn, New York, AOC Index No. A2-0523-0705, GEI Consultants, Inc., December 2009.
- Gowanus Canal Ecological Investigation Report, Gowanus Canal, Brooklyn, New York, GEI Consultants, Inc. December 2009.
- Environmental Forensic Investigation Report, Gowanus Canal, Brooklyn, New York, NewFields Environmental Forensics Practice, LLC, March 2007.

GEI's investigation revealed the following:

- The upper 3 feet of sediment are dominated by fine-grained organic-rich accumulations of sewage and combined sewer overflow (CSO) outfall materials. These materials are impacted by the presence of multiple chemical stressors (pesticides, polychlorinated biphenyls (PCBs), metals, polycyclic aromatic hydrocarbons (PAHs), and benzene, toluene, ethylbenzene, xylene (BTEX).
- Physical observations and environmental forensic analyses indicate that the hydrocarbons (including PAHs) in the upper 3 feet of sediments are largely derived from petroleum sources.
- Canal sediments were toxic to sediment dwelling organisms in controlled laboratory exposures, with sewage-related contaminants, including ammonia, being the drivers of the toxicity.
- Ecotoxicological analyses indicated the current canal benthic invertebrate communities are inherently impoverished due to the chemical and physical stressors related to CSO discharges and other sources. As a result, the benthic communities consist of organic pollution tolerant organisms, the distribution of which seems to be driven by physical habitat variability.
- Isotopic age dating of the sediments established that the upper 3 feet of sediments were deposited in the 1960s or more recently, well after the Fulton MGP Site ceased operating.
- Tar was primarily encountered below the accumulated sewage/sediment in the native coarse-grained sediment materials.

- Tar was encountered at shallow elevations in soil borings GC-GP-05 and GC-GP-07 along the western bulkhead of the Gowanus Canal across from the Site, and at deeper elevations along the eastern bulkhead of the Gowanus Canal. Concentrations of BTEX, PAHs, pesticides, and metals were detected above applicable New York State Standards. Gowanus Canal shallow sediment and surface water quality is adversely impacted by multiple chemical and physical stressors that are largely unrelated to the former MGPs.

2.1.2.2 United States Environmental Protection Agency (USEPA) Gowanus Canal Investigation 2011

On March 10, 2010, the USEPA added the Gowanus Canal to the Superfund National Priorities List (NPL). National Grid entered into an AOC (Comprehensive Environmental Response, Compensation and Liability Act [CERCLA]-02-2010-2009) with USEPA for the Canal on April 29, 2010. The City of New York also entered into an AOC (CERCLA-02-2010-2011) for the Gowanus Canal Site with USEPA.

The findings of the USEPA Gowanus Canal RI are provided in the January 2011 *Draft Gowanus Canal Remedial Investigation Report, Volume I prepared by HDR, et al. dated January 2011*.

The USEPA Gowanus Canal RI concluded:

- The top 6 inches of surface sediments contained PAHs, PCBs, and metal compounds (barium, cadmium, chromium, copper, lead, mercury, nickel and silver).
- Deeper accumulated sediments included elevated concentrations of BTEX, SVOCs, pesticides, PCBs and metals.
- NAPL is primarily encountered in native sediments. USEPA suggested the NAPL appears to be associated with tar. However, the USEPA did not conduct chemical forensic analyses to determine the origin of the observed NAPL; their physical descriptions broadly characterized NAPL as “hydrocarbon-like”.
- The NAPL contained high concentrations BTEX and PAHs. The report did not reference other potential sources of NAPL (e.g. bulk petroleum storage) along the Canal.
- Primary sources of contamination to the Gowanus Canal include:
    - Direct discharges from historical industrial activities (including CSOs)
    - On-going CSO and stormwater discharges
    - Non-CSO Outfall discharges
    - Discharges from contaminated sites.

2.2 Remedial Investigation

GEI executed a NYSDEC-approved RI at and adjacent to the Fulton Municipal Works Former MGP Site from May 2008 to May 2011. RI sample locations and results are presented in the December 2011, Draft RI Report, which is currently being finalized. The Draft Report focused on soil, groundwater, and air impacts on or adjacent to the Site. RI boring locations are shown in **Figure 2**. All soil and groundwater samples were analyzed for VOCs, SVOCs, TAL metals, herbicides, pesticides, PCBs and total cyanide. A summary of the Draft RI findings are presented in the sections below.

2.2.1 Soil

Surface Soil

Twelve surface soil samples were collected from the top 2 inches of soil with the exception of FW-SS-01 which was collected from 0.5 to 1 foot bgs. Nine surface soils samples (FW-SS-01 through FW-SS-09) were collected from unpaved areas of Parcel I, Parcel II, Parcel IV, Parcel VI, and from exposed soils in tree planters within the Degraw and Sackett Street ROWs, as part of the RI. Three additional surface soil samples (FW-DSS-01 through DSS-03) were collected to characterize soils within the temporary investigation-derived waste (IDW) storage area located in Parcel VI. SVOCs, pesticides, PCBs, and metals were detected in most surface soils above the Unrestricted Soil Cleanup Objectives (SCOs). Concentrations of PAHs were detected in half of the samples above the Commercial SCOs.

Subsurface Soil

Eight test pits (FW-TP-02A, FW-TP-02B, and FW-TP-03 through FW-TP-08) were installed to depths of 8 to 13 feet within Parcels II and IV during RI activities. The test pit excavations were completed to evaluate the presence, configuration and contents of former underground gas oil tanks and the former 500,000-gallon oil tank at Parcel II, and the former gasholder at Parcel IV. One grab soil sample was collected from each test pit for laboratory analysis. Visual petroleum and tar impacts were observed within all Parcel II test pits. Visual petroleum impacts including sheen and staining were observed from 3.5 to 12 feet bgs. Visual tar impacts including staining, blebs and globs, coating, and saturation were observed from 11 to 13.2 feet bgs. Concentrations of benzene, PAHs, dibenzofuran, and metals were present in the visually-impacted samples above the Unrestricted SCOs. Concentrations of PAHs, barium, and lead were present in impacted soil samples above the Commercial SCOs. Within the non-visually impacted soils of Parcel IV, metals exceeded Unrestricted SCOs.

One hundred and five soil borings were drilled during the RI to characterize subsurface geology, identify former MGP structures, assess the horizontal and vertical extent of visual impacts, evaluate the chemical impacts in soils, and enable the installation of monitoring wells. In

general, three subsurface soil samples were collected at each boring location. The first subsurface soil sample was collected within the top 5 feet from the sidewall of the hand-cleared boring within fill. The second sample was collected from the deeper boring interval that exhibited the greatest observed occurrence of tar, staining, odors, sheen, and/or PID readings. The third sample was collected from soils below observed impacts or at the completion depth of a boring. Observations and analytical results for RI soil borings are discussed, by parcel, below.

Parcel I

The shallowest observable impacts on and around Parcel I were petroleum odors (diesel like odors) and a sheen at approximately 5 feet bgs. Most petroleum-related observed impacts were found coincident with or near the water table at approximately 8 feet bgs or deeper. Petroleum (diesel)-like odors and staining were observed to as deep as 32 feet bgs [elevation -22.16 feet NAVD88]. With one exception, tar-related soil impacts were observed at depths of 10 feet bgs or greater. Tar sheen and isolated blebs of tar were observed as shallow as 5 feet bgs. The deepest tar-related impacts observed were tar-coated soils at 115 feet bgs. Concentrations of VOCs, PAHs, pesticides, and metals were detected at levels above the Unrestricted Use SCOs. Benzene in one sample and PAH compounds in a number of samples were present at concentrations above the Commercial Use SCOs.

Parcel II

Petroleum odors were observed as shallow as 1 to 5 feet bgs in multiple soil borings. Below 5 feet, soils with staining and sheens that exhibited petroleum-like odors were encountered between approximately 5 and 20 feet bgs [elevation 6.9 and -1.45 feet NAVD88] in multiple soil borings. The shallowest tar-related impacts (tar-like odor and tar-stained soils) were observed starting at 5 feet bgs [elevation 8.78 feet]. Intervals of tar staining and coating were encountered primarily between 20 and 60 feet bgs [elevation -1.73 to -42.35 feet] in most borings. Tar-saturated lenses were observed in one soil boring from 10 to 20 feet bgs. The deepest tar-related impacts in this area were tar-coated soil observed at 105 feet bgs [elevation -91.22 feet]. Concentrations of VOCs, SVOCs, total PCBs, pesticides, and metals were present above the Unrestricted Use SCOs. BTEX, PAHs, and metal concentrations also exceeded the Commercial Use SCOs.

Parcel III

Petroleum odors and staining were encountered between 2 and 10 feet bgs [elevation 6.59 feet and -1.45 feet NAVD88] and between 29.5 and 40 feet bgs [elevation -20.52 and -31.41 feet]. Tar sheen was observed in the top 5 feet of fill and as shallow as 3.7 feet bgs [elevation 7.86 feet NAVD88] within the footprint of the former holder. Within the former holder foundation tar-saturated soils were encountered as shallow as 5 to 11 feet bgs. Lenses of tar, sheen, tar-saturated layers and tar-coated soils were encountered from 5 feet [elevation 6.56 feet NAVD88]

to the bottom of the holder at approximately 18.5 feet bgs [elevation -7.2 feet NAVD88]. Tar impacts were observed as deep as 50 feet bgs [elevation -41.45 feet NAVD88]. NYSDEC noted diesel odors at 4.0 to 6.5 feet bgs in one soil boring location. Concentrations of VOCs, SVOCs, pesticides, PCBs, Chlorinated VOCs and metals were detected at concentrations above the Unrestricted Use SCOs. BTEX, PAHs and metals were detected at concentrations above the Commercial Use SCOs. Chlorinated VOCs, PCBs, and pesticides were detected but are not associated with MGP operations.

Parcel IV

Tar-related impacts ranging from sheen to tar-saturated lenses were observed within the holder foundation between 16.5 feet [elevation -0.55 Feet NAVD88] and at the suspected bottom of the holder foundation at 19 feet bgs [elevation -3.05 feet NAVD88]. BTEX, SVOCs, pesticides, PCBs and metals were present at concentrations that exceeded the Unrestricted Use SCOs. BTEX and PAH compounds were present at concentrations above the Commercial Use SCOs.

Parcel V

Petroleum-like and naphthalene-like odors were observed at 6 feet bgs [elevation 15.76 feet NAVD88] and at 31 feet bgs [elevation -9.79 feet NAVD88] within the footprint of the holder. Petroleum odors were also encountered intermittently between 16.3 feet and 45 feet bgs [elevation 4.59 to -23.79 feet NAVD88]. Concentrations of VOCs, PAHs, 4,4-DDT (pesticide), and metals exceeded Unrestricted Use SCOs. Concentrations of PAHs and metals were present at levels that exceeded the Commercial Use SCOs. These compounds are not associated with MGP operations.

Parcel VI

Petroleum-like odors were encountered from 2.5 to 4.5 feet bgs. Petroleum-stained soils were observed from 4 to 5 feet bgs [elevation 4.3 to 3.3 feet NAVD88]. Tar-like odors and tar-staining was observed at 5 feet bgs. Blebs, globs, and tar-coated soil were encountered between 6.5 feet bgs and 31 feet bgs [elevation 1.8 to -22.7 feet NAVD88]. Tar-saturated soil was observed between 13.5 to 31 feet bgs [elevation -5.2 to -22.67 feet NAVD88]. Deeper, intermittent tar impacts ranging from tar saturation, lenses of tar, tar-coated soils, and sheen were also encountered from 46 feet bgs [elevation -37.67 feet NAVD88] to 105 feet bgs [elevation -96.67 feet NAVD88]. The heaviest tar impacts (inter-bedded lenses of tar saturation and tar-saturated soils were encountered between approximately 32.5 to 50 feet bgs [elevation -25.06 to -42.5 feet NAVD88]. Intervals of tar-saturated soils and soils with inter-bedded lenses of tar saturation were also observed between 70 feet bgs and 98 feet bgs [elevation -61.67 feet to -90.56 feet NAVD88]. The deepest tar impacts were observed at 127.5 feet bgs [elevation -119.96 feet NAVD88]. Concentrations of VOCs, PAHs, pesticides, and metals were detected

above the Unrestricted Use SCOs. BTEX, PAHs, and arsenic were detected at concentrations above the Commercial Use SCOs.

Parcel VII

Petroleum-like odors were observed between 2.7 and 5.0 feet bgs and 24.5 to 29 feet bgs [elevation -17.19 feet to -21.69 feet NAVD88]. Tar-like odors and sheen were observed from 63.2 to 68 feet bgs. VOCs, PAHs, and metals were detected at concentrations that exceeded the Unrestricted Use SCOs. PAHs and arsenic was present above the Commercial Use SCO.

Parcel VIII and West of the Gowanus Canal

The shallowest tar-related impacts (tar coating, staining and sheens) were observed at 25 feet bgs [elevation -20.32 feet NAVD88] and as deep as approximately 107 feet bgs [elevation -102.62 feet NAVD88]. Within this zone, intervals with varying degrees of tar coating, staining, and sheens were encountered. An interval of tar-saturated soil was encountered from approximately 39 to 42 feet bgs [elevation -34.32 to -37.32 feet NAVD88]. Concentrations of BTEX and PAHs exceeded the Unrestricted Use SCOs. BTEX and PAH concentrations also exceeded the Commercial Use SCOs.

2.2.2 Groundwater

Shallow Groundwater Zone - East of Gowanus Canal

Thirty-one monitoring wells and six temporary groundwater points were installed in the shallow groundwater zone (at the water table) east of the Gowanus Canal. Tar and petroleum impacts, including petroleum-like odors and NAPL blebs, were encountered in two monitoring wells (FW-MW-1R and FW-MW-03). These samples were not submitted for laboratory analysis. Concentrations of BTEX ranged from not detected in nine monitoring wells to 770 micrograms per liter (µg/L) in FW-MW-14 located on Parcel V. The highest BTEX concentration likely associated with the former MGP operations was in a groundwater sample collected from well FW-GW-11, located immediately adjacent to the former gas holder foundation in tar-impacted soils on Parcel III. Total PAH concentrations ranged from not detected in six monitoring wells to 11,087 µg/L in KSF-MW-6 located on Parcel II. The highest concentrations of PAHs were detected within or adjacent to the gas production area (Parcel I), and the gas holders and petroleum tanks (Parcels II, III, and IV). Total cyanide concentrations ranged from not detected in multiple samples to 495 µg/L in FW-GW-11 collected adjacent to the former gas purifying houses at Parcel III. Concentrations of VOCs, SVOCs, metals, pesticides and total cyanide were detected above the AWQS.

Shallow Groundwater Zone - West of Gowanus Canal

Six monitoring wells were installed in the shallow groundwater zone west of the Gowanus Canal. Concentrations of BTEX ranged from not detected in four monitoring wells to 8.48 µg/L in GCMW-03S located southwest of the former MGP Site. Total PAH concentrations ranged from not detected in three monitoring wells to 225.3 µg/L in GCMW-34S located to the west of Parcel I. Total cyanide was not detected. Concentrations of methyl tert butyl ether, trichloroethene (TCE), and tetrachloroethene (PCE) were detected above the AWQS.

Intermediate Groundwater Zone - East of Gowanus Canal

Five monitoring wells were installed within the intermediate groundwater zone east of the Gowanus Canal. Concentrations of BTEX ranged from not detected in one monitoring well to 12,690 µg/L in GCMW-02I (Parcel II). Total PAH concentrations ranged from 10.92 µg/L in GCMW-01I (near the top of the canal) to 15,893 µg/L in GCMW32I (Parcel II). Total cyanide concentrations ranged from not detected in three monitoring wells to 22.4 µg/L in GCMW-31I (Parcel VI). Concentrations of VOCs, SVOCs, and Beta-BHC (a pesticide) were detected above the AWQS.

Intermediate Groundwater Zone - West of Gowanus Canal

Six monitoring wells were installed within the intermediate groundwater zone west of the Gowanus Canal. Tar was encountered in FW-MW-22I and was, therefore, not sampled for laboratory analysis. Concentrations of BTEX ranged from not detected in four monitoring wells to 1.57 µg/L in GCMW-34I [west of Parcel I]. Total PAH concentrations ranged from 0.55 µg/L in FW-MW21I located west of Parcel VI to 861.1 µg/L in GC-MW-34 located west of Parcel I. Total cyanide was not detected. Concentrations of VOCs and SVOCs were detected above the AWQS.

Deep Groundwater Zone

Two monitoring wells were screened within the deep groundwater zone. BTEX concentrations ranged from not detected in one monitoring well to 151.3 µg/L in GC-MW30D1 (Parcel I). Total PAH concentration ranged from not detected in one monitoring well to 275.62 µg/L in GC-MW30D1 (Parcel I). Total cyanide was not detected. Concentrations of VOCs and PAHs were detected above the AWQS.

Jameco Aquifer

Two monitoring wells were screened within the Jameco Aquifer. BTEX and total cyanide were not detected. Total PAH concentrations ranged from not detected in one monitoring well to 1.8433 µg/L in GCMW-30D2 (Parcel I). Concentrations of VOCs and PAHs were detected above the AWQS.

2.2.3 Soil Vapor, Indoor Air, and Ambient (Outdoor) Air

Soil vapor was sampled at Parcels I through Parcel V. Soil vapor intrusion (SVI) investigations, including the collection of soil vapor, indoor air, and ambient (outdoor air) samples, were completed for occupied buildings at Parcels I, III and Parcel V.

At this time, there is no background comparison data for soil vapor. In commercial settings, NYSDOH suggests that indoor and outdoor ambient air results should be compared to criteria in *Building Assessment and Survey Evaluation* (BASE), conducted by USEPA in 2001 (NYSDOH, 2006). NYSDOH has established air guideline values for five non-MGP related compounds [TCE, PCE, methylene chloride, PCBs and tetrachlorodibenzo-p-dioxin]. Indoor air samples were compared to EPA BASE Indoor Air Concentrations 90th Percentile and NYSDOH Air Guideline Values. Outdoor air samples were compared to EPA BASE Outdoor Air Concentrations 90th Percentile. The NYSDOH Guidance for Evaluating Soil Vapor Intrusion includes soil vapor/indoor air decision matrices that were developed to address situations where soil vapor may be entering a building. The NYSDOH has developed decision matrices for several compounds including TCE and PCE. Sub-slab vapor and indoor air samples were compared to the NYSDOH decision matrices.

VOCs were detected in sub-slab soil vapor, indoor air, and outdoor air samples at all locations. Concentrations of 2-butanone, toluene, ethyl benzene, xylene, ethanol, acetone, methylene chloride, 1, 2-dichloroethane, p-ethyltoluene, styrene, n-decane and chlorinated solvents (TCE, 1,2-cis dichloroethene, and 1,4-dichlorobenzene) were detected above the 90th percentile BASE study at Parcels III and V. Concentrations of TCE were also detected above the NYSDOH guidelines in Parcel III. PCE concentrations were above the NYSDOH matrix ratio of soil vapor to indoor air concentrations.

2.3 Conceptual Site Model

This section presents a summary of the Draft RI Report conceptual site model designed to focus on model elements most pertinent to the IRM. Tar and petroleum impacts are present beneath the following areas:

- East of and immediately adjacent to the Gowanus Canal (Parcels I, VI, and VII)
- West of the Gowanus Canal (Parcel VIII and surrounding areas)
- Uplands east of Gowanus Canal (Parcel II, III, IV, and V)
- Gowanus Canal.

East of and Immediately Adjacent the Gowanus Canal (Parcels I, VI, and VII)

Adjacent to the eastern bulkhead of the Gowanus Canal, petroleum staining was observed from 4 to 32 feet bgs [elevation 4.3 to -22.16 feet NAVD88] in Parcels I and VI, only.

Tar impacts including sheen, staining, and blebs were encountered as shallow as 5 feet bgs in Parcels I and VI. Sheen was observed from 63.2 to 68 feet bgs in Parcel VII. Staining and coating were observed from 6.5 to 128 feet bgs (elevation 1.8 to -120.96 feet NAVD88) in Parcels I and VI. Inter-bedded lenses of tar saturation and tar saturated soils were observed in Parcel VI from 46 to 105 bgs (elevation -37.67 to -96.67 feet NAVD88). The heaviest areas of

saturation in Parcel VI were observed between 32.5 to 50 feet bgs (elevation -25.06 to -42.5 feet NAVD88). Soil boring FW-SB-42 [Parcel VII] is the northernmost boring within the three parcels adjacent to the eastern canal bulkhead. No visual impacts were observed at this location, suggesting petroleum and tar impacts do not extend to the north side of Parcel VII.

At the southeastern boundary of the RI study area, south of Parcel I, an isolated lens of tar was observed in FW-SB-37 at 53 feet bgs (elevation -41.91 feet NAVD88) and elevated PAH concentrations were observed in FW-SB-38 (60 to 65 feet bgs [elevation -49.89 to -54.89 feet NAVD88]). Generally, soil concentrations of BTEX and total PAHs are significantly reduced, to non-detectable away from the tar sources.

West of the Gowanus Canal (Parcel VIII and adjacent areas)

Tar impacts were only observed in boring locations adjacent (within approximately 50 feet) to the Gowanus Canal. Impacts including sheen, staining, blebs and globs, and coating were observed between 18.1 and 106 feet bgs (elevation -12.77 to -102.12 feet NAVD88). Areas of tar saturation were observed between 20 and 80 feet bgs (elevation -14.67 to -74.67 NAVD88).

FW-SB-50 located at the southeastern boundary of the RI study area did not have any visual impacts.

Uplands East of the Gowanus Canal (Parcels II, III, IV, and V)

Tar saturated soils are present beneath Parcel II next to the former holder and unidentified tanks both in fill above the meadow mat, and in and glacial outwash deposits below the meadow mat (10 to 20 feet bgs). Some tar migrated laterally atop the meadow mat to the northwest. Where the meadow mat is absent, the tar migrated downward through the more permeable glacial outwash. Stained and coated soils were observed as shallow as 5 feet, but primarily between 20 and 60 feet bgs. The deepest tar impacts were encountered at approximately 128 feet.

Tar-related impacts at Parcel III and IV were observed within the vicinity of the former holder foundations.

There are no MGP-related impacts on Parcel V that exceed the Unrestricted Use SCO. Petroleum impacts not related to the MGP use of the property are present on the parcel at concentrations below the Commercial Use SCO.

Gowanus Canal

Within the Canal, tar impacts were primarily encountered in native sediments. Tar-impacted soils were found at similar elevations next to Parcel I and Parcel VI and along the western bulkhead (Parcel VIII). Some subsurface migration of tar into the canal from the east may have occurred. But if the primary source was subsurface migration from the former MGP the sediments adjacent to Parcel VII (where no DNAPL has been observed) would not be tar impacted. Instead, these tar impacts in canal sediments are more consistent with direct spills or leaks of tar that occurred historically, via barging or during the operation of the MGP. Tar in sediments near the former Fulton MGP may also have been transported through the sediments along the length of the Canal from other sources (e.g. manufacturers who utilized tar as a feedstock). Such migration may have been influenced by the former operation of the Flushing Tunnel, which pulled water from Gowanus Bay and pumped it up the Canal and out the Flushing Tunnel to Buttermilk Channel of the East River. Tar in the Canal sediments appears to have impacted shallow soils adjacent to the Canal in and around the bulkheads.

Groundwater

Groundwater flow in the shallow zone (water table) is to the southwest. The intermediate groundwater flows to the south. Groundwater-containing dissolved phase tar-related chemicals discharges to the Canal; however, volatilization, biodegradation, and dilution likely mitigate the concentrations of dissolved concentrations.

VOCs (BTEX and chlorinated) in groundwater and soils will volatilize into the vadose zone. Aerobic degradation of aromatic hydrocarbons (PAHs) will reduce the potential and likelihood for any impact to indoor or ambient air, while chlorinated VOCs un-related to the former MGP operations may impact indoor air as they migrate through the vadose zone relatively un-degraded. SVI testing at on-site buildings show that potential MGP-related impacts were found within background levels; however, chlorinated compounds have adversely affected indoor air at Parcel III.

Ecological Receptors

There is minimal risk for impacts to ecological receptors at the former Fulton MGP Site because of the lack of habitat and the transient nature of urban wildlife.

Human Receptors

There are potentially complete pathways for human receptors to come into contact with both MGP-related and non-MGP-related chemical compounds in subsurface soil, groundwater, soil vapor and indoor air. Under current conditions, however, these impacts pose no risk of harm to human health. Potential future utility and construction workers may contact contaminants in subsurface soils at each of the parcels and beneath the streets during excavation activities. There

is a potential risk of harm to these workers performing utility repairs or future construction activities from exposure to contaminated subsurface soil, groundwater and soil vapor.

3. IRM Goals and Objectives

3.1 IRM Goals

In a letter dated January 18, 2012, the NYSDEC requested that National Grid complete an IRM to prevent potentially mobile MGP-related material from migrating into the Gowanus Canal. The NYSDEC recommended that the IRM include a subsurface barrier and DNAPL collection system.

Section 1.3 of the NYSDEC DER-10 defines an IRM as "activities to address both emergency and non-emergency site conditions, which can be undertaken without extensive investigation and evaluation, to prevent, mitigate or remedy environmental damage or the consequences of environmental damage attributable to a site, including, but not limited to, the following activities: construction of diversion ditches; collection systems; drum removal; leachate collection systems; construction of fences or other barriers; installation of water filters; provision of alternative water systems; the removal of source areas; or plume control".

The goals of this IRM are consistent with the NYSDEC's request and the goals described in NYSDEC DER-10. Potentially mobile, MGP-related source material was identified during the RI, adjacent to the Gowanus Canal along the eastern and western bulkheads. The goal of this IRM is to prevent, to the extent practical, potentially mobile MGP tar from the Fulton Municipal Works Former MGP Site, from migrating into the Gowanus Canal. The focus of this IRM and PDI WP will be limited to the adjacent parcels east and west of the Gowanus Canal, north of Union Street.

For the purposes of this work plan, potentially mobile, MGP-related source material is defined as soils saturated by coal tar. Tar coated soil may be an indicator that potentially mobile tar is nearby; this IRM aims to address coatings whenever practicable.

3.2 IRM Pre-Design Investigation Objectives

The objective of the proposed PDI activities is to collect sufficient information necessary to design and implement the IRM. Additional information required includes:

- Geotechnical data related to soil properties and strength for design of a barrier wall system.
- Additional delineation of potential MGP-related source material along the eastern and western bulkheads of the Gowanus Canal.
- Data to refine the baseline groundwater model to evaluate the effects of an impervious subsurface barrier on groundwater flow and Site hydraulics.

- Information regarding the construction of buildings and foundations adjacent to the IRM area.
- Data identifying noise and vibration levels anticipated and allowable under the site-specific circumstances during IRM construction activities.

3.3 Remedial Action Objectives

Remedial Action Objectives (RAOs) are medium-specific or operable-unit specific objectives for the protection of human health and the environment that are identified for the remedy selection process. RAOs are developed based on contaminant-specific Standards, Criteria and Guidance (SCGs) and the intended land use. DER-10 states that RAOs may be established using either generic RAOs as applicable to the contaminants at the site identified by the RI or site-specific RAOs where the generic RAOs do not address a unique site condition. Ultimately, the specific RAOs will be developed and submitted with the IRM Work Plan.

4. PDI Scope of Work

4.1 Execution of the PDI for the IRM

This PDI WP proposes activities to gather necessary information to design the IRM. The main components of the IRM are the installation of a subsurface barrier wall and support system with DNAPL recovery, as appropriate, behind the barrier.

The subsections below identify what information is needed as well as the proposed scope of work. The information gathered during the PDI will help to determine the applicable technology that will be used to construct the barrier wall and support system, with as minimal impact to the community as is practical.

Once the PDI is complete, the information acquired will be summarized and submitted to the NYSDEC in an IRM Work Plan. The IRM Work Plan will include an evaluation of barrier wall types, alignments, and support structures, and recommend an alternative that will be carried forward into the design phase. The IRM Work Plan will also identify potential data gaps, and evaluate the need for pilot testing.

4.2 Pre-Design Investigation Scope of Work

The purpose of the PDI is to obtain information that will be used to design and implement the IRM. The data gathered will help in determining the barrier type, alignment, depth, and support system. The scope of work proposed for the PDI includes:

- Environmental and Geotechnical Investigation
- Refinement of the Existing Gowanus Canal Groundwater Model for use in the IRM design
- Background Noise and Vibration Survey
- Utility Survey and Subsurface Infrastructure Investigation
- Evaluation of the Construction of Adjacent Buildings, Bulkheads and Foundations
- DNAPL Delineation for Potential Future Recovery

The following subsections describe each PDI activity.

4.2.1 Environmental and Geotechnical Investigation

An investigation will be conducted to acquire geotechnical information and to further delineate the extent of MGP-related source material and the meadow mat along the bulkheads of the Gowanus Canal. The information will be gathered via test borings and Cone Penetration Tests (CPTs). The geotechnical data will be used to evaluate barrier wall and support system design alternatives. Selected soil samples will be collected from the borings and tested for geotechnical index and strength parameters in a geotechnical laboratory. The MGP-related source material delineation data will be used to evaluate the extent of the barrier and the practicability of tar recovery. The additional meadow mat data will be used to refine the groundwater model. A summary of the proposed borings, their rationale, and sampling plan can be found in **Table 1**.

All work will be performed in accordance with the NYSDEC-Approved *Health and Safety Plan* (HASP), *Quality Assurance Project Plan* (QAPP), and *Field Sampling Plan* (FSP), included as **Appendices A, B,** and**, C**, respectively.

The first 5 feet of each on-land boring will be advanced using soft dig procedures to identify potential utilities. If refusal occurs, the depth and drilling information (e.g. hard refusal) will be noted and the boring will be offset approximately 5 feet.

4.2.1.1 Delineation Borings

A minimum of twelve soil borings (FW-SB-115 through FW-SB-126) will initially be completed to further delineate MGP-related source material and meadow mat along the bulkheads. The borings will be advanced to a depth of approximately EL.-40 ft NAVD 88 (approximately 45 ft bgs). The soil borings will be advanced using Geoprobe® drilling technology. The approximate locations of the borings are depicted in **Figure 3**. Additional borings may be required to delineate the southern extent of the MGP-related source material. This is discussed further in paragraphs below.

MGP-Related Source Material Delineation

To further delineate the extent of MGP-related source material, a minimum of eight borings (FW-SB-115, FW-SB-116, and FW-SB-118 through FW-SB-123) will be installed to a depth of approximately El.-40 ft.

If MGP-related source material is encountered in either of the two southernmost borings (FW-SB-115 and FW-SB-121), additional borings will be completed, offset approximately 100 ft south of the original location. This iteration will continue until the extent is fully delineated, or Union Street is reached. If MGP-related source material is not encountered at the original location, additional borings will be completed, offset approximately 25 feet south to verify the absence of MGP-related source material.

Borings FW-SB-122 and FW-SB-123 have been located to determine if MGP-related source material extends onto Parcel 7. If MGP-related source material is not observed at both FW-SB-122 and FW-SB-123, borings FW-SB-114 and FW-SB-114A may not be completed. If impacts are encountered in FW-SB-123, additional borings will be completed, offset approximately 50 feet north until the extent of impacts is delineated by two adjacent non-impacted borings, or the head of the canal is reached. In this case, borings FW-SB-114 and FW-SB-114A will be performed.

Meadow Mat Delineation

Four soil borings (FW-SB-117 and FW-SB-124 through FW-SB-126) will be installed to a depth of approximately El.-40 ft to delineate the meadow mat and gather additional groundwater modeling information.

Up to four monitoring wells will be installed at FW-SB-117 and FW-SB-126 (up to two monitoring wells at each location). These monitoring wells will be installed to assess the hydraulic conditions of meadow mat. The meadow mat serves as an aquitard and it will likely affect how groundwater will behave after the installation of an impervious barrier wall. The purpose of the monitoring wells is to measure groundwater elevations and vertical head potentials. One well couple, located at FW-SB-117, will be installed within 50 feet of the canal, and the other couple located at FW-SB-126, will be installed about 200 feet west of the canal. For each well couple, one well will be screened above the meadow mat and across the water table, and the other well will be screened from 40 to 50 ft bgs. At either location, the deeper well will not be installed if meadow mat is not observed.

The monitoring wells will be constructed of 1-inch inside diameter (ID), flush-threaded, schedule 40, polyvinyl chloride (PVC) riser, 10 slot well screen, with a 2-foot sump. The annular space between the well screen and borehole wall will be backfilled with chemically inert, #0 sand, to 1 foot above the well screen. A 2-foot thick, bentonite clay seal will be placed above the sand pack. The remaining annular space will be filled to grade with cement/bentonite grout. Each monitoring well will be fitted with a flush-mounted curb box secured with cement.

All wells will be installed and developed in accordance with the NYSDEC-approved FSP (**Appendix C**). Borings not completed as wells will be tremie grouted to grade using a Portland cement/bentonite slurry mixture.

4.2.1.2 Geotechnical Borings

Up to twenty-three geotechnical soil borings (FW-CPT-100 through FW-SB-114A) will be completed to evaluate the soil parameters necessary for design of the barrier wall. The approximate locations of the borings are depicted in **Figure 3**. To determine soil conditions and to evaluate anchor support (e.g. tieback) requirements, borings are spaced approximately 100

feet apart on alternate sides of the barrier wall alignment and approximately 150 to 200 feet apart in the anchorage zone behind the wall. This program is consistent with the following Federal Highway Administration (FHWA) investigation criteria[1] for retaining walls:

> *"Minimum Number of Investigation Points and Location of Investigation Points - For retaining walls more than 30 m in length, investigation points spaced every 30 to 60 m with locations alternating from in front of the wall to behind the wall. For anchored walls, additional investigation points in the anchorage zone spaced at 30 to 60 m".*

The borings will be advanced to approximately El.-60 feet (approximately 55 to 70 ft bgs), which corresponds to a depth of about 1.5 times the barrier wall height. This depth is consistent with the following FHWA investigation depth criteria:

> *"Minimum Depth of Investigations – Investigate to a depth below the bottom of wall between 1 and 2 times the wall height or a minimum 3 m into bedrock. Investigation depth should be great enough to fully penetrate soft highly compressible soils (e.g., peat, organic silt, soft fine grained soils) into competent material of suitable bearing capacity (e.g., stiff to hard cohesive soil, compact dense cohesionless soil, or bedrock)"*

Land Side

Up to sixteen borings (FW-SB-107 through FW-SB-114A) will likely be advanced using rotosonic drilling techniques. Standard penetration tests (SPTs) will be performed in each boring at a frequency of one SPT test every 5 feet in depth by driving a split-spoon sampler with a 140-pound hammer. Samples of coarse-grained soils (i.e., sand and gravel) will be collected from the split-spoon sampler. Undisturbed samples of organic and fine-grained soils (i.e., elastic silt, lean or fat clay) will be recovered in a thin-walled tube (Shelby Tube) sampler.

Canal Side

Seven borings (FW-CPT-100 through FW-SB-106) will be performed within the Gowanus Canal. Four of these borings will likely be advanced using rotosonic drilling techniques, and SPTs will be performed in each of these boring at a frequency of one SPT test every 5 feet in depth by driving a split-spoon sampler with a 140-pound hammer. Samples of coarse-grained soils (i.e., sand and gravel) will be collected from the split-spoon sampler. Undisturbed samples of organic and fine-grained soils (i.e., elastic silt, lean or fat clay) will be recovered in a thin-walled tube (Shelby Tube) sampler.

[1] Sabatini, P.J., Bachus, R.C., Mayne, P.W., Schneider, J.A., Zettler, T.E., Evaluation of Soil and Rock Properties, Geotechnical Engineering Circular No. 5, Report No. FHWA-IF-02-034, "Table 3, Guidelines for minimum number of investigation points and depth of investigation", Federal Highway Administration, April 2002.

Three of these borings will be advanced using CPT methodologies. CPTs conducted within the canal will be advanced initially using the standard cone. If soils are found to be very soft and the standard cone is not adequate to measure the low soil strength, an additional CPT will be advanced through the soft soil zone using a modified cone.

A utility investigation within the canal may be performed if landside utility investigations indicate that utilities may be present within the canal. The borings performed in the canal will be installed from a barge or floating drilling platform suitable for the site conditions.

Logging, Sampling, and Testing

Each land-side and canal-side boring will be continuously logged. Laboratory testing of samples collected from the test borings will consist of geotechnical index tests (i.e., grain-size, unit weight, organic content, Atterberg Limits, moisture content tests, and strength tests (i.e., unconsolidated-unconfined triaxial tests and consolidated-undrained triaxial tests) to assist in identifying appropriate geotechnical parameters for design of the barrier wall. Two grain size analyses will be taken from each boring locations from within the fill and the outwash sands. The remainder of the analyses will be collected from the fine grained or organic materials. A summary of proposed laboratory testing is provided in **Table 1**.

4.2.1.3 Groundwater Elevation Gauging

One round of site-wide groundwater elevation gauging will be performed, in which all accessible site monitoring wells associated with the Fulton Municipal Works Former MGP site will be gauged. Additional elevation gauging will be necessary if seasonal variations are observed when comparing data from this initial round to historical measurements taken by previous Site activities.

All work will be performed in accordance with the NYSDEC-Approved HASP, QAPP, and FSP, included as **Appendices A, B,** and**, C**, respectively.

4.2.2 Groundwater Model

The potential effects of the proposed impervious barrier wall on groundwater hydraulics (elevations and flow directions) will be evaluated using a computer groundwater flow model. This model will assist in determining the potential wall alignment and the potential of groundwater mounding behind the wall. An existing groundwater model that was developed for the Gowanus Canal will be refined based on information collected during the PDI.

4.2.3 Background Noise and Vibration Investigation

A survey will be conducted at the Site and adjacent area to measure existing background noise and vibration levels. The measurements will be used to determine if noise and vibration

mitigation is needed during construction to comply with the New York City Noise Code and other noise and vibration guidelines. The general scope of work for this investigation includes the characterization of existing noise and vibration conditions and assessment of vibration propagation characteristics at the Site and surrounding areas. It will also include the prediction of future noise and vibration conditions during remedial activities, assessment of noise and vibration impacts, and recommended mitigation measures. At a minimum, the investigation will include:

- A survey of noise- and vibration-sensitive land-use within 500 feet of the Site
- Noise will be monitored adjacent to nearby residences and businesses at up to ten locations and on a 24-hours basis for a minimum of one week to develop a baseline noise pattern. This will be completed in two opposite seasons. In addition, noise will be monitored for a minimum of 1 hour at up to ten locations around the Site perimeter during the above week-long events.
- Vibration propagation characteristics of the ground will be assessed between the Site and adjacent properties/buildings and utilities considered to be potentially sensitive to vibrations.
- Additional monitoring of background vibration levels will be monitored in the Site vicinity independent of the PDI to provide a record of baseline conditions. Projected maximum noise and vibration levels during the IRM construction will be assessed at sensitive receptors. Predictions of noise and vibration scenarios will be made by modeling expected construction equipment use, in conjunction with background noise and vibration data.

Background noise levels will be measured at nearby noise-sensitive receptors (primarily residences) during two different seasons at the same locations as required by New York City (NYC). A Noise Mitigation Plan in accordance with §24-219 of the New York City Noise Code, to be posted at the Site in accordance with the Rules of the City of New York (RCNY) Title 15 §28-100, will be prepared and submitted with the Final IRM Design.

The ground vibration transfer mobility (determined during the vibration study) will be used to determine where pre-construction structural surveys of surrounding buildings will be required. Once these areas are established, property owners will be contacted to negotiate access for the pre-construction surveys and, if available, structural plans will be obtained from the property owners, the NYC Department of Small Business Services or the New York City Department of Buildings (NYCDOB) to evaluate potential structural issues.

4.2.4 Utility Survey and Subsurface Infrastructure Investigation

Utility identification in prior studies at the Site consisted of the mark-out required by law and geophysical surveys around RI locations to confirm the required mark-outs and to investigate the presence of other underground infrastructure. Utilities present in the IRM area—such as the

oxygenation pipe located in the canal, or the outfall pipes into the canal, will impact construction planning, and other utilities and structures are known to exist but they are not identified on available utility drawings. Therefore, utilities or other subsurface infrastructure will be identified as part of the PDI Scope.

Identification of potential utilities/infrastructure will consist of the following:

- Review of historic maps and plans obtained as part of our previous investigations at the Site
- A utility mark-out to obtain information regarding active utilities at and surrounding the Site will be used to evaluate impacts to proposed or potential remediation activities
- Geophysical surveys (ground penetrating radar and electromagnetic induction) in the areas of investigations to confirm public utility mark-outs and investigate the presence of other underground infrastructure
- Survey of utilities identified.

4.2.5 Evaluation of Construction of Adjacent Buildings, Bulkheads, and Foundations

Understanding the construction of surrounding buildings and foundation systems is important to the design of the barrier wall. The installation of a subsurface barrier wall and associated support system has the potential to interfere with building foundations and the structural integrity of buildings adjacent to the barrier wall alignment (i.e., Block 411, Block 418, Block 425, Block 432, Block 417, Block 424, and Block 431). Final design of the barrier wall and support system will depend on the nature and depth of the foundations supporting adjacent structures. Additional property information can be found in **Figure 4**. The evaluation will consist of the items below.

- Records/drawing search of agencies and property owners for foundations, bulkheads, and utility information.
- General physical survey of structures noting general conditions of building, any major structural concerns, review of any basements, pits, etc.
- General physical survey of bulkheads above the water line, noting conditions, construction materials, and outfalls.
- Property survey of adjacent buildings located within 100 ft of the bulkhead.

4.2.6 Dense Non-Aqueous Phase Liquid (DNAPL) Delineation for Future Recovery

DNAPL recovery may be implemented as part of the overall IRM. Information gathered during the PDI will be used to evaluate the potential for the installation of recovery wells. If sufficient tar-saturated soils are encountered during the boring program, they will be evaluated for the installation of a 4-inch diameter PVC monitoring well. Should recovery be consistent and

significant, a DNAPL monitoring/recovery program will be developed to determine the rate of recovery at each well. If the rate of recovery is consistent, it will then be considered for replacement by recovery wells.

4.3 PDI Completion and IRM Work Plan

Information gathered from the PDI activities will be summarized and submitted to NYSDEC in an IRM Work Plan. The IRM Work Plan will evaluate potential barrier wall types, alignment, and wall support systems and recommend an alternative for the barrier wall system.

The IRM Work Plan will also identify potential data gaps and whether pilot testing is necessary. It will describe the future design activities and propose a schedule of design deliverables and IRM milestones (i.e., 50% Design Package, 95% Design Package; Final 100% Design Package; Procurement Process; Implementation; and Construction Completion Report). Implementation of the IRM design will not proceed without NYSDEC approval of the IRM Work Plan.

4.3.1 Pre-Investigation Survey

A pre-construction survey will be performed prior to accessing a private property or road right-of-way. The pre-investigation survey will include the following:

- A photo/video-documentation of pre-investigation conditions of each property.
- The locations of cracks or fractures on any pavement, sidewalk, or driveway apron will be identified and documented.

4.4 Schedule

The implementation of the PDI is dependent upon obtaining access to applicable private properties. National Grid is currently in access discussions with the property owners. We believe that the boring program can be completed in 45 field days once access agreements are secured, and that the boring program will be completed in the summer of 2012. The evaluation of the adjacent buildings and utility and property surveys can be completed within the same general timeframe. The background noise and vibration study will take additional time to implement because monitoring data are required for two opposite months.

A detailed schedule of design milestones will be submitted with the IRM Work Plan. We anticipate that the IRM Work Plan will be submitted in December 2012. This is dependent upon private property access. To meet this date, the boring program must be completed by August 2012.

5. Community and Environmental Response Plan

5.1 Community Air Monitoring Plan

GEI will conduct perimeter air monitoring, and work zone monitoring in accordance with NYSDEC and NYSDOH requirements for a Community Air Monitoring Plan (CAMP). The objective of the perimeter air-monitoring plan is to provide a measure of protection for the downwind community (i.e., off-site receptors, including residences and businesses and on-site workers not involved with the site field activities) from potential airborne contaminant releases as a direct result of field activities. Appendix D of the HASP identifies key action levels. A copy of the CAMP is provided in Appendix D of the HASP. The HASP is provided in **Appendix A**.

Fugitive Dust Control

Dust control measures will be implemented to minimize the potential for dust generation during PDI activities. Dust control measures will include water spraying and limiting dust generating activities.

Odor Control

Odor control measures will be implemented at the site to minimize the potential exposure to nuisance odors. Impacted soil will be containerized or covered to minimize the potential for odors. Additional odor control measures may be needed, including the use of odor suppressant foam.

5.2 Erosion and Sediment Control

PDI activities are not likely to generate erosion and sediment concerns. During PDI activities, erosion control measures will be installed as appropriate to the specific activity. These measures will be maintained throughout the duration of the activity.

5.3 Site Security

All vehicles and/or equipment left in the work area will be secured at the end of each working day inside a perimeter fence, or at a remote secured area, overnight or during non-work days. No vehicles or equipment will be left overnight in an unsecured location

5.4 Decontamination

The objectives of the decontamination plan at the Site are to provide the procedures and equipment necessary to decontaminate personnel and equipment to prevent cross-contamination from PDI work areas to public areas (i.e., highways, roads, support trailer, vehicles, etc.). This plan does not replace the decontamination procedures outlined in the HASP, QAPP, or FSP, included as **Appendices A, B,** and**, C**, respectively. This plan provides additional guidelines on decontamination locations, necessary equipment, and procedures.

Personnel Decontamination

A personnel field decontamination/cleanup area will be available on Site.

Personal protective equipment (PPE) will be disposed of in a drum or large plastic bag. The drum or plastic bag will be secured to prevent the accidental spread of contamination. Additional details for personnel decontamination are presented in the HASP contained in **Appendix A**.

Equipment Decontamination

Equipment decontamination will take place on a decontamination pad when feasible. Decontamination activities shall include the removal of contaminated soil, debris and other miscellaneous materials from all construction equipment and tools that have come in contact with contamination.

Drilling equipment, hand tools, and miscellaneous small equipment that come in contact with impacted soil or groundwater will be decontaminated on the decontamination pad in buckets of water and detergent.

Wastewater from equipment decontamination will be collected and pumped into either 55-gallon drums or fractioning tanks. Disposal of the wastewater will be sent to the properly-licensed, National Grid-approved disposal facility as necessary.

Soils collected from the decontamination pads will be bulked and sent to the properly-licensed, National Grid-approved disposal facility, as necessary.

Decontamination Supplies

A sufficient supply of materials/equipment required to implement decontamination procedures will be maintained, including, but not limited to, the following items:

- Plastic trash barrels
- Liners for trash barrels
- Wash basins
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handled soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Stepladder(s)
- Steam generator
- Liquid detergent and paper towels
- Plastic trash bags
- Supplies/equipment to construct the decontamination pads
- All necessary hosing, connections, etc., to collect and transport decontamination fluids to the wastewater treatment system

5.5 Investigation-Derived Wastes

Soil cuttings and wastewaters produced during decontamination will be collected and contained within 55-gallon, Unites States Department of Transportation (USDOT) drums, roll-off or frac tank. National Grid will arrange for the disposal of the investigation-derived wastes after they have been characterized.

Waste Disposal Sampling

National Grid will arrange for the disposal of the investigation-derived wastes.

A waste profile sample of soil and fluid investigation-derived wastes will be collected to characterize the wastes to determine the appropriate disposal options available. Samples will be collected into laboratory-preserved bottles, chilled with ice and submitted to the laboratory under chain of custody as described in the FSP and QAPP. Each disposal sample media will be sampled for parameters to meet the requirements of the approved disposal facilities. A list of potential disposal parameters is provided in the QAPP.

5.6 Traffic Control

When working within street right-of-ways or sidewalks, regulations and requirements stated within the street opening permits should be followed along with New York City parking and traffic regulations. Highly visible safety items including traffic cones/barriers, caution tape, and men working signs should be used.

If PDI activities necessitate additional traffic control measures, National Grid, the Engineer and applicable PDI Contractors will develop a plan according to the specific activity. An appropriate Traffic Control Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

6. Restoration Plan

Upon completion of the PDI activities, the Site surface will be returned to the pre-PDI activity conditions. Restoration actions may include, but are not limited to:

- Backfill and compaction of the exploration areas and replacement of asphalt and concrete areas that were disturbed from PDI activities
- Demobilization of any waste generated(s)
- Removal of all equipment and barricades
- Demobilization of the CAMP equipment
- Removal of any decontamination pads

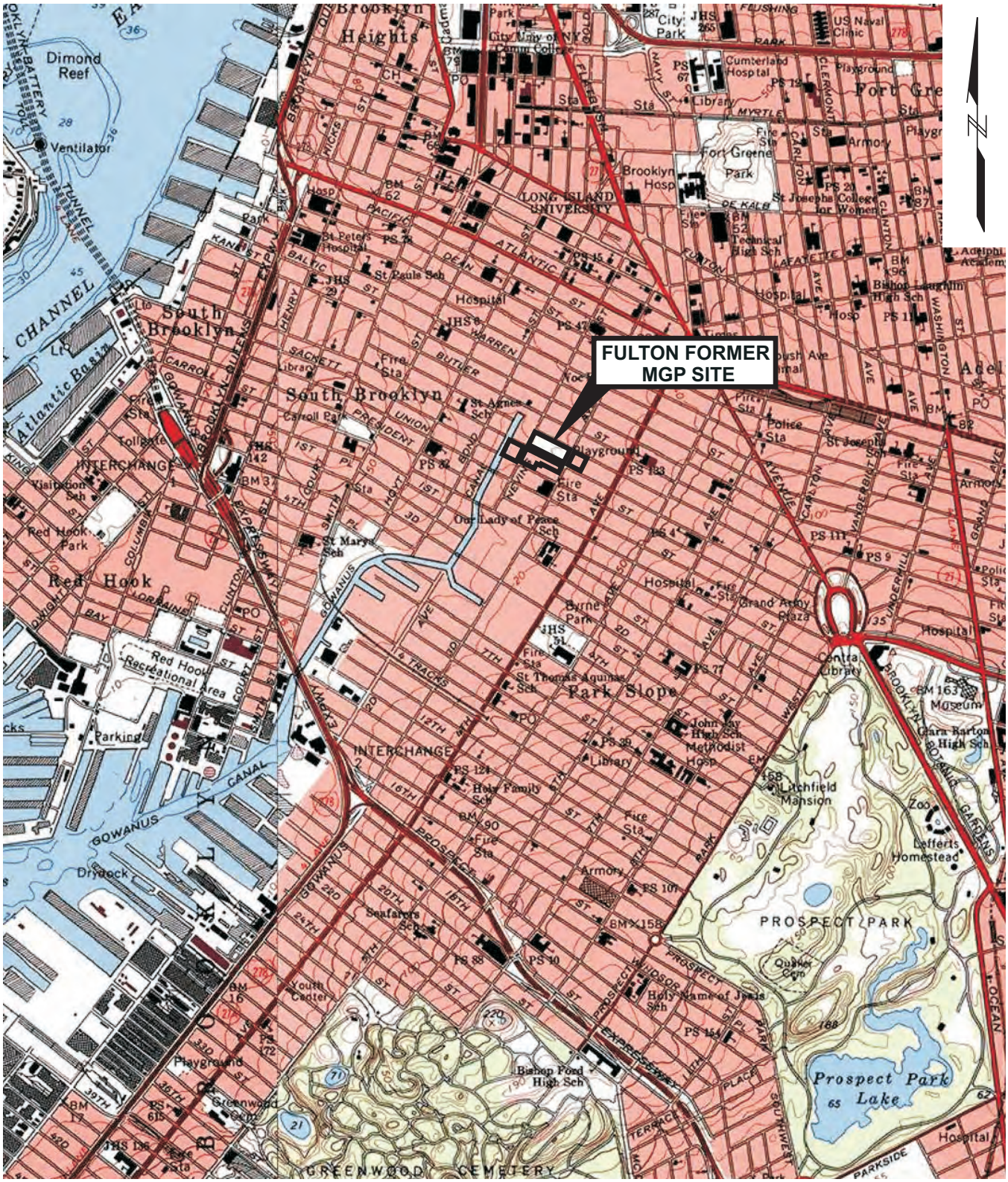
Table

Table 1
Exploration Location Rationale Table
IRM PDI Work Plan
Fulton Municipal Works Former MGP

Boring ID	Location	Rationale	Easting	Northing	Estimated Ground Surface Elevation (ft NAVD88)	Bottom Elevation (ft NAVD88)	Total Depth of Boring (ft)	Sample Frequency	Laboratory Analysis	Estimated Number of Laboratory Tests							
										Grain Size	Unit Weight	Moisture Content	Organic Content	Atterberg Limits	UUC	CIUC	Consolidation
										ASTM D422	ASTM D2937	ASTM D2216	ASTM D2974	ASTM D4318	ASTM D2850	ASTM D4767	ASTM D2435
FW-CPT-100	Within the canal, along the western canal bulkhead.	Canal boring used to collect geotechnical information. Boring locations spaced between landside borings every ~ 150 ft.	634133.64	673140.31	-5.6	-60	54	Continuously logged and SPTs performed at standard 5-foot intervals.	SPT, mechanical grain size distribution (ASTM D422), unit weight (ASTM D2937), moisture content (ASTM D2216), organic content (ASTM D2974), Atterberg Limits (ASTM D4318), and isotropically-consolidated undrained compression (ASTM D4767) tests.	-	-	-	-	-	-	-	-
FW-SB-101			634204.2	673273.2	-5.4	-60	55			2	1	2	1	2	1	-	-
FW-CPT-102			634271.4	673402.5	-5.0	-60	55			-	-	-	-	-	-	-	-
FW-SB-103			634355.9	673528.4	-5.3	-60	55			2	1	2	1	2	1	-	-
FW-SB-104	Within the canal, along the eastern canal bulkhead.	Canal boring used to collect geotechnical information. Boring locations spaced between landside borings every ~ 200 ft.	634402.9	673520.0	-2.6	-60	57			2	1	2	1	2	-	1	-
FW-CPT-105			634322.0	673351.2	-3.9	-60	56			-	-	-	-	-	-	-	-
FW-SB-106			634226.4	673166.6	-3.0	-60	57			2	1	2	1	2	1	-	-
FW-SB-107	Sackett Street ROW, west of canal	Landside borings along potential barrier wall alignment to collect geotechnical information, spaced between 150 and 200 ft depending on access.	634076.9	673092.0	4.1	-60	64			2	1	2	1	2	-	-	-
FW-SB-108	495 Sackett Street, west of canal		634151.6	673215.9	5.0	-60	65			2	1	2	1	2	1	-	-
FW-SB-109	Degraw Street ROW, west of canal		634216.3	673359.5	5.7	-60	66			2	1	2	1	2	-	-	-
FW-SB-110	497 Degraw Street, west of canal		634288.1	673494.3	5.8	-60	66			2	1	2	1	2	-	1	1
FW-SB-111	270 Nevins Street, east of canal		634207.0	673054.8	6.0	-60	66			2	1	2	1	2	-	-	-
FW-SB-112	Degraw Street ROW, east of canal		634312.5	673267.0	6.7	-60	67			2	1	2	1	2	1	-	-
FW-SB-113	424 Nevins Street, east of canal		634392.8	673429.4	6.4	-60	66			2	1	2	1	2	-	-	-
FW-SB-114	226 Nevins Street, east of canal		634456.3	673563.1	7.2	-60	67			2	1	2	1	2	1	-	-
FW-SB-107A	Sackett Street, west of canal	Landside borings located ~ 60 ft offset from barrier wall alignment boring location to collect geotechnical information in the area of the barrier wall anchor.	634029.5	673109.1	5.0	-60	65			2	1	2	1	2	-	-	-
FW-SB-108A	495 Sackett Street, west of canal		634105.3	673238.0	6.0	-60	66			2	1	2	1	2	-	1	1
FW-SB-109A	Degraw Street ROW, west of canal		634176.7	673374.6	5.9	-60	66			2	1	2	1	2	-	-	-
FW-SB-110A	497 Degraw Street, west of canal		634263.1	673508.2	5.8	-60	66			2	1	2	1	2	1	-	-
FW-SB-111A	270 Nevins Street, east of canal		634241.6	673041.7	6.5	-60	66			2	1	2	1	2	-	-	-
FW-SB-112A	Degraw Street ROW, east of Canal		634344.8	673240.5	6.9	-60	67			2	1	2	1	2	1	-	-
FW-SB-113A	424 Nevins Street, east of canal		634433.9	673418.2	6.7	-60	67			2	1	2	1	2	-	-	-
FW-SB-114A	226 Nevins Street, east of canal		634507.1	673541.9	7.7	-60	68			2	1	2	1	2	-	1	-
FW-SB-115	510 Sackett Street, west of canal	Additional delineation to determine extent of impacts observed at GCMW-03. Additional borings may be necessary to determine southern extent.	634064.7	673028.7	6.9	-40	47	Continuously logged and screened for presence of NAPL.	None	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-116	495 Sackett Street, west of canal	Confirm observed impacts at GCMW-34.	634115.6	673152.1	4.7	-40	45			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-117/FW-MW-24	267 Bond Street, west of canal	Delineation of meadow mat/gather modeling information.	634181.4	673277.5	5.7	-40	46			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-118	Degraw Street ROW, west of canal	Additional delineation to determine extent of impacts observed at GC-GP-05.	634205.2	673333.7	5.7	-40	46			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-119	497 Degraw Street, west of canal	Additional delineation to determine extent of impacts observed at GC-GP-05 and FW-SB-45.	634256.5	673415.9	6.3	-40	46			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-120	Douglas Street ROW, west of canal	Additional delineation to determine extent of impacts observed at FW-SB-45.	634311.5	673567.2	5.9	-40	46			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-121	525 Union Street, east of canal	Confirmation that tar impacts do not extent onto 525 Union St.	634184.9	673026.1	6.4	-40	46			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-122	424 Nevins Street, east of canal	Additional delineation to determine extent of impacts observed at FW-MW-10.	634436.9	673484.0	7.0	-40	47			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-123	226 Nevins Street, east of canal	Additional delineation to determine extent of impacts observed at FW-MW-10.	634458.5	673530.6	7.2	-40	47			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-124	267 Bond Street, west of canal	Delineation of meadow mat/gather modeling information.	634046.3	673187.1	5.2	-40	45			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-125	267 Bond Street, west of canal	Delineation of meadow mat/gather modeling information.	634087.1	673287.2	6.6	-40	47			NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-126/FW-MW-25	267 Bond Street, west of canal	Delineation of meadow mat/gather modeling information.	634031.6	673320.0	7.1	-40	47			NA	NA	NA	NA	NA	NA	NA	NA

Notes:
1. NAVD88 - Oct. 2011 Ocean Survey Inc., and New York City Department of Information Technologies & Telecommunications (NYC DoITT)
2. Two Monitoring Wells will be installed at each MW location. One well will be screened above the meadow mat and across the water table, and the other well will be screened from 40 to 50 ft bgs. At either location, the deeper well will not be installed if meadow mat is not observed.

Figures



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FINAL IRM PRE-DESIGN INVESTIGATION WORK PLAN
FULTON MUNICIPAL WORKS FORMER MGP
BOROUGH OF BROOKLYN, NEW YORK

nationalgrid

GEI Consultants

SITE LOCATION MAP

Project 093020-2-1202 | March 2012 | Figure 1

I:\Project\National Grid\Fulton\Remedial Design\PDI Work Plan\Fulton-Site Location.cdr

BALTIC STREET

BUTLER STREET

DOUGLASS STREET

DEGRAW STREET

SACKETT STREET

UNION STREET

BOND STREET

NEVINS STREET

3RD AVENUE

4TH AVENUE

GOWANUS CANAL

NEW YORK CITY DEPARTMENT OF PROTECTION (NYCDEP) GOWANUS CANAL PUMP STATION

FLUSHING TUNNEL (CURRENTLY NOT IN OPERATION, LOCATION APPROXIMATE)

FLOW

PARCEL I

PARCEL II

PARCEL III

PARCEL IV

PARCEL V

PARCEL VI

PARCEL VII

PARCEL VIII

TEMPORARY INVESTIGATION-DERIVED WASTE STORAGE AREA

HANDBALL COURTS

FORMER BAYSIDE FUEL OIL DEPOT PROPERTY

VERIZON PROPERTY
318 NEVINS STREET
[NYSDEC SPILL NUMBER 92-07367]

FW-SB-52 FW-SB-41/ FW-MW-19 FW-SB-40 FW-SB-42/ FW-MW-20 FW-MW-09 FW-SB-36 FW-SB-39 FW-SB-28 FW-MW-08 FW-SB-30 FW-SB-44 FW-SB-45 FW-SB-31 FW-SB-47 FW-SB-46 FW-MW-22I FW-SB-48 FW-SB-49 FW-SB-50 FW-SB-37/ FW-MW-18 FW-SB-38 FW-SB-35 FW-SB-27 FW-SB-29 FW-MW-14 FW-OA-03* FW-IA-06* FW-SV-11 FW-SB-33 FW-SB-34/ FW-GW-34 FW-SB-43/ FW-GW-43 FW-IA-07* FW-SV-12 FW-IA-08* FW-SB-33A FW-IA-05* FW-SV-13 FW-MW-12 FW-MW-13 FW-MW-07 FW-SS-08 FW-SS-09 FW-SB-19 FW-SB-24 FW-SV-10 FW-SB-20/ FW-GW-20 FW-SB-23A FW-SB-23 FW-TP-07 FW-SB-18 FW-MW-06 FW-SB-22A FW-SB-22 FW-TP-05 FW-TP-04 FW-TP-06 FW-SB-17 FW-SB-17B FW-SB-21 FW-MW-5R FW-SB-17A FW-SS-04 FW-SB-26 FW-SB-32 FW-SB-05 FW-SB-12 FW-SS-05 FW-MW-11 FW-MW-10 FW-MW-10/ GCMW-31S GCMW-31I SB-8 SB-9 SB-10 SB-11 SB-12 SB-6 SB-7 SB-5 SB-1 SB-2 SB-3 SB-4 FW-DSS-03* FW-DSS-02* FW-DSS-01* FW-MW-1R KSF-SB-23/MW-1 GC-GP-06 FW-SB-07/ FW-MW-17 FW-OA-01 KSF-SB-24* KSF-SB-25* FW-SB-01 FW-SB-04 FW-SB-02 FW-SB-08 KSF-SB-26/MW-3 FW-IA-01 FW-SB-05B FW-SB-05A FW-SB-05 FW-MW-3R FW-SV-03 FW-SB-03 FW-SV-01 FW-IA-02 FW-MW-03 FW-SS-06 GCMW-30I GCMW-30D1 FW-MW-02 GCMW-30D2 FW-MW-01 FW-MW-01/ GCMW-30S FW-MW-4R KSF-SB-27/MW-4 KSF-SB-22 FW-SB-10 KSF-SB-21/MW-7 KSF-SB-20* KSF-SB-19 FW-SB-14* FW-TP-02A FW-SS-01 FW-TP-02B FW-SB-11A FW-SB-11/ FW-GW-11 FW-SB-12 FW-SB-14(R1) FW-SB-15/ FW-GW-15 FW-SB-02* FW-SB-13 FW-SB-13A FW-SB-16/ FW-GW-16 FW-SV-05 FW-SV-08 FW-TP-03 FW-SV-09 FW-SS-03* FW-MW-05 FW-OA-04* FW-SV-06 FW-SV-07 FW-IA-03 FW-SS-07* FW-OA-02* FW-MW-04 KSF-SB-29* KSF-SB-28* FW-SB-09 FW-MW-21I FW-MW-21S FW-MW-22S FW-SB-228 GC-GP-05 GC-SD152 GC-SED-08 GC-SED-07 GC-SED-09B GC-SD107 GC-SED-02 GC-SED-01 GC-SED-03B GC-SD126 GC-SD124 GC-SD125 ERT 1-1 ERT 1-2 ERT 1-3 ERT 2-1 ERT 2-2 ERT 2-3 TBM-3 GC-SED-05 GC-SED-04 GC-SD108 ERT 3-1 ERT 3-2 ERT 3-3 TBM-2 GC-SED-10 GC-SED-11 GC-SED-12 TBM-1 MW-11 MW-9 MW-8 MW-12 MW-7 GCMW-01I/ SB01I/MW01I GCMW-01S/ SB01S/MW01S GCMW-33S,I FW-MW-23S FW-MW-23I FW-MW-23D1 FW-SB-51/ FW-MW-23D2 GCMW-02I/ SB02I/MW02I GCMW-02S/ SB02S/MW02S GCMW-34S,I GCMW-04S,I GCMW-03S,I SGMW-3 GCMW-32I GCMW-32IR FW-MW-16 FW-MW-16/ GCMW-32S FW-SS-09 FW-SB-24 FW-SV-10 FW-SB-19 FW-MW-07 FW-SB-20/ FW-GW-20 FW-SB-23A FW-SB-23 FW-TP-07 FW-SB-18 FW-MW-06 FW-SB-22A FW-SB-22 FW-TP-05 FW-TP-04 FW-TP-06 FW-SB-17 FW-SB-17B FW-SB-21 FW-MW-5R FW-SB-17A FW-SS-04 FW-SB-26 FW-SB-32 FW-SB-05 FW-SB-12 FW-SS-05 FW-MW-11 FW-MW-10 FW-MW-10/ GCMW-31S GCMW-31I SB-8 SB-9 SB-10 SB-11 SB-12 SB-6 SB-7 SB-5 SB-1 SB-2 SB-3 SB-4 FW-DSS-03* FW-DSS-02* FW-DSS-01* FW-MW-1R KSF-SB-23/MW-1 GC-GP-06 FW-SB-07/ FW-MW-17 FW-OA-01 KSF-SB-24* KSF-SB-25* FW-SB-01 FW-SB-04 FW-SB-02 FW-SB-08 KSF-SB-26/MW-3 FW-IA-01 FW-SB-05B FW-SB-05A FW-SB-05 FW-MW-3R FW-SV-03 FW-SB-03 FW-SV-01 FW-IA-02 FW-MW-03 FW-SS-06 GCMW-30I GCMW-30D1 FW-MW-02 GCMW-30D2 FW-MW-01 FW-MW-01/ GCMW-30S FW-MW-4R KSF-SB-27/MW-4 KSF-SB-22 FW-SB-10 KSF-SB-21/MW-7 KSF-SB-20* KSF-SB-19 FW-SB-14* FW-TP-02A FW-SS-01 FW-TP-02B FW-SB-11A FW-SB-11/ FW-GW-11 FW-SB-12 FW-SB-14(R1) FW-SB-15/ FW-GW-15 FW-SB-02* FW-SB-13 FW-SB-13A FW-SB-16/ FW-GW-16 FW-SV-05 FW-SV-08 FW-TP-03 FW-SV-09 FW-SS-03* FW-MW-05 FW-OA-04* FW-SV-06 FW-SV-07 FW-IA-03 FW-SS-07* FW-OA-02* FW-MW-04 KSF-SB-29* KSF-SB-28* FW-SB-09 FW-MW-21I FW-MW-21S FW-MW-22S FW-SB-228 GC-GP-05 GC-SD152 GC-SED-08 GC-SED-07 GC-SED-09B GC-SD107 GC-SED-02 GC-SED-01 GC-SED-03B GC-SD126 GC-SD124 GC-SD125 ERT 1-1 ERT 1-2 ERT 1-3 ERT 2-1 ERT 2-2 ERT 2-3 TBM-3 GC-SED-05 GC-SED-04 GC-SD108 ERT 3-1 ERT 3-2 ERT 3-3 TBM-2 GC-SED-10 GC-SED-11 GC-SED-12 TBM-1 MW-11 MW-9 MW-8 MW-12 MW-7 GCMW-01I/ SB01I/MW01I GCMW-01S/ SB01S/MW01S GCMW-33S,I FW-MW-23S FW-MW-23I FW-MW-23D1 FW-SB-51/ FW-MW-23D2 GCMW-02I/ SB02I/MW02I GCMW-02S/ SB02S/MW02S GCMW-34S,I GCMW-04S,I GCMW-03S,I SGMW-3 GCMW-32I GCMW-32IR FW-MW-16 FW-MW-16/ GCMW-32S FW-SS-09 FW-SB-24 FW-SV-10 FW-SB-19 FW-MW-07 FW-SB-20/ FW-GW-20 FW-SB-23A FW-SB-23 FW-TP-07 FW-SB-18 FW-MW-06 FW-SB-22A FW-SB-22 FW-TP-05 FW-TP-04 FW-TP-06 FW-SB-17 FW-SB-17B FW-SB-21 FW-MW-5R FW-SB-17A FW-SS-04 FW-SB-26 FW-SB-32 FW-SB-05 FW-SB-12 FW-SS-05 FW-MW-11 FW-MW-10 FW-MW-10/ GCMW-31S GCMW-31I SB-8 SB-9 SB-10 SB-11 SB-12 SB-6 SB-7 SB-5 SB-1 SB-2 SB-3 SB-4 FW-DSS-03* FW-DSS-02* FW-DSS-01* FW-MW-1R KSF-SB-23/MW-1 GC-GP-06 FW-SB-07/ FW-MW-17 FW-OA-01 KSF-SB-24* KSF-SB-25* FW-SB-01 FW-SB-04 FW-SB-02 FW-SB-08 KSF-SB-26/MW-3 FW-IA-01 FW-SB-05B FW-SB-05A FW-SB-05 FW-MW-3R FW-SV-03 FW-SB-03 FW-SV-01 FW-IA-02 FW-MW-03 FW-SS-06 GCMW-30I GCMW-30D1 FW-MW-02 GCMW-30D2 FW-MW-01 FW-MW-01/ GCMW-30S FW-MW-4R KSF-SB-27/MW-4 KSF-SB-22 FW-SB-10 KSF-SB-21/MW-7 KSF-SB-20* KSF-SB-19 FW-SB-14* FW-TP-02A FW-SS-01 FW-TP-02B FW-SB-11A FW-SB-11/ FW-GW-11 FW-SB-12 FW-SB-14(R1) FW-SB-15/ FW-GW-15 FW-SB-02* FW-SB-13 FW-SB-13A FW-SB-16/ FW-GW-16 FW-SV-05 FW-SV-08 FW-TP-03 FW-SV-09 FW-SS-03* FW-MW-05 FW-OA-04* FW-SV-06 FW-SV-07 FW-IA-03 FW-SS-07* FW-OA-02* FW-MW-04 KSF-SB-29* KSF-SB-28* FW-SB-09

LEGEND

APPROXIMATE BOUNDARY OF FORMER FULTON MGP PROPERTY

HISTORIC MGP STRUCTURE

REMEDIAL INVESTIGATION (RI) PARCEL BOUNDARY (PARCELS I TO VIII)

FULTON MUNICIPAL WORKS MGP REMEDIAL INVESTIGATION (RI) SAMPLE LOCATIONS

FW-MW-01	MONITORING WELL
FW-SB-01	SOIL BORING
FW-SB-20	SOIL BORING WITH TEMPORARY GROUNDWATER WELL SAMPLE
FW-SS-06	SURFACE SOIL SAMPLE
FW-SV-10	SOIL VAPOR POINT
FW-IA-01	INDOOR AIR SAMPLE
FW-OA-01	OUTDOOR AIR SAMPLE
TBM-1	GOWANUS CANAL GAUGING POINT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA) GOWANUS CANAL RI SAMPLE LOCATIONS

GCMW-04S,I	USEPA BORING/MONITORING WELL
GC-SD107	USEPA SEDIMENT CORE
SGMW-3	USEPA GOWANUS CANAL GAUGING POINT

PREVIOUS SAMPLE LOCATIONS

KSF-SB-24	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) SITE CHARACTERIZATION (SC) BORING
KSF-SB-23/MW-1	NYSDEC SC MONITORING WELL
MW-7	PREVIOUS NYSDEC SPILL REPORT INVESTIGATION MONITORING WELL/ BORING
SB-1	PREVIOUS NYSDEC SPILL REPORT INVESTIGATION BORING
GC-GP-05	KEYSPAN CORPORATION (NATIONAL GRID) GOWANUS CANAL RI BORING
GC-SED-01	KEYSPAN CORPORATION (NATIONAL GRID) GOWANUS CANAL RI SEDIMENT CORE

NOTES:

1. * INDICATES THE SAMPLE LOCATION WAS NOT SURVEYED (LOCATION APPROXIMATE).
2. SINGLE RI MONITORING WELLS WERE SCREENED AT OR NEAR THE WATER TABLE. SHALLOW "S", INTERMEDIATE "I", DEEP ZONE "D1" AND JAMECO "D2" DESIGNATIONS ARE USED FOR MONITORING WELL CLUSTERS. "S" DESIGNATES A SHALLOW MONITORING WELL SCREENED AT OR NEAR THE WATER TABLE. "I "DESIGNATES A WELL SCREENED APPROXIMATELY 5-FEET BELOW THE NATIVE MATERIAL INTERFACE IN THE GOWANUS CANAL. D1 WELLS ARE SCREENED APPROXIMATELY 5 FEET ABOVE THE ANTICIPATED ELEVATION OF GARDINERS CLAY. D2 WELLS ARE SCREENED WITHIN OR JUST ABOVE JAMECO GRAVEL.
3. OFFSET BORINGS WERE COMPLETED AT THE FOLLOWING LOCATIONS: FW-SB-42/FW-MW-20, FW-SB-41/FW-MW-19, FW-SB-37/FW-MW-18, FW-SB-07/FW-MW-17, FW-MW-04, FW-MW-03, FW-MW-06, FW-MW-05.

SOURCES:

1. GOOGLE™ EARTH PRO, ©2011 GOOGLE, IMAGERY DATE 06/17/10, ACCESSED ON 07/28/11.
2. SANBORN FIRE INSURANCE MAPS (1886 THROUGH 2007).
3. *SITE CHARACTERIZATION REPORT, FULTON FORMER MANUFACTURED GAS PLANT, BROOKLYN (II), KING'S COUNTY, NEW YORK, SITE No. 2-24-051,* SEPTEMBER 2007, PREPARED BY NYSDEC REMEDIAL BUREAU C., DIVISION OF ENVIRONMENTAL REMEDIATION.
4. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM (http://www.oasisnyc.net), ACCESSED JANUARY 2008.
5. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE, NORTH AMERICAN DATUM (NAD) 83). VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD) 88.
6. *DRAWING 2034: FOUNDATION FOR 100,000 GAL. NAPHTHA TANK,* THE BROOKLYN UNION GAS CO. FULTON MUNICIPAL BRANCH, SCALE 1/8"=1 ' DATED AUGUST 16, 1897.
7. *DRAWING 2-F-98: OIL DRAINAGE SYSTEM,* THE BROOKLYN UNION GAS CO., SCALE 1/8"=1 ' DATED DECEMBER, 17,1907.
8. NEW YORK CITY GEOGRAPHIC INFORMATION SYSTEM (GIS) 1924 AERIAL PHOTOGRAPH (http://gis.nyc.gov/doitt/nycitymap/)
9. BIRD'S EYE VIEW PHOTOGRAPH DOUGLASS STREET STORE YARD (1906), THE BROOKLYN UNION GAS CO., DATED MARCH 13, 1928.
10. PROPERTY DEED INFORMATION FOR 270 NEVINS STREET, 537 SACKETT STREET, 225 NEVINS STREET, 560 DEGRAW STREET, AND 191 3RD AVENUE.
11. NEW YORK STATE ARCHIVES, BROOKLYN UNION GAS1915 AND 1920 INSETS 13345-89, 09/29/2009.
12. *DRAFT GOWANUS CANAL REMEDIAL INVESTIGATION REPORT,* PREPARED FOR U.S. ENVIRONMENTAL PROTECTION AGENCY (CONTRACT NO. EP-W-09-009/ WORK ASSIGNMENT NO. 013-RICO-022F], PREPARED BY HDR, CH2MHILL, GRB ENVIRONMENTAL SERVICES, INC. JANUARY 2011.
13. *FIGURE 1: TOTAL DISSOLVED VOC CONCENTRATIONS IN GROUNDWATER ON JUNE 15, 2009,* VERIZON NEW YORK FACILITY, 318 NEVINS STREET, BROOKLYN, NY, PREPARED BY ENVIROTRAC, SCALE: 1" =40', REVISION DATE: 8/12/09.
14. *FIGURE 1: AERIAL PHOTOGRAPH,* 242 NEVINS STREET, BROOKLYN, NY, PREPARED BY ENVIROTRAC, FROM LETTER REPORT ADDRESSING NYSDEC SPILL NUMBER 0510546 APRIL 4, 2006, SCALE: 1" = 60', UNDATED.
15. GEI CONSULTANTS, INC. 2009, REMEDIAL INVESTIGATION TECHNICAL REPORT GOWANUS CANAL, BROOKLYN, NEW YORK AOC INDEX NO. A2-0523-0705. SUBMITTED TO: NYSDEC ON BEHALF OF NATIONAL GRID .

0 60 120
SCALE, FEET

FINAL IRM PRE-DESIGN INVESTIGATION WORK PLAN
FULTON MUNICIPAL WORKS FORMER MGP
BOROUGH OF BROOKLYN, NEW YORK

nationalgrid

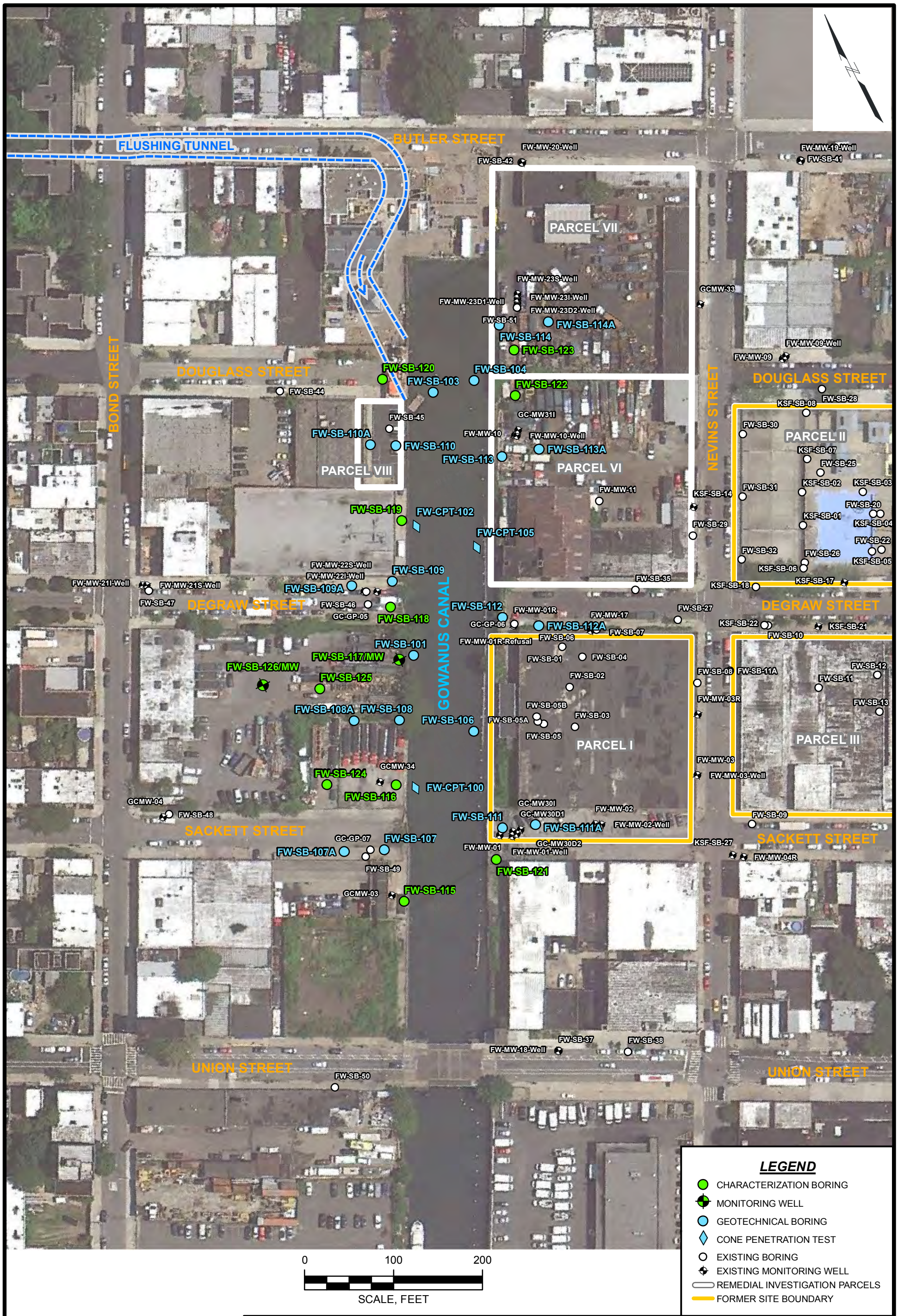
PROJECT 093020-2-1202

GEI Consultants
455 WINDING BROOK DRIVE
SUITE 201
GLASTONBURY, CONNECTICUT 06033

HISTORICAL MGP STRUCTURES AND RI SAMPLE LOCATION MAP

March 2012 Figure 2

I:\Project\National Grid\Fulton\Remedial Design\PDI Work Plan\Fulton-Sample Locations-2011_No Aerial.dwg



SOURCES:

1. PHOTOGRAPH OBTAINED FROM GOOGLE ™ EARTH PRO, © 2011, GOOGLE IMAGERY DATE 06/17/10. ACCESSED ON 7/28/11.

FINAL IRM PRE-DESIGN INVESTIGATION WORK PLAN
FULTON MUNICIPAL WORKS FORMER MGP
BOROUGH OF BROOKLYN, NEW YORK

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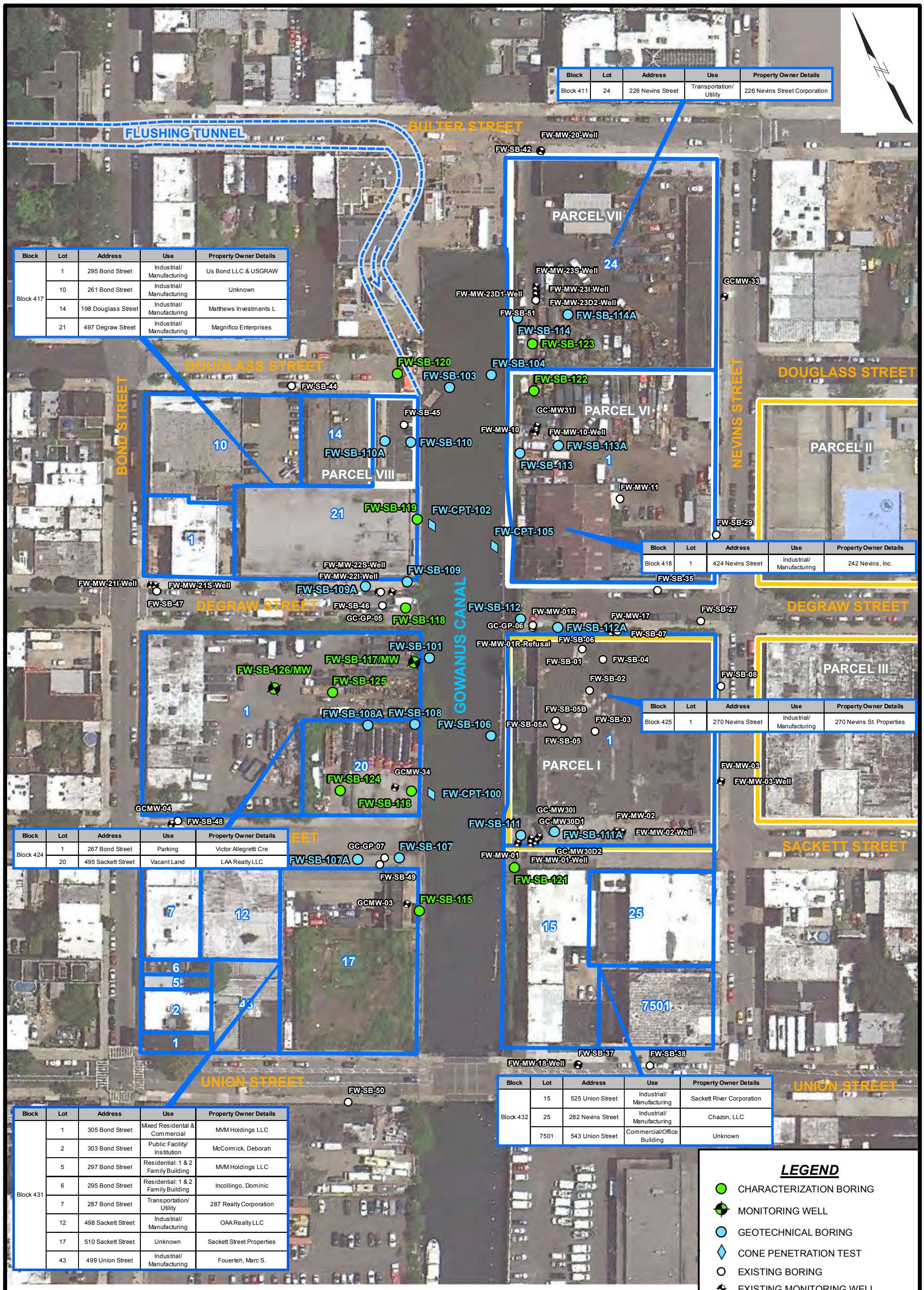
PROPOSED EXPLORATION LOCATIONS

Project 093020-2-1202 | March 2012 | Figure 3

J:\Projects\National_Grid\Fulton\Geotech_Inv\Proposed_LocationsV2.mxd



Block	Lot	Address	Use	Property Owner Details
Block 411	24	226 Nevins Street	Transportation/ Utility	226 Nevins Street Corporation

Block	Lot	Address	Use	Property Owner Details
Block 417	1	295 Bond Street	Industrial/ Manufacturing	Us Bond LLC & USGRAW
	10	261 Bond Street	Industrial/ Manufacturing	Unknown
	14	198 Douglass Street	Industrial/ Manufacturing	Matthews Investments L
	21	497 Degraw Street	Industrial/ Manufacturing	Magnifico Enterprises

Block	Lot	Address	Use	Property Owner Details
Block 418	1	424 Nevins Street	Industrial/ Manufacturing	242 Nevins, Inc.

Block	Lot	Address	Use	Property Owner Details
Block 425	1	270 Nevins Street	Industrial/ Manufacturing	270 Nevins St. Properties

Block	Lot	Address	Use	Property Owner Details
Block 424	1	267 Bond Street	Parking	Victor Allegretti Cre
	20	495 Sackett Street	Vacant Land	LAA Realty LLC

Block	Lot	Address	Use	Property Owner Details
Block 431	1	305 Bond Street	Mixed Residental & Commercial	MVM Holdings LLC
	2	303 Bond Street	Public Facility/ Institution	McCormick, Deborah
	5	297 Bond Street	Residential: 1 & 2 Family Building	MVM Holdings LLC
	6	295 Bond Street	Residential: 1 & 2 Family Building	Incollingo, Dominic
	7	287 Bond Street	Transportation/ Utility	287 Realty Corporation
	12	498 Sackett Street	Industrial/ Manufacturing	OAA Realty LLC
	17	510 Sackett Street	Unknown	Sackett Street Properties
	43	499 Union Street	Industrial/ Manufacturing	Fouerteh, Marc S.

Block	Lot	Address	Use	Property Owner Details
Block 432	15	525 Union Street	Industrial/ Manufacturing	Sackett River Corporation
	25	282 Nevins Street	Industrial/ Manufacturing	Chazon, LLC
	7501	543 Union Street	Commercial/Office Building	Unknown

LEGEND

- CHARACTERIZATION BORING
- MONITORING WELL
- GEOTECHNICAL BORING
- CONE PENETRATION TEST
- EXISTING BORING
- EXISTING MONITORING WELL
- PROPERTY BOUNDARIES
- REMEDIAL INVESTIGATION PARCELS
- FORMER SITE BOUNDARY

SOURCES:

1. PHOTOGRAPH OBTAINED FROM GOOGLE ™ EARTH PRO, © 2011, GOOGLE IMAGERY DATE 06/17/10. ACCESSED ON 7/28/11.
2. PARCEL BOUNDARIES FROM NEW YORK CITY DEPARTMENT OF CITY PLANNING, MAPPLUTO UPDATED NOV 2009.
3. PROPERTY INFORMATION FROM NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM (http://www.oasisnyc.net), ACCESSED JANUARY 2012.

0 100 200

SCALE, FEET

FINAL IRM PRE-DESIGN INVESTIGATION WORK PLAN
FULTON MUNICIPAL WORKS FORMER MGP
BOROUGH OF BROOKLYN, NEW YORK

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GEI Consultants

PROPERTY BOUNDARIES AND DATA

Project 093020-2-1202 | March 2012 | Figure 4

J:\Projects\National_Grid\Fulton\Geotech_Inv\Property_Boundaries.mxd

Appendix A

Health and Safety Plan (electronic only)

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Health and Safety Plan

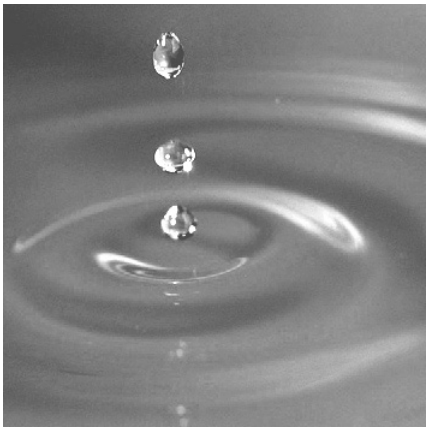
Fulton Municipal Works Former MGP Site

Brooklyn, New York

Submitted to:
National Grid Corporation
1 MetroTech Center
Brooklyn, NY 11201

Submitted by:
GEI Consultants, Inc.
455 Winding Brook Drive
Glastonbury, CT 06033
860-368-5300

March 2012
093020



By their signature, the undersigned hereby certify that this HASP has been reviewed and approved for use at the National Grid Fulton Municipal Works Former Manufactured Gas Plant Site located in Brooklyn, New York.

PROJECT MANAGER	DATE
SITE SAFETY OFFICER	DATE
CORPORATE HEALTH & SAFETY OFFICER	DATE

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1. Introduction

1.1 Purpose

This Health and Safety Plan (HASP) addresses the health and safety practices that will be employed by workers participating in investigation activities at the Fulton Municipal Works Former Manufactured Gas Plant (MGP) Site (Site) that are under the direction of GEI Consultants, Inc. (GEI). This work will be performed on behalf of National Grid at the Site located in the Gowanus neighborhood of Brooklyn, New York. The HASP takes into account the specific hazards inherent to the Site, and presents procedures to be followed by **GEI and GEI Subcontractors**, and all site visitors in order to avoid and if necessary, protect against health and/or safety hazards. GEI subcontractors are required to develop their own site-specific HASP and may use these as a reference. A copy this HASP will be maintained at the Site for the duration of work.

All workers who may participate in activities at the Site that are under the direction of **GEI** are required to comply with the provisions specified in this HASP. All site visitors who enter designated work zones must also comply with this HASP. Refusal or failure to comply with the HASP or violation of any safety procedures by field personnel and/or subcontractors performing work covered by this HASP may result in immediate removal from the site following consultation with **National Grid**.

1.2 Scope of Work

This HASP addresses all general activities listed below:

Mobilization/Demobilization

- Mobilization/demobilization of equipment and supplies
- Establishment of site security, work zones, and staging areas

Pre-Investigation Activities

- Location of all utilities to and from the Site
- Location and protection of all active utility lines on site

Pre-Design Investigation Activities

- Subsurface soil boring installation and sample collection
- Monitoring well installation and sample collection
- Air monitoring
- Investigation-derived waste handling and storage activities

2. Project Organization and Responsibilities

This section includes the project organization and structure, and establishes the specific chain-of-command for responsibilities and communications.

2.1 National Grid

National Grid may review and comment on the content of the HASP. GEI is responsible for resolving issues identified by National Grid, to National Grid's satisfaction. National Grid project-specific contact information is included in **Appendix A**.

2.2 GEI Consultants, Inc.

GEI provides general health and safety for its employees and acts as National Grid's consultant. GEI also conducts perimeter air monitoring, and work zone monitoring for its employees. GEI is the primary point of contact with National Grid and regulatory agencies for health and safety related matters. GEI health-and-safety roles for this project include:

- Project Manager
- Site Safety Officer
- Corporate Health and Safety Officer

2.2.1 Project Manager (PM)

The Project Manager is Jeff Parillo. The PM responsibilities include the following:

- Ensures implementation of this program;
- Conducts periodic inspections;
- Participates in incident investigations;
- Ensures the HASP has all of the required approvals before any site work is conducted;
- Ensures that the Site Manager (SM) is informed of project changes which require modifications of the Site safety plan;
- Has overall project responsibility for Project Health and Safety, and
- Acts as the primary point of contact with National Grid for site related activities and coordination with non-project related site operations.

2.2.2 Corporate Health and Safety Officer (CHSO)

The CHSO is a qualified health and safety professional with experience in hazardous waste site remediation activities. The CHSO is Dr. Robin DeHate. The CHSO responsibilities include the following:

- Provides for the development and approval of the HASP;
- Serves as the primary contact to review health and safety matters that may arise;
- Approves revised or new safety protocols for field operations;
- Coordinates revisions of this HASP with field personnel;
- Coordinates upgrading or downgrading of personal protective equipment (PPE) with the SM; and
- Leads the investigation of all accidents/incidents.

2.2.3 Site Safety Officer (SSO)

The Site Safety Officer is Amy Malsbary. The SSO responsibilities include the following:

- Ensures that the HASP is implemented and that all health and safety activities identified in site safety plans are conducted and/or implemented;
- Ensures that field work is scheduled with adequate personnel and equipment resources to complete the job safely and enforce site health and safety rules;
- Ensures that adequate communication between field crews and emergency response personnel is maintained;
- Ensures that field site personnel are adequately trained and qualified to work at the site and that proper PPE is utilized by field teams;
- Report all accidents/incidents to the PM and the CHSO;
- Stop work if necessary;
- Identifies operational changes which require modifications to health and safety procedures and to this HASP, and ensures that the procedure modifications are implemented and documented through changes to the HASP, with CHSO and National Grid approval;
- Direct and coordinate health and safety monitoring activities;
- Determines upgrades or downgrades of PPE based on site conditions and/or real-time monitoring results with CHSO and National Grid approval;
- Reports to the CHSO to provide summaries of field operations and progress.

2.2.4 Site Personnel

The Site Personnel responsibilities include the following:

- Report any unsafe or potentially hazardous conditions to the SSO;
- Maintain knowledge of the information, instructions and emergency response actions contained in the HASP;
- Comply with rules, regulations and procedures as set forth in this HASP and any revisions;
- Prevent admittance to work sites by unauthorized personnel;
- Inspect all tools and equipment, including PPE, prior to use;
- Stop work if necessary and,

- Ensures that monitoring instruments are calibrated.

The following Contractors may be selected for the implementation of the *Fulton Municipal Works Former MGP Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan (*Final PDI Work Plan).

Task	**Contractor**
Field Management and Implementation of The Fulton Municipal Works Former MGP Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan	GEI Consultants, Inc. 455 Winding Brook Drive, Suite 201 Glastonbury, CT 06033 (860) 368-5396 National Grid Program Manager: David Terry
	Subcontractor
Proposed Drilling Subsurface Soil Borings and Monitoring Well Installation	TBD
Proposed Cone Penetrometer Testing	TBD

A Contractor project-specific organization chart with contact information is included in **Appendix A**.

3. Site History and Project Description

3.1 Location

The Fulton Municipal Works Former MGP site is located in an industrial and commercial section of the Gowanus neighborhood of Brooklyn, New York. **Figure 1** in **Appendix B** shows the location of the Site. The Fulton former MGP site was subdivided in the years following decommissioning and the former plant is now comprised of six properties that encompass approximately 5.5 acres. The property addresses and parcel information for the properties of the Fulton former MGP site are listed below.

Fulton Former MGP Site

Address	Block	Lot
225 Nevins Street, Brooklyn, NY 11217	419	1
270 Nevins Street, Brooklyn, NY 11217	425	1
537 Sackett Street, Brooklyn, NY 11217	426	1
560 Degraw Street, Brooklyn, NY 11217	426	17
553 (aka 549) Sackett Street, Brooklyn, NY 11217	426	49

Fulton Former MGP Holder Site

Address	Block	Lot
191 3rd Avenue, Brooklyn, NY 11217	420	1

3.2 Site History and Current Site Conditions

The site history of the Fulton Municipal Works Former MGP and surrounding area was developed through the review of available Sanborn Fire Insurance (Sanborn) Maps and newspaper articles.

3.2.1 MGP History

The Fulton Municipal Gas Company was incorporated in March 1879 as documented in Brooklyn Union-A Centennial History. The Fulton MGP is first shown on the 1886 Sanborn Map. The MGP gas production facilities were isolated to 270 Nevins Street and consisted of coal gas production facilities including a retort house, an engine room, condenser rooms and a gasoline house. Gas storage and purification facilities including two gas holders, a governor house, purifying houses and a lime house were located to the southeast across Nevins Street on 537 Sackett Street and 560 Degraw Street. A hydrogen tank, a purge tank and naphtha tanks were located at 225 Nevins Street. By late 1888, the gas holder was constructed at 191 3rd Avenue. These structures are shown in Figure 2 of the Final PDI Work Plan. Based upon the age of their construction, these holders were likely pit style holders with sub-grade foundations.

In 1895, the Fulton Municipal Gas Company and others merged to form the Brooklyn Union Gas Company, a predecessor to KeySpan, a predecessor to National Grid. The 1904 Sanborn indicates that the MGP was referred to as the Brooklyn Union Gas Fulton Municipal Branch.

According to 1904 Sanborn maps, the gas production facilities at 270 Nevins Street remained relatively unchanged with the exception of the addition of a circular oil storage tank, underground oil tanks, and an aboveground tar separator. Two circular oil tanks and additional underground gas oil tanks were noted at 225 Nevins Street. By 1915, the MGP appears to have converted to water gas production as evidenced by the addition of generators and conversion of the retort house to a generator house at 270 Nevins Street. An additional oil storage tank was noted on the 225 Nevins Street property (Figure 2 of the Final PDI Work Plan).

The Fulton Former MGP ceased operation prior to 1938. The MGP structures were dismantled and vacant lots are shown in the 1938 Sanborn map.

3.2.2 Post MGP History

The Fulton MGP was subdivided and redeveloped for commercial, industrial, and recreational uses. A brief history of the post-MGP use was developed from available Sanborn maps and is presented below by current parcel address and tax lot.

- 225 Nevins Street [Block 419 Lot 1]: A Comfort Station is shown on the northern portion of the site in the 1950 and 1969 Sanborn Maps. By 1979, the pool and associated changing rooms were constructed. The parcel is currently Thomas Greene Playground.

- 270 Nevins Street [Block 425 Lot 1]: The current warehouse building was constructed by 1950. An underground gasoline tank is depicted on the 1950 Sanborn Map. By 1969, the building was occupied by T.E. Conklin Brass & Copper Company and utilized as a warehouse from at least 1969 until 1996 according to Sanborn maps.

- 537 Sackett Street [Block 426 Lot 1]: A warehouse/industrial building was constructed by 1950 and was occupied by the Majestic Metal Spinning and Stamping Company, Inc. from at least 1950 until 1982. By 1986, the property was occupied by the Adams Book Company which currently occupies the site. The remaining southern portion of the lot was developed with a warehouse in 1955 that operated until 1982. A commercial auto repair facility operated at the property from at least 1986 through 1996 according to Sanborn map information.

- 560 Degraw Street [Block 426 Lot 17] and 553 Sackett Street [Block 426 Lot 49]: The properties were utilized for used truck parking, truck wrecking, and truck sales from 1950 through 1995 based upon Sanborn map information.

- 191 3rd Avenue [Block 420 Lot 1]: The property was developed as a garage for the News Syndicate Inc. prior to 1951. The garage had a paint shop and underground gasoline storage tanks as part of the operations. The News Syndicate Inc. operated the garage from 1951 through 1995 according to Sanborn maps.

3.2.3 Current Site Conditions

The current site conditions and the surrounding area are shown on the aerial photograph in Figure 2 of the Final PDI Work Plan. As discussed above in the site history, the site was subdivided into six parcels. The current site conditions were summarized from the publicly accessible areas including sidewalks and Thomas Greene Playground. The interior conditions of the buildings were not accessed as part of the visit. As shown in the aerial photograph, the majority of the Fulton former MGP Site is either paved or developed with buildings. The site conditions of each parcel are summarized below.

Fulton Former MGP

Address	Current Owner	Block	Lot	Land Use Description
225 Nevins Street	New York City Parks and Recreation	419	1	Thomas Greene Playground which includes an asphalt-paved picnic area and playing courts to the east and concrete paved playing courts and 2 swimming pools with associated buildings to the west.
270 Nevins Street	270 Nevins St Property	425	1	Industrial-Factory Building
537 Sackett Street	ATS Realty Inc.	426	1	Industrial-Factory Building
560 Degraw Street	242 Nevins, Inc.	426	17	Commercial-Store Building - Automotive
553 (aka 549) Sackett Street	ATS Realty Inc.	426	49	Commercial-Vacant Land - Garage/Parking Lot

Fulton MGP Holder Site

Address	Block	Block	Lot	Land Use Description
191 3rd Avenue	595 Degraw, LLC.	420	1	Commercial-Garage

The Fulton MGP and surrounding area are zoned for manufacturing (M2-1), as a result the site is surrounded by commercial and manufacturing businesses. The Fulton MGP is bordered by the remainder of Thomas Greene Playground and Douglass Street to the north, Sackett Street and then properties with mixed use including transportation uses and residential apartments and industrial building to the south. To the east by the Gowanus Canal and a commercial truck facility and the former Fulton MGP Holder site to the west. Degraw Street bisects the Fulton Former MGP.

The Fulton Former MGP Holder Site is currently covered with a commercial garage building. The site is bounded by Third Avenue to the west and then Thomas Greene Playground, Douglass Street and then industrial use buildings and one multi-family building to the north, a vacant lot and garage are located to the east, Degraw Street and then industrial use buildings are located to the south.

The Fulton Former MGP is developed with buildings that are secured with locked entrances or fences with the exception of Thomas Greene Playground. The pool area of Thomas Greene Playground is secured with fences and locked gates. The remainder of the Playground is surrounded with a chain link fence with open entrances. The NYSDEC SC indicated that there is no exposure pathway for current users of the Playground. The property at 560 Degraw Street is secured with a chain link fence and gates.

3.3 Project Description

National Grid has retained GEI and other contractors as specified in Section 2 of the HASP to perform a Pre-Design Investigation program at the Fulton Municipal Works Former MGP Site in the Gowanus neighborhood of Brooklyn, New York. This Pre-Design Investigation (PDI) was prepared to investigate potential flowable tar and soil conditions for the design of an interim remedial measure (IRM).

The PDI scope of work described in the Final PDI Work Plan is intended to collect sufficient data to design a remedy for the Fulton Municipal Works MGP site.

The scope of the PDI sampling program is presented in the *Fulton Municipal Works Former MGP Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan* dated March 2012. A summary of the Pre-Design Investigation will include the following tasks:

- Pre-Design Investigation Activities
- Background Noise and Vibration Investigation
- Utility Survey and Subsurface Infrastructure Investigation
- Structural Survey of Adjacent Buildings
- Baseline Groundwater Model
- Evaluate the Suitability of Recovery Wells

The selected contractor will sample subsurface soils and install monitoring wells and temporary groundwater monitoring points. Soil borings, monitoring wells and temporary groundwater monitoring points are located within the Fulton Municipal Works Former MGP and outside of the MGP footprint within New York City street rights-of-way (ROWs).

4. Potential Site Hazards

This section presents an assessment of potential chemical, physical, and biological hazards that may be encountered during the project work. This section also includes an activity hazard analysis (AHA) to assess and control potential site hazards for each general project task.

4.1 Chemical Hazards

The characteristics of compounds that may be encountered at the Site are discussed below in the following subsections for informational purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below. Chemical characteristics and potential exposure information for the compounds that may be encountered during site activities are presented in Table 4-1 below. Material safety data sheets (MSDS) for commonly used compounds and compounds that may be encountered during the Pre-Design investigation activities are located in **Appendix C.**

4.1.1 Volatile Organic Compounds (VOCs)

Volatile organic chemicals (VOCs), such as benzene, toluene, ethyl benzene, and xylene (BTEX) are potentially present within subsurface soils and groundwater at the Site because of its former use for manufactured gas manufacturing and storage. In some cases, the chemical components may be present in non-aqueous phase liquids (NAPL) such as fuels, oils, or tar within subsurface soils at the Site. These compounds generally have a depressant effect on the central nervous system (CNS), may cause chronic liver and kidney damage, and some are suspected human carcinogens. Benzene is a known human carcinogen. Acute exposure may include headache, dizziness, nausea, and skin and eye irritation. The primary route of exposure to VOCs is through inhalation, and therefore air monitoring and respiratory protection is the primary control against exposure to VOCs.

Air monitoring will be completed as specified in Section 8.0 to minimize airborne exposures. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the Final PDI Work Plan and **Appendix D** of this HASP. Exposure through direct contact is possible and will be minimized through the use of PPE as prescribed in Section 6.0.

4.1.2 Coal Tar and Oil Products

Coal tar and petroleum products contain semi-volatile organic compounds (SVOCs). SVOCs consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene,

benzo(e)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methyl naphthalene, naphthalene, phenanthrene, phenols, pyrene and other compounds.

Coal tar products, petroleum products, and other SVOCs are potentially present within subsurface soils and groundwater at the site. Coal tar products within subsurface soils may have been associated with the former gas storage. Petroleum products within subsurface soils could be associated with commercial/manufacturing activities.

Coal tar products such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Coal tar is considered to be very toxic, if ingested. High levels of exposure to coal tar, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney, and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever anemia, liver damage, vomiting convulsions, and coma. Poisoning may occur by ingestion of large doses, inhalation, or skin absorption.

The major route of exposure of SVOCs during work activities to be conducted at this Site is through direct contact. Exposure is most likely when handling soil, and groundwater samples. Exposure through direct contact is possible and will be minimized through the use of PPE as prescribed in Section 6.0. Inhalation of SVOCs may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne or through the volatilization of naphthalene. Air monitoring will be completed as specified in Section 8.0 to minimize airborne exposures. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the Final PDI Work Plan and **Appendix D** of this HASP.

4.1.3 Heavy Metals

The subsurface soil may contain elevated levels of metals including: arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium, and zinc.

As with SVOCs, the primary route of metal exposure is through inhalation of dust particles when subsurface soils are disturbed and become airborne. Air monitoring will be completed as specified in Section 8.0 to minimize airborne exposures during subsurface soil investigations. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the Final PDI Work Plan and **Appendix D** of this HASP.

4.1.4 Asbestos-Containing Materials

Asbestos containing materials (ACM) can be present at investigation sites in the form of demolition debris, ACM pipe insulation, and asbestos cement pipe. Chronic exposure to asbestos may cause asbestosis and mesothelioma. The primary route of exposure for asbestos is inhalation during the disturbance and/or removal of asbestos from the pipe insulation and cement pipes.

Asbestos is strictly regulated under OSHA 29 CFR 1910.1001/1926.1101. Employees that may be potentially exposed to ACM must participate in a medical surveillance program, have specific training in the hazards and controls of exposure to asbestos and wear respirators with high-efficiency particulate air (HEPA) filters. All work must be conducted in demarcated regulated areas to minimize the amount of people within the exposure area. Employers must conduct air sampling and provide signs and labels regarding the presence of asbestos.

4.1.5 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) may be of potential concern based on previous land uses at the Site. PCBs have historically been used from a number of sources including, but not limited to; electrical systems, hydraulic oils, lubricants, cutting oils, printer's ink, and asphalt. Exposure to PCBs can occur through unbroken skin without immediate pain or irritation. Acute affects of PCB exposure can include eye, skin, nose, and throat irritation. Chronic effects of PCB exposure can include skin swelling and redness, gastro-intestinal disturbances, and neurological effects such as headache, dizziness, nervousness and numbness of extremities. PCBs are suspected human carcinogens that can cause liver cancer. PCBs can accumulate in fatty tissues and result in health effects after the initial exposure has occurred. The primary route of exposure for PCBs is inhalation, dermal contact, and ingestion.

4.1.6 Cyanide

Cyanide compounds are common by-products of manufactured gas production but are also used in rat poisons, silver and metal polish, photographic solutions, fumigating solutions, and electroplating solutions. Hydrogen cyanide is toxic because it is a chemical asphyxiant. It replaces the oxygen in the blood and thereby suffocates the cells.

Ferrocyanides (which are associated with purifier waste from gas manufacture) are not considered toxic because the hydrogen cyanide ion is bound tightly to the iron and cannot therefore replace the oxygen. It takes a great amount of heat and/or acid to release hydrogen cyanide gas from the ferrocyanide molecule. However, it is National Grid policy to monitor for hydrogen cyanide during earth-disturbing activities at sites where MGP-related contaminants have been found. Air monitoring will be completed as specified in Section 8.0 to minimize airborne exposures during subsurface soil investigations.

4.1.7 Hydrogen Sulfide

Hydrogen sulfide is a by-product of manufactured gas production and is also associated with the breakdown of sewage by bacteria in sewer pipes. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. These symptoms usually go away in a few weeks. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Breathing very high levels (>800 ppm) of hydrogen sulfide can cause death within just a few breaths. The primary route of exposure is through inhalation, and therefore respiratory protection is the primary control against exposure to hydrogen sulfide. Air monitoring will be completed as specified in Section 8.0 to minimize airborne exposures during subsurface soil investigations.

4.1.8 Pesticides

The Gowanus Canal sediments contained elevated concentrations of pesticides including DDT. These compounds are summarized in the EPA data included in **Appendix E**. It does not appear that pesticides are of concern from the previously detected concentrations of pesticides in sediments.

4.1.9 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when PPE must be upgraded or changed. Action levels for volatile organic compounds and associated contingency plans for the work zone are discussed within Section 8.0 of this Health and Safety Plan. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the Final PDI Work Plan and **Appendix D** of this HASP.

Exposure to organic vapors shall be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photoionization detector (PID) or a flame ionizing detector (FID)
- When possible, engineering control measures will be utilized to suppress the volatile organic vapors. Engineering methods can include utilizing a fan to promote air circulation, utilizing volatile suppressant foam, providing artificial ground cover, or covering up the impacted material with a tarp to mitigate volatile odors.
- When volatile suppression engineering controls are not effective and organic vapor meters indicate concentrations above the action levels, then appropriate respiratory protection (i.e. air purifying respirator with organic vapor cartridge) will be employed.

Table 4-1 Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Asbestos	1332-21-4	0.1 f/cc	0.1 f/cc over 8 hr period or 1.0f/cc over 30 min.	Inhalation Ingestion Skin Contact	Asbestosis (chronic exposure); mesothelioma, breathing difficulty, interstitial fibrosis' restricted pulmonary function, finger clubbing; irritate eyes, potential carcinogen	Respiratory system, eyes	White, greenish, blue, or gray-green fibrous solids FP: NA IP: NA LEL: NA UEL NA VP: 0 mm
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3 A.L. 0.5mg/m3	Inhalation Skin Absorption Ingestion Skin Contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyper pigmentation of skin, potential carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 ppm TWA 5 ppm STEL	Inhalation Skin Absorption Ingestion Skin Contact	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea; staggering gait, fatigue, anorexia, weakness, dermatitis, bone marrow depression, potential carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12° F IP: 9.24 eve LEL: 1.2% UEL:7.8% VP: 75 mm
Ethyl benzene	100-41-4	100 ppm	100 ppm	Inhalation Ingestion Skin Contact	Eye, skin, mucous membrane irritation; headache; dermatitis, narcosis; coma	Eyes, skin, respiratory system, CNS	FP: 55° F IP: 8.76 eV LEL: 0.8% UEL:6.7% VP: 7 mm
Hydrogen cyanide	74-90-8	4.7 ppm (5 mg/m^3) STEL [skin]	10 ppm (11 mg/m^3) [skin]	Inhalation Ingestion Absorption Skin/Eye Contact	Asphyxia; weakness, headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes	CNS, CVS, thyroid, blood	Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. VP: 630 mmHg IP: 13.60 eV

Table 4-1 Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/Eye Contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, CNS	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm IP: 10.46 eV
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m^3	Inhalation Ingestion Skin Contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, CNS, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m^3	Inhalation Ingestion Skin Contact Skin Absorption	Irritates eyes and skin, chest pain, cough, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, Gastrointestinal disturbance, weight loss, proteinuria	Eyes, skin, respiratory tract, central nervous system	Silver-white, heavy odorless liquid FP: NA IP: unknown LEL: NA UEL:NA VP: 0.0012 mm
PAH's as Coal tar pitch Volatiles (CTPV)	65996-93-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Skin contact Ingestion	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory system, CNS, liver, kidneys, skin, bladder, carc	Black or dark brown amorphous residue.

Table 4-1 Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
PCBs	11097-69-1	0.5 mg/m^3 (Skin)	0.5 mg/m^3 (Skin)	Inhalation Skin Absorption Ingestion Skin Contact	Irritate eyes; chloracne; liver damage;	Skin, eyes, liver, reproductive system	Colorless liquid or solid with a mild, hydro-carbon odor VP = 0.00006 mm
Phenol	108-95-2	10 ppm (skin)	5 ppm (19 mg/m^3) [skin]	Inhalation Skin Absorption Ingestion Skin Contact	Irritates eyes, nose, throat, anorexia, weight loss, weakness, muscle ache, pain, dark urine, cyanosis, liver and kidney damage, skin burns, dermatitis, tremors, convulsions, twitching,	Eyes, skin, respiratory system, liver, kidneys	Colorless to light pink crystalline solid with sweet, acrid odor. FP:175 ^{o}F IP:8.5 LEL:1.8% UEL: 8.6% VP: 0.4 mm
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Ingestion Skin Contact	Irritant to eyes, skin, nose and throat, visual disturbance, headache, chills, fever, breathing difficulty, bronchitis, metallic taste, garlic breath, GI disturbance, dermatitis, eye and skin burns,	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amphorous or crystalline, red to gray solid FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Toluene	108-88-3	50 ppm	200 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, nose irritation; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, tearing of eyes; nervousness, muscle fatigue, insomnia, tingling in limbs; dermatitis	Eyes, skin, respiratory system, CNS, liver, kidneys	FP: 40°F IP: 8.82 eV LEL: 1.1% UEL:7.1% VP: 21 mm
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; incoordination, staggering gait; corneal damage; appetite loss, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, CNS, GI tract, blood, liver, kidneys	FP: 90°F IP: 8.56 eV LEL: 0.9% UEL: 6.7% VP: 9 mm

Table 4-1 Chemical Data	
Abbreviations	
C = ceiling limit, not to be exceeded	LEL = Lower explosive limit
CNS = Central Nervous System	mm = millimeter
CVS = Cardiovascular System	ppm = parts per million
eV = electron volt	Skin = significant route of exposure
FP = Flash point	STEL = Short-term exposure limit (15 minutes)
IP = Ionization Potential	TWA = Time-weighted average (8 hours)
GI = Gastro-intestinal	UEL = Upper explosive limit
A.L. = Action Level	VP = vapor pressure approximately 68° F in mm Hg (mercury)

4.1.10 Evaluation of Respirable Dust Inhalation

Inhalation of respirable dust containing metals, asbestos, and SVOCs is possible when surrounding ground cover is disturbed by heavy equipment, conducting demolition work, or using power tools on surfaces that contain these materials. Contaminated particulate matter (soil, pavement, lead paint, insulation, etc.) becomes suspended in air due to a combination of factors including lack of vegetative cover and/or dry or dusty conditions. Air monitoring reduces the risk of overexposure to respirable dust inhalation by indicating when action levels have been exceeded and when PPE must be upgraded or changed. Action levels for respirable dust and associated contingency plans for the work zone and perimeter of the Site are discussed within Section 8.0 of this HASP. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the Final PDI Work Plan and **Appendix D** of this HASP.

Control of respirable dust will be conducted at this Site as follows:

- When possible, dust control measures will be utilized to suppress the dust. These methods include wetting down the area, providing artificial ground cover, or covering up the material with a tarp.
- When dust suppression is not possible and respirable dust meters indicate concentrations above the action levels, a HEPA Filter must be used to prevent against inhalation of contaminated dusts.

4.1.11 Evaluation of Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of proper hygiene practices, PPE, and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves, safety glasses) as described in Section 6.0 will be worn for all activities where contact with potential contaminated media or materials are expected.

4.1.12 Other Chemical Hazards

Chemicals not identified in this HASP may be used during the Pre-Design Investigation activities. Prior to the initiation of any on-site tasks, GEI and its Subcontractor or Consultant will provide Material Safety Data Sheets to the SSO for each of the chemicals to be used. The MSDS's will be maintained at the Site by the SSO and all site workers and visitors who may potentially be exposed to the chemicals will be made aware of these hazards and the location of the on-site MSDS's during a hazard briefing session by the SSO.

4.2 Physical Hazards

4.2.1 High Loss Potential Physical Hazards

Activities to be conducted at the Site may involve operations that have the potential for a serious injury to occur, and can include the following:

- Lockout/Tag out
- Heavy Equipment Operation
- Excavation and Trenching
- Confined Space Entry
- Line Breaking
- Work within a Temporary Structure

Subsurface utilities will likely be located in the vicinity of the subsurface soil borings.

4.2.1.1 Lockout-Tag out

Site personnel will assume that all electrical equipment at surface, subsurface, and overhead locations is energized, until the equipment has been designated as de-energized by a National Grid representative. If the equipment cannot de-energized, then work will stop and the SSO will consult with the PM and CHSO. GEI will notify National Grid prior to working adjacent to this equipment, and will verify that the equipment is energized or de-energized in the vicinity of the excavation location.

All power lines, which have been indicated by National Grid to be de-energized must be locked out, such that the lines cannot be energized when personnel are working near them. The lines will not be unlocked and re-energized until the Contractor notifies National Grid that they have completed work in the area and that all personnel are clear of the area. National Grid representatives will thoroughly familiarize GEI personnel with site-specific lockout/tagout procedures during the site orientation.

If power lines cannot be de-energized, the SSO will consult with the local utility provider safety personnel to determine the safe working distance from the energized line. Work tasks will only commence after determination that a safe working distance can be maintained and all personnel working in the area have been informed of the limitation.

4.2.1.2 Heavy Equipment Operation

Heavy equipment will be operated under the following conditions:

- The operation of heavy equipment will be limited to authorized personnel specifically trained in its operation. Subcontractor site supervisors must provide this information to the SSO.
- Equipment will be inspected daily to ensure that there are no exposed belts, fans, etc.

- When not in use, hydraulic and pneumatic components will be left in down or "dead" position.
- Roll-over protection will be provided on hilly terrain.
- Maintain all emergency shut-offs in sound working condition.
- The operator will use the safety devices provided with the equipment, including seat belts. Backup warning indicators and horns will be operable at all times.
- While in operation, all personnel not directly required in the area will keep a safe distance from the equipment.
- Personnel directly involved in activity will avoid moving in the path of operating equipment or any portion thereof. Areas blinded from the operator's vision will be avoided. Spotters will be used when personnel may be in areas where the operator's view is obstructed.
- Additional riders will not be allowed on equipment unless it is specifically designed for that purpose.

4.2.1.3 Excavation and Trenching

The safety requirements for each excavation must be determined by a competent person who is capable of identifying existing and predictable hazards and work conditions that are unsanitary, hazardous, or dangerous to employees. The competent person must also have the authorization to take prompt corrective measures to eliminate unsatisfactory conditions.

Subsurface utilities will likely be located in the vicinity of the PD investigation points.

The following are general requirements for work activities in and around excavations:

- Prior to initiation of any excavation activity (or ground intrusive activity, such as drilling), the location of underground installations will be determined. The New York State one-call center will be contacted by the Drilling Subcontractor a minimum of 72 hours prior to excavation activities. It may also be necessary to temporarily support underground utilities during excavation.
- When excavations approach the estimated location of underground installations, the exact location of the underground installations will be determined by means that are safe to workers, i.e., hand dig, test pits, etc.
- All excavations will be inspected daily by the competent person prior to commencement of work activities. Evidence of cave-ins, slides, sloughing, or surface cracks or excavations will be cause for work to cease until necessary precautions are taken to safeguard employees.
- Excavated and other materials or equipment that could fall or roll into the excavation will be placed at least five feet from the edge of the excavation.

- Vehicular traffic and heavy equipment will remain at least four feet from the face of the excavation.
- All excavation operations will cease immediately during hazardous weather conditions such as high winds, heavy rain, lightning and heavy snow.

4.2.1.4 Excavation Entry Safety

No GEI personnel will enter a trench or excavation that is greater than four feet deep.

4.2.1.5 Working within a Temporary Enclosure

Work within a temporary enclosure is not anticipated for this site.

4.2.2 Line Breaking

During line breaking activities, the potential exists for exposure to suspect asbestos containing materials (ACM). If suspect ACM is encountered, work will stop and will not resume until asbestos trained personnel have been upgraded to the proper PPE, and water is available to keep the work area and the suspect ACM wetted. All workers are to have completed asbestos awareness training prior to working with suspect ACM. The project management team (National Grid Project Manager, GEI Project Manager, and Sub-Contractor Project Manager and CHSO) is to be notified if suspect ACM is encountered.

4.2.3 Fire and Explosion

Subsurface utilities including gas lines and electrical lines may be located in the vicinity of the subsurface soil borings.

When conducting excavating activities, the opportunity of encountering fire and explosion hazards also exists from contamination in the soils and the possibility of free product in the underground structures and pipelines. Additionally, the use of diesel–powered excavating equipment could present the possibility of encountering fire and explosion hazards.

4.2.4 Cold Stress

At certain times of the year, workers may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia as well as slippery surfaces, brittle equipment, poor judgment and unauthorized procedural changes. The procedures to be followed are found in **Appendix F**, the Cold Stress Program.

4.2.5 Heat Stress

Heat stress is a significant potential hazard, which is greatly exacerbated with the use of PPE in hot environments. The potential hazards of working in hot environments include dehydration, cramps, heat rash, heat exhaustion, and heat stroke. A heat stress prevention program will be implemented when ambient temperatures exceed 70ºF for personnel

wearing chemical protective clothing. The procedures to be followed are found in **Appendix G**, the Heat Stress Program.

4.2.6 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps and generators. Site workers who will perform suspected high noise tasks and operations for short durations (less than one hour) will wear earplugs. If deemed necessary by the SSO, the CHSO will be consulted on the need for additional hearing protection and the need to monitor sound levels for site activities. Other workers who do not need to be in proximity of the noise should distance themselves from the equipment generating the noise.

4.2.7 Hand and Power Tools

In order to complete the various tasks for the project, personnel will utilize hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Work gloves, safety glasses, and hard hats will be worn by the operating personnel at all times when utilizing hand and power tools and Ground Fault Circuit Interrupter (GFCI)-equipped circuits will be used for all power tools.

4.2.8 Slips, Trips, and Falls

Working in and around the Site will pose slip, trip, and fall hazards due to slippery surfaces that may be oil covered, or from surfaces that are wet from rain or ice. Excavation at the Site will cause uneven footing in the trenches and around the spoil piles. GEI will employ good work practice and housekeeping procedures to minimize the potential for slip, trip, and fall hazards.

4.2.9 Manual Lifting

Manual lifting of heavy objects such as sections of pipe may be required. Failure to follow proper lifting technique can result in back injuries and strains. Site workers should use power equipment to lift heavy loads whenever possible and should evaluate loads before trying to lift them (i.e. they should be able to easily tip the load and then return it to its original position). Carrying heavy loads with a buddy and proper lifting techniques include: 1) make sure footing is solid, 2) make back straight with no curving or slouching, 3) center body over feet, 4) grasp the object firmly and as close to your body as possible, 5) lift with legs, and 6) turn with your feet, don't twist. In addition, hand digging may present lifting/ergonomic hazards.

4.2.10 Steam, Heat, Splashing

Exposure to steam/heat/splashing hazards can occur during steam cleaning activities. Exposure to steam/heat/splashing can result in scalding/burns, eye injury, and puncture wounds. Proper PPE will be worn during all steam cleaning activities including rain gear or Tyvek®, hardhat equipped with splashguard, and water resistant gloves and boots.

4.2.11 Boat Safety

Part of the PDI work may be conducted on a sampling vessel and/or, if needed, a barge within the Gowanus Canal. Personnel will board the barge at specified locations to be determined and agreed upon by National Grid and GEI. Safe access, as specified by USACE Safety and Health Requirements Manual (EM) 385-1-1, Section 19.B, will be provided by GEI to board and get off the barge.

Personnel may be transported between the shore of the canal and the barge using a separate support boat. The support boat will be used as a safety boat and will be available at all times at the barge to transport all personnel (three to four) from the barge. The support boat can accommodate the entire crew and will have safety equipment as specified in EM 385-1-1, Section 05.J.04 onboard [2 oars, oar locks, boat hook, ring buoy with attached line, and Type III Personal Flotation Devices (PFDs) for boat/barge occupants]. The PFDs will be worn at all times when working over water. The gunwale of the support boat is just below the level of the deck of the barge such that access between these vessels can be by stepping from one to the other.

For retrieving a person overboard, GEI or the contractor will throw a life ring and line, and use a ladder attached to the barge or the support boat step transom to allow the person to climb out of the water. For retrieving a person overboard, the support boat will also be equipped with a life ring attached to approximately 90 feet of rope. The barge and the support boat will be equipped with an ABC rated fire extinguisher(s).

Emergency procedures for fire and man overboard will be reviewed on the first day of operations and any time a change of personnel occurs.

4.2.12 Personal Safety

Field activities have the potential to take site workers into areas which may pose a risk to personal safety. The following websites (sources) have been researched to identify potential crime activity in the area of the project:

- http://www.nyc.gov/html/nypd/html/crime_prevention/crime_statistics.shtml

In the two precincts that the site covers, (76th and 78th), there have been two sexual assaults, fourteen robberies, eight felony assaults, nineteen burglaries, thirty five grand larcenies, and one grand larceny auto reported in the area over the past 28 days. Statistics indicate that the primary form of crime in New York, NY is larceny or theft. Robbery, aggravated assault, and all violent crime categories are above the national average.

To protect yourself, take the following precautions:

- Use the buddy system (teams of a minimum of two persons present);
- Let the SSO know when you begin work in these areas and when you leave;
- Call in regularly;
- Pay attention to what is going on around you; and
- If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely.

Site workers must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If site workers encounter hostile individuals or a confrontation develops in the work area, suspend work activities, immediately leave the area of concern, and contact local 911 for assistance. Notify the SSO and CHSO of any incidents once you are out of potential danger.

In the event of an emergency, prompt communications with local emergency responders is essential. At least one charged and otherwise functioning cell phone to facilitate emergency communications will be on site. Confirmation of cellular phone operation and site worker safety will be confirmed at the start, mid-point, and near the end of each working day.

4.3 Biological Hazards

During the course of the project, there is a potential for workers to come into contact with biological hazards such as animals, insects, plants, and sewage. Workers should be aware of these potential hazards that are discussed below.

4.3.1 Animals

During the conduct of site operations, wild animals such as stray dogs or cats, raccoons, and rats may be encountered.

Workers will use discretion and avoid all contact with wild animals. If these animals present a problem, efforts will be made to remove these animals from the Site by contacting a licensed animal control technician.

4.3.2 Insects

Insects, including bees, wasps, hornets, mosquitoes, ticks, and spiders, may be present at the Site making the chance of a bite possible. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life threatening condition. Some insect bites can transmit diseases such as Lyme Disease or a virus such as West Nile; any individuals who have been bitten or stung by an insect should notify the SSO. The following is a list of preventive measures:

- Apply insect repellent prior to performing any field work and as often as needed throughout the work shift
- Wear proper protective clothing (work boots, socks and light colored pants)
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible
- Field personnel who may have insect allergies will have bee sting allergy medication on site and should provide this information to the SSO prior to commencing work.

4.3.2.1 Lyme Disease

Lyme disease is caused by infection from a deer tick that carries a spirochete. During the painless tick bite, the spirochete may be transmitted into the bloodstream often after feeding on the host for 12 to 24 hours. The ticks that cause the disease are often no bigger than a poppy seed or a comma in newsprint. The peak months for human infection are from May to September.

Symptoms appear in three stages. First symptoms usually appear from two days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick was attached. The rash is often bulls-eye like with red on the outside and clear in the center. The rash may be warm, itchy, tender, and/or "doughy." Unfortunately, this rash appears in only 60 to 80% of infected persons. An infected person also has flu-like symptoms of a stiff neck, chills, fever, sore throat, headache, fatigue and joint pain. These symptoms often disappear after a few weeks. The second stage symptoms, which occur weeks to months later include meningitis, severe headache, drooping of the muscles on the face, called Bell's Pals, encephalitis, numbness, withdrawal and lethargy. These symptoms may last for several weeks to several months. Third stage symptoms, which occur months or years later include arthritis, heart problems, and loss of memory. The third stage symptoms may mimic multiple sclerosis and Alzheimer's disease.

It is recommended that personnel check themselves when in areas that could harbor deer ticks, wear light color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a tick is found biting an individual, the SSO

should be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. If tweezers are not available, cover your fingers (e.g., tissue paper) and use to grasp the tick. It is important to grasp the tick as close to the site of attachment and use a firm steady pull to remove it. Wash hands immediately after with soap and water. The affected area should then be disinfected with an antiseptic wipe. All mouth parts must be removed from the skin. If the tick is removed with breaking off the mouth parts, an irritation or infection may occur. Also, the organism that is causing the disease can still enter the body through the skin. The employee will be offered the option for medical treatment by a physician, which typically involves antibiotics. If personnel feel sick or have signs similar to those above, they should notify the SSO immediately. Treatment with antibiotics is effective and recovery is usually complete. In the first stage antibiotics are usually given orally. Second and third stage treatment, however is prolonged and recovery may take longer. Antibiotic treatment is usually provided intravenously for second and third stage Lyme disease.

4.3.2.2 West Nile Virus

West Nile Virus (WNV) is a mosquito-borne infection transmitted through the bite of an infected mosquito. The symptoms of WNV can be asymptomatic (no symptoms) or in more serious cases can lead to West Nile Fever. West Nile Fever can include fever, headache, tiredness, body ache, an occasional rash on the trunk of the body, and swollen lymph glands, In severe cases, people have developed West Nile encephalitis or meningitis which symptoms include fever, headache, neck stiffness, tremors, coma and in some cases death. The incubation period for the disease is usually two to 15 days. The symptoms can range from a few days to several weeks.

Since the initial outbreak in 1999, the virus has spread rapidly throughout New York State. There are about 65 different species of mosquitoes in New York State, but only a small percentage has been associated with the WNV. Most mosquitoes are not infected and the chance of infection from a mosquito bite of an on-site worker is very small. All residents of areas where virus activity has been identified are at risk of getting WNV, but those of the highest risk for becoming seriously ill from WNV are people are over 50 and individuals with some immunocompromised person (transplant patients).

The following precautions will be used to help reduce the risk of mosquito bites:

- Reduce mosquito-breeding areas by making sure wheelbarrows, buckets, and other containers are turned upside down when not used so that they do not collect standing water.
- Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many mosquitoes are most active (between dawn and dusk).

- Use mosquito repellant according to the manufacturer's directions when outdoors for long periods of time and when mosquitoes are most active.

4.3.3 Plants

The potential for contact with poisonous plants exists when performing fieldwork in undeveloped and wooded areas. Poison ivy, sumac, and oak may be present on site. Poison ivy can be found as vines on tree trunks or as upright bushes. Poison ivy consists of three leaflets with notched edges. Two leaflets form a pair on opposite sides of the stalk, and the third leaflet stands by itself at the tip. Poison ivy is red in the early spring and turns shiny green later in the spring. Poison sumac can be present in the form of a flat-topped shrub or tree. It has fern-like leaves, which are velvety dark green on top and pale underneath. The branches of immature trees have a velvety "down." Poison sumac has white, "hairy" berry clusters. Poison oak can be present as a sparingly branched shrub. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches. Prophylactic application of Tecnu® may prevent the occurrence of exposure symptoms. Post exposure over the counter products are available and should be identified at the local pharmacist. Susceptible individuals should identify themselves to the SSO.

Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. If you believe you have contacted one of these plants, immediately wash skin thoroughly with soap and water, taking care not to touch your face or other body parts.

4.3.4 Blood Poisoning

Blood poisoning is a term used to indicate a large number of bacteria present in the circulating blood. The most common symptom of blood poisoning is the reddening of skin which advances toward the heart. For example, if the point of contact is the hand, then a red line will appear at the hand and extend up the arm towards the heart.

Signs and symptoms include swelling, stiffness and tenderness in the affect area, fatigue chills and fever, pustules, abscesses. If allowed to progress without treatment, the organisms may multiply and cause an overwhelming infection which can lead to death.

Personal protective equipment will be worn to prevent direct contact with equipment that may be contaminated with bacteria such as well caps and soil.

4.3.5 Sewage and Bacterial Impacted Sediments

The Gowanus Canal has served as a combined sewer overflow and consequently has received untreated sanitary sewage from numerous outflows throughout the canal. Decomposed sewage will potentially be encountered within canal sediments and surface water. The GEI investigation identified elevated concentrations of bacteria in canal

sediments. GEI investigation data is located in **Appendix E**. Bacteria species identified in the Gowanus Canal sediments were associated with sewage and can cause illness if ingested or direct contact. Personal protective equipment as specified in Section 6.0 will be worn to minimize potential exposures. Personnel will use decontamination procedures identified in Section 10.0

4.4 Hazard Analysis

This section includes an AHA to assess and control potential site hazards for each general project task. This Project-specific AHA addresses the health and safety hazards of each specific project task or operation and includes requirements and procedures for worker protection.

WORK TASK	POTENTIAL HAZARDS	CONTROLS
Activity: Pre-Investigation and Utility Clearance		
Site Mobilization/Activity	Biological Hazards.	Proper clothes, body inspections, insect repellant.
	Slip, Trip, Fall Hazards	Identify and repair potential tripping hazards. Maintain safe and orderly work areas. Wear safety boots with proper support.
	Traffic Hazards	Use traffic cones, signage, and high visibility reflective vests in accordance with New York City Traffic Regulations. Use a traffic spotter.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Noise	Distancing form noise, hearing protection.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
Activity: Sediment Boring and Sample Collection		
Moving barge to exploration locations; set up barge to sample by lowering anchors.	Interaction with other boat traffic	Wear personal flotation device (PFD). Follow USCG Safe Boating Practices located in **Appendix H**.
	Drowning	
Advancing borings and sampling.	Subsurface hazards (utilities especially)	Contact One Call Center. Visually confirm clearance from known utilities.
	Contact with equipment, especially moving parts. Overhead hazards (rods)	Stay alert and maintain suitable clearance from moving and overhead equipment. Do not wear loose clothing, jewelry, or equipment, which could get caught by moving equipment. Inspect equipment daily. Train all personnel on use of emergency shutoff switches.
	Weather related equipment hazards (slippage in rain, lightning)	Cease operations prior to and during electrical storms. Cease operations if equipment cannot be operated safely under wet conditions.
	Slip/trip/fall	Keep trafficked areas on boat or barge free of slip/trip/fall hazards. Wear safety boots with proper support.

WORK TASK	POTENTIAL HAZARDS	CONTROLS
Advancing borings and sampling (continued)	Drowning	Use personal flotation device (PFD).
	Loud noise (outboard motor, generator, VC sampler)	Use hearing protection during the operation of equipment that produces loud noise.
	Contact with contaminated sediments	Wear protective coveralls (e.g. Tyvek®) with shoe covers, nitrile gloves, safety glasses and face shield when handling samples. Dispose of gloves after sampling. If exposed to the sediments or surface waters of the canal, wash the exposed skin immediately with anti-bacterial wipes/ gel and wash with soap and water. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated sediments	Use work zone air monitoring equipment including photo ionization detector and multiple gas meter (that monitors % oxygen, lower explosive limit, hydrogen sulfide and hydrogen cyanide) to monitor the works zone as specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then upgrade to half or full face respirator as indicated in Section 6.0 of the HASP.
Lift and secure anchors. Relocate to next exploration location.	Heavy lifting	Use proper lifting technique. Stay alert to moving or overhead equipment. Keep trafficked areas on boat or barge free of slip/trip/fall hazards. Wear flotation vest Anchoring equipment and boat deck will be rinsed to remove accumulated sediments prior to demobilization from the canal at the end of the day.
	Slip/Trip/Fall	
	Drowning	
Activity: Sediment Core Handling		
Opening Cores / Collecting Samples	Cuts or abrasions (cutting aluminum or acetate core barrel)	Wear Kevlar or leather gloves over nitrile gloves.
	Loud noise (generator)	Use hearing protection if working near the generator. Stage generator away from work area.
	Electrical Hand Tools (cutting aluminum or acetate core barrel).	Ensure electrical equipment is in good condition and is connected to a Ground Fault Circuit Interrupter (GFCI). Do not operate electrical equipment when exposed to moisture.
	Weather related equipment hazards (slippage in rain, lightning).	Cease operations prior to and during electrical storms. Cease operations if equipment cannot be operated safely under wet conditions.
	Slip/Trip/Fall	Keep trafficked areas on boat or barge free of slip/trip/fall hazards.
	Loud noise (outboard motor, generator, VC sampler).	Use hearing protection during the operation of equipment that produces loud noise.
	Contaminant contact.	Wear protective coveralls (e.g. Tyvek®) with shoe covers, nitrile gloves, safety glasses and face shield when handling samples. Dispose of gloves after sampling. If exposed to the sediments or surface waters of the canal, wash the exposed skin immediately with anti-bacterial wipes/ gel and wash with soap and water. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.

WORK TASK	POTENTIAL HAZARDS	CONTROLS
Opening Cores / Collecting Samples (continued)	Exposure to vapors from contaminated sediments	Use work zone air monitoring equipment including photo ionization detector and multiple gas meter (that monitors % oxygen, lower explosive limit and hydrogen cyanide) to monitor the works zone as specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, implement engineering control and upgrade to half or full face respirator as indicated in Section 6.0 of the HASP.
	Heavy lifting	Use proper lifting technique. Stay alert to moving or overhead equipment. Keep trafficked areas free of slip/trip/fall hazards.
	Slip/Trip/Fall	
	Drowning	
Activity: Subsurface Boring / Monitoring Well Installation and Sample Collection		
Subsurface Boring / Monitoring Well Installation and Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hats, steel toed/shank safety boots, hearing protection.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing from noise, hearing protection.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Contaminant Contact	Wear protective coveralls (e.g., Tyvek®) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling samples. Dispose of gloves after sampling. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hats, steel toed/shank safety boots, hearing protection.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
Activity: Surface Soil Sample Collection		
Surface Soil Sample Collection	Contaminant Contact	Wear nitrile gloves, and safety glasses when installing points. Dispose of gloves after installation. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photoionization detector. If air monitoring action levels are exceeded, then engineering controls will be implemented.

WORK TASK	POTENTIAL HAZARDS	CONTROLS
Activity: Groundwater Sampling and Hydraulic Conductivity Testing		
Groundwater Sampling and Hydraulic Conductivity Testing	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Contaminant Contact	Wear nitrile gloves when sampling points. Dispose of gloves after installation. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated groundwater	Use work zone air monitoring equipment including photo-ionization detector. If air monitoring action levels are exceeded, then engineering controls will be implemented.
Activity: Survey		
Survey	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Traffic Hazards	Use traffic cones, signage, and high visibility reflective vests as needed.
Activity: Test Pit Installation and Sample Collection		
Test Pit Installation and Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hearing protection.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing form noise, hearing protection.
	Traffic Hazards	Use traffic cones, signage, and high visibility reflective vests in accordance with New York City Traffic Regulations. Use a traffic spotter.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Contaminant Contact	Wear protective coveralls (e.g., Tyvek®) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling samples. Dispose of gloves after sampling. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.

WORK TASK	POTENTIAL HAZARDS	CONTROLS
Test Pit Installation and Sample Collection (continued)	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photoionization detector and multiple gas meter (that monitors % oxygen, lower explosive limit, hydrogen sulfide and hydrogen cyanide), and dust monitor to monitor the workzone as specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then engineering controls will be implemented. If excursions of the action levels persist, then upgrade to half or full face respirator with HEPA/organic vapor cartridge as indicated in Section 6.0 of the HASP. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the Final PDI Work Plan and **Appendix D** of this HASP.
Activity: Soil Vapor Point Installation and Sampling		
Soil Vapor Point Installation and Sampling	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing form noise, hearing protection.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Contaminant Contact	Wear nitrile gloves, and safety glasses when installing points. Dispose of gloves after installation. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photoionization detector. If air monitoring action levels are exceeded, then engineering controls will be implemented.

5. Training

5.1 General Health and Safety Training

In accordance with 29 CFR 1910.120, hazardous waste site workers will, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training will have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training will not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical). Proof of training will be submitted to the SSO prior to the start of field activities.

5.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current eight-hour refresher training will be submitted to the SSO prior to the start of field activities.

5.3 Supervisor Training

Personnel acting in a supervisory capacity shall have received 8 hours of instruction in addition to the initial 40 hours training.

5.4 Site Safety Officer (SSO)

The SSO will have completed the following training and work experience prior to the commencement of site activities:

- One year of construction experience
- 40-Hour Hazardous Materials training course
- 8-Hour HAZWOPER Supervisor Training
- Training specific to work activities (i.e., excavation and trenching activities, lock out/tag out, etc.)

5.5 Site-Specific Training

Prior to commencement of field activities, the SSO will ensure all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the Site and will highlight all provisions contained within this HASP.

This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Personnel that have not received site-specific training will not be allowed on site.

5.6 On-Site Safety Briefings

Project personnel and visitors will be given health and safety briefings daily by the SSO to assist site personnel in safely conducting work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. Documentation of this briefing will be recorded in the GEI field notes. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity to periodically update the crews on monitoring results.

5.7 First Aid and CPR

The SSO will identify individuals certified in first aid and CPR, or identify individuals for such training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association and will include training on blood borne pathogens.

5.8 Hazard Communication

Hazard communication training will be provided in accordance with the requirements contained in the Hazard Communication Program found in the GEI Health and Safety manual.

6. Personal Protective Equipment

The personal protective equipment (PPE) specified in Table 6-1 represents PPE selection required by 29 CFR 1910.132, and is based on the AHA of Section 4. The PPE program addresses elements, such as PPE selection based on site hazards, use and limitations, donning and doffing procedures, maintenance and storage, decontamination and disposal, training and proper fitting, inspection procedures prior to / during / and after use, evaluation of the effectiveness of the PPE program, and limitations during temperature extremes, heat stress, and other appropriate medical considerations.

A summary of PPE for each level of protection is as follows:

Safety Equipment	Level A	Level B	Level C	Level D
Tyvek® suit or work overalls				•
Hard hats with splash shields and/or safety glasses			•	•
Steel-toe boots with over boots			•	•
Chemical-resistant gloves as appropriate for work being performed and materials handled			•	•
Respirator/ Half- or full-face respirators as approved by the CHSO			•	
Tyvek® splash-resistant suit or chemical resistant clothing appropriate for the work being performed or materials handled			•	
Chemical-resistant clothing		•		
Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA	•	•		
Inner and outer chemical-resistant gloves	•	•		
Chemical-resistant safety boots or shoes	•	•		
Two-way radio	•	•		
Fully encapsulating chemical-resistant suit	•			

Table 6-1 describes the anticipated task-specific PPE. For activities not covered by Table 6-1, the SSO/CHSO will revise the hazard assessment and select the PPE in consultation with the CHSO.

6.1 PPE Abbreviations and Selection

HEAD PROTECTION HH = Hard Hat HEARING PROTECTION EP = ear plugs	EYE/FACE PROTECTION APR = Full Face Air Purifying Respirator with HEPA filter and organic vapor cartridge PFS =Plastic Face shield SG = ANSI approved safety glasses with side shields	RESPIRATORY PROTECTION Level D = No respiratory protection required Level C = Half face or full face air purifying respirator with approved cartridges (HEPA filter/organic vapor cartridge)
HAND PROTECTION LWG = Leather Work Gloves Nit = Nitrile Gloves Kev = Kevlar Gloves	BODY PROTECTION Poly = Polyethylene coated Tyvek® coveralls or apron WC = Work clothes PFD = Personal Flotation Device (USCG-approved)	FOOT PROTECTION OB = Over boot STB = Leather work boots with steel toe and steel shank

Table 6.1 - PERSONAL PROTECTIVE EQUIPMENT SELECTION

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR
Mobilization/Demobilization							
Mobilization/ demobilization of equipment and supplies	HH as needed	SG as needed	STB	LWG as needed	WC	EP as needed	Level D
Establishment of site security, work zones and staging area	HH as needed	SG as needed	STB	LWG as needed	WC	EP as needed	Level D
Locate all utilities to and from the site	HH as needed	SG as needed	STB	LWG as needed	WC	EP as needed	Level D
Locate all active utility lines on site	HH as needed	SG as needed	STB	LWG as needed	WC	EP as needed	Level D
Pre-Design Investigation Activities							
Surface Soil Sampling	HH as needed	SG	STB, OB as needed	Nit	WC	EP as needed	Level D
Sediment Collection	HH	SG, PFS, APR as needed	STB, OB	Nit, Kev	WC, Poly, PFD	EP as needed	Level C
Sediment Core Processing	HH	SG, PFS, APR as needed	STB, OB	Nit, Kev	WC, Poly, PFD	EP as needed	Level C
Subsurface Soil Boring and Monitoring Well Installation and Sampling	HH	SG	STB, OB as needed	Nit	WC, Poly as needed	EP	Level D initially, Level C-If action levels exceeded (see Section 8.0 of HASP)
Monitoring Well Development	HH as needed	SG as needed	STB	Nit	WC	EP as needed	Level D
Groundwater Sampling	HH as needed	SG	STB, OB as needed	Nit	WC, Poly as needed	EP as needed	Level D
Survey	HH as needed	SG as needed	STB	LWG as needed	WC	EP as needed	Level D
Waste Handling	HH	SG	STB, OB as needed	LWG and Nit as needed	WC, Poly as needed	EP as needed	Level D initially, Level C-If action levels exceeded (see Section 8.0 of HASP)
Test Pit Installation and Sampling	HH	SG	STB, OB as needed	Nit	WC	EP	Level D initially, Level C-If action levels exceeded (see Section 8.0 of HASP)

7. Medical Surveillance

All personnel performing field work where potential exposure to contaminants exists at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f) and, where applicable, expanded health standards. Documentation of current medical monitoring clearances will be submitted to the PM and CHSO for all GEI and subcontractor personnel prior to the start of the project.

7.1 Medical Surveillance Requirements

A physician's medical release for work will be confirmed by the SSO before a worker can enter the exclusion zone. The examination will be taken annually at a minimum and upon termination of hazardous waste site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the CHSO in consultation with the SSO if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other site conditions warrant further medical surveillance.

8. Monitoring

Monitoring will be performed to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of worker protection needed on site.

GEI will conduct perimeter air monitoring, and work zone monitoring for its employees. GEI will monitor and document daily site conditions and operations on National Grid's behalf.

GEI will provide the following equipment for health and safety monitoring of its personnel:

- Photoionization Detector (PID), or Flame Ionization Detector (FID),
- Particulate Meter (PM-10 capable)
- Multiple gas Meter with Combustible Gas Indicator (CGI)/Oxygen (O_2) / H_2S / HCN sensors
- Dräger Chip Measurement System (CMS) (or equivalent instrument)
- Sound Level Meter if deemed necessary by the SSO and CHSO (type to be appropriate to the activities performed)

GEI will adopt the air monitoring action levels and contingency plan presented within the Table 8-1 below. The perimeter air monitoring will be conducted during subsurface soil boring installations to conform to the community air monitoring plan (CAMP) guidelines presented by the New York State Department of Health (NYSDOH) in Appendix 1A of the Draft New York State Department of Conservation DER-10 Technical Guidance for Site Investigation and Remediation. The CAMP is located in **Appendix D**.

Total volatile organic compounds (VOCs), respirable particulate matter, and odor will be monitored during all intrusive subsurface soil activities in accordance with the CAMP.

Table 8-1 provides a summary of real time air monitoring action levels and contingency plans for work zone activities.

TABLE 8-1: Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
PID/FID	Breathing Zone	1.0 ppm	Use Dräger Chip Measurement System (CMS) tube for benzene or Z-nose® to verify if concentration is benzene.
PID/FID	Breathing Zone	0 - 50 ppm	No respiratory protection is required if benzene is not present.
		50 - 100 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels persist Upgrade to Level C.
		> 100 ppm	Stop work, withdraw from work area; notify PM & CHSO.
Oxygen meter (O_2)	Breathing Zone	< 20.7%	Stop work; withdraw from work area; ventilate area, notify SSO & CESM.
		> 21.1%	Stop work; withdraw from work area; notify SSO & CESM.
Hydrogen Sulfide (H_2S) meter	Breathing Zone	<5 ppm	No respiratory protection is required.
		>5 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, and notify SSO & CESM.
Hydrogen Cyanide (HCN) meter	Breathing Zone	<1.0 ppm	Run CMS Dräger tube, continue monitoring with real time meter, and continue work if CMS Dräger Tube Reading is less than 2ppm.
		1.0< HCN <2.0 ppm	Run CMS Dräger tube and confirm concentration is less than 2.0 ppm, notify SSO and CESM. Run CMS Dräger tube for sulfur dioxide, hydrogen sulfide, and phosphine chip potential interferences. Continue to monitor with real time meter.
		>2.0 ppm	Stop work, and move (with continuous HCN monitoring meter) at least 25 feet upwind of the excavation until continuous meter reads less than 1 ppm, Notify SSO & CESM. Run CMS Dräger hydrogen cyanide chip and re-evaluate activity, continue monitoring with a real time meter, resume work if concentrations read less than 1.0 ppm.
Combustible Gas Indicator (CGI)	Excavation/ Work Zone	< 10 % Lower Explosive Limit (LEL)	Investigate possible causes, allow excavation to ventilate; use caution during procedures.
		> 10% LEL	Stop work; allow excavation, borehole to ventilate to < 10% LEL; if ventilation does not result in a decrease to < 10% LEL, withdraw from work area; notify SSO & CESM.
Particulate Meter	Excavation/ Work Zone	0.150 ug/m^3	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

Carry cellular telephones for communication in a designated area away from subsurface investigation and sampling activities. Cellular phone use will not be permitted in the Exclusion Zone while work is being conducted in Level C PPE.

9. Site Control Measures

9.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It will include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ), and a Support Zone (SZ). Specific zones will be established on the work site when operations begin for each task requiring such delineation (i.e. drilling, construction, excavation, trenching in impacted areas of the Site). Maps depicting the zones will be available at the Site.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to site contaminants exists, will only be allowed access after proper training and medical documentation as required by National Grid. These records are maintained by the CHSO, and copies are provided to the SSO prior to mobilization for project activities.

The following will be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone. This zone will be clearly delineated by cones, tapes or other means. The SSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ will be determined by the site SSO allowing adequate space for the activity to be completed, field members and emergency equipment.

9.2 Communications

The following communications equipment shall be specified as appropriate:

- Telephones - A cellular telephone will be located in the SZ for communication with emergency support services/facilities and the home office. Personnel in the EZ can carry cellular telephones for communication in a designated area way from subsurface investigation and sampling activities. Cellular phone use will not be permitted in the EZ while work is being conducted in Level C PPE.

- Hand Signals - Hand signals shall be used by field teams along with the buddy system. They shall be known by the entire field team before operations commence and their use covered during site-specific training. Typical hand signals are the following:

Signal	Meaning
Hand gripping throat	Out of air, can't breathe
Grip on a partner's wrist or placement of both hands around a partner's waist	Leave area immediately, no debate
Hands on top of head	Need assistance
Thumbs up	Okay, I'm all right, I understand.
Thumbs down	No, negative.

10. Decontamination

PPE helps prevent the wearer from becoming contaminated or inhaling contaminants, and good work practices help reduce contamination on protective clothing, instruments, and equipment. Even with these safeguards, contamination may occur. Harmful materials can be transferred to clean areas, exposing unprotected personnel. To prevent such occurrences, the following contamination reduction and decontamination procedures have been developed.

10.1 Minimization of Contact with Contaminants

During completion of all site activities, personnel should attempt to minimize the degree of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel should minimize kneeling, splash generation, and other physical contact with contamination. This may ultimately minimize the degree of decontamination required and the generation of waste materials from site operations.

10.2 Personnel Decontamination

Personal hygiene, coupled with diligent decontamination, will significantly reduce the potential for exposure. Consideration will be given to prevailing wind directions so that the decontamination line, the support zone, and contamination reduction zone exit is upwind from the exclusion zone and the first station of the decontamination line. Decontamination will be performed by removing all PPE used in EZ and placing in drums/trash cans at CRZ. Disinfecting hand wipes will be available for wiping hands and face. For Level D Decontamination, personnel should wash and rinse gloves, and use anti bacterial wipes/gel and wash and rinse hands and face with potable water.

For Level C Decontamination, personnel should wash and rinse gloves and over boots, remove boot covers, remove outer gloves, remove Tyvek® splash-resistant suit or chemical resistant clothing, wash inner gloves, remove respirator, rinse inner gloves, remove inner gloves and wash and rinse hands and face.

If exposed to subsurface soils, wash with soap and water.

10.3 Emergency Decontamination

If circumstances dictate that contaminated clothing cannot be readily removed then remove gross contamination, wrap injured personnel with clean garments/blankets to avoid contaminating other personnel or transporting equipment. If the injured person can be moved, he/she will be moved to the exclusion zone boundary and decontaminated by site personnel as described above before emergency responders handle the victim.
If the person cannot be moved because of the extent of the injury (a back or neck injury) provisions will be made to ensure that emergency response personnel will be able to

respond to victim without being exposed to potentially hazardous atmospheric conditions. The only time an injured person should be removed is if the worker's life is threatened to a greater degree than if he/she is left in the spot where the accident occurred. If emergency response personnel have to enter hazardous conditions to respond to victim this should be communicated when the emergency call is made and responders can come prepared in appropriate PPE. If the potential for inhalation hazards exist, such as with an open excavation, this area will be covered with plastic sheeting, or similar controls, to eliminate any potential inhalation hazards. All emergency personnel are to be immediately informed of the injured person's condition, potential contaminants, and provided with all pertinent chemical data.

10.4 Hand Held Equipment Decontamination

Hand held equipment includes all monitoring instruments, samples, hand tools, and notebooks. The hand held equipment is dropped at the first decontamination station to be decontaminated by one of the decontamination team members. These items must be decontaminated or discarded as waste prior to removal from the exclusion zone.

To aid in decontamination, monitoring instruments can be sealed in plastic bags or wrapped in polyethylene. This will also protect the instruments against contaminants. The instruments will be wiped clean using antibacterial wipes and paper towels if contamination is visually evident.

Decontamination procedures for sampling equipment, hand tools, etc., will include the use of steam cleaning or a detergent wash, as appropriate for the site conditions. The standard decontamination procedures will be used as presented in the Final PDI Work Plan. All liquids generated in the decontamination will be stored at the Site in drums and then disposed of at an approved facility in accordance with federal, state and local regulations. Personnel performing this task will wear the proper PPE as prescribed in Table 6-1.

10.5 Heavy Equipment Decontamination

Decontamination of chemically contaminated heavy equipment will be accomplished using high -pressure steam or dry decontaminated with brushes and shovels. Decontamination will take place on a decontamination pad and all liquids used in the decontamination procedure will be collected. Vehicles or equipment brought into an exclusion zone will be treated as contaminated, and will be decontaminated prior to removal. All liquids used in the decontamination procedure will be stored at the Site drums and then disposed of at an approved facility in accordance with federal, state and local regulations. Personnel performing this task will wear the proper PPE as prescribed in Table 6-1.

11. Emergency Response Plan

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff are essential. Specific elements of emergency support procedures which are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on-site, record keeping, and emergency site evacuation procedures.

11.1 Pre-emergency Planning

Before the field activities begin, the local emergency response personnel may be notified by National of the schedule for field activities and about the materials that are thought to exist on the Site so that they will be able to respond quickly and effectively in the event of a fire, explosion, or other emergency.

In order to be able to deal with any emergency that might occur during remedial activities at the Site, emergency telephone numbers will be readily available in the SSO vehicle or construction office. These telephone numbers are presented in **Appendix A**. A hospital route map will also be readily available at the Site, and is in **Appendix B** as **Figure 3**.

11.2 Roles and Responsibilities

11.2.1 Corporate Health and Safety Officer (CHSO)

The CHSO oversees and approves the Emergency Response Plan and performs audits to determine that the plan is in effect and that all pre-emergency requirements are met. The CHSO acts as a liaison to applicable regulatory agencies and notifies OSHA of reportable accidents.

11.2.2 Site Safety Officer (SSO)

The SSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The SSO is required to immediately notify GEI and National Grid Project Managers, and CHSO of any fatalities or injuries requiring more than basic first aid treatment. The CHSO will notify OSHA within the required time frame if a reportable incident has occurred. The CHSO will be notified of all OSHA recordable injuries, fires, spills, releases or equipment damage in excess of $500 within 24 hours.

The SSO also serves as the Emergency Coordinator. In the event of an emergency, the Emergency Coordinator, with National Grid representatives, will make contact with Local Emergency Response personnel.

In these contacts, the Emergency Coordinator will inform response personnel about the nature of work on the Site, the type of contaminants and associated health or safety effects, and the nature of the emergency, particularly if it is related to exposure to contaminants.

The Emergency Coordinator will review this plan and verify emergency phone numbers, identify hospital routes, and will ensure the appropriate emergency equipment is available and in working order prior to beginning work on site.

The Emergency Coordinator will implement the Emergency Response Plan whenever conditions at the Site warrant such action.

11.2.3 Site Personnel

Site personnel are responsible for knowing the Emergency Response Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency.

11.3 Evacuation Routes and Procedures

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs at the work area, including but not limited to fire, explosion, or significant release of toxic gas into the atmosphere, immediate evacuation of all personnel is necessary due to an immediate or impending danger. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at a pre-determined location.

A site-specific emergency plan was developed to address what actions will be taken in the event of an emergency including natural disasters, infrastructure failure (e.g. gas leaks, transformer explosion, etc), potential or actual terrorist event in New York City. Although infrequent and random, it is important to have a plan of action and response in the event of one of these events. The Emergency Event Procedures Plan is provided in **Appendix I**.

11.4 Contingency Plans

11.4.1 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the work area. The Emergency Coordinator will immediately notify the local fire and police departments. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials
- Storage of flammable liquids and gases away from oxidizers
- No smoking in the exclusion zone or any work area
- No hot work without a properly executed hot work permit
- Shutting off engines to refuel
- Grounding and bonding metal containers during transfer of flammable liquids
- Use of UL approved flammable storage cans
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities
- Monthly inspections of all fire extinguishers.

The SSO is responsible for the maintenance of fire prevention and/or control equipment. The SSO is responsible for the control of fuel source hazards.

11.4.2 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet will be followed as necessary. If first aid or emergency medical treatment is necessary the Emergency Coordinator will contact the appropriate emergency facilities.

SKIN AND EYE CONTACT:	Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. Skin should also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs. Transport to hospital or local medical provider.
INHALATION:	Move to fresh air. Decontaminate. Transport to hospital or local medical provider.
INGESTION:	Decontaminate and transport to emergency medical facility.
PUNCTURE WOUND OR LACERATION:	Decontaminate and transport to emergency medical facility.

11.4.3 Decontamination during Medical Emergencies

If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or postponed. The SSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away.

If the outer contaminated garments cannot be safely removed on site, a plastic barrier between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

11.4.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SSO will determine if work can continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries
- Potential for cold stress and cold-related injuries
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds)
- Limited visibility (fog)
- Potential for electrical storms
- Earthquakes
- Other major incidents

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The SSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

When severe weather has passed, the SSO will direct all contractors to inspect project equipment to ensure its readiness for operation prior to commencing field activities.

11.4.5 Spill Control and Response

All small hazardous spills/environmental releases will be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining the best means of containment and cleanup. For small spills, absorbent materials such as sand, sawdust, or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid or caustic spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. Drains or drainage areas should be blocked. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size and type of the spill.

Refueling of sampling equipment will be done with NFPA-approved safety cans and by approved USCG refueling methods. Fuel will be stored in containers meeting applicable fuel storage safety regulations.

The Emergency Coordinator should take the following steps:

1. Determine the nature, identity and amounts of major spill components
2. Make sure all unnecessary persons are removed from the spill area
3. Notify appropriate response teams and authorities
4. Use proper PPE in consultation with the SSO and information provided on the MSDS for the spilled material
5. If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosive proof equipment to contain or clean up the spill (diesel only vehicles, air operated pumps, etc.)
6. If possible, try to stop the leak with appropriate material
7. Remove all surrounding materials that can react or compound with the spill.

Notify the National Grid Project Manager

11.5 Emergency Contact Information

Emergency Phone List
Fulton Municipal Works Former MGP Site

Medical Emergencies

Emergency Medical Services (NYC Fire Department)	
Emergency	911
All other communications	311
Nearest Emergency Room (New York Methodist Hospital	(718) 780-3137
506 Sixth Street, (Park Slope) Brooklyn, NY	(718) 780-3138
Concentra Medical Center	
130 Liberty Street, New York, New York	(212) 346-0077

Fire and Rescue Emergencies

Emergency	911
All other communications	311

Police Emergencies

NYC Police Department (78th Precinct 65 6th Avenue)	
Emergency	911
All other communications	311
Switchboard	(718) 636-6411

Utility Emergencies

Electric (Con Edison)	(800) 752-6633
Water/Sewer (NYC Dept of Environmental Protection)	(718) 699-9811
Natural Gas (KeySpan)	(718) 643-4050
National Grid Site Contacts	
To Be Determined	
Underground Utilities (New York City One Call Center)	(800) 272-4480

Spill Incident

New York State Department of Environmental Conservation	
National Response Center	(800)-457-7362
	(800) 424-8802

National Information Centers

Chemtrec	(800) 424-9300
Poison Control Center	(800) 222-1222

11.6 Emergency Equipment

The following minimum emergency equipment will be kept and maintained at the Site.

- Industrial first aid kit
- Portable eye washes
- ABC-rated fire extinguishers (one per vehicle and heavy equipment [drill rig and sample vessel])
- Absorbent material [Sorbent pads and booms]
- Bloodborne pathogen kit.

In case of minor injuries, on-site care will be administered with the Site first aid kit. A first aid kit will be kept in a waterproof container at the Site. In addition, eye wash, antibacterial wipes/gel, soap, and potable water will be kept at the Site.

For serious injuries that cannot be treated with the first aid kit, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger.

11.7 Postings

The following information will be posted or be readily visible and available at the Site:

- Emergency telephone numbers
- Hospital Route Map

The expected travel time from the Site to the nearest hospital is less than one minute, depending on local traffic conditions.

11.8 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers
- Refilling medical supplies
- Recharging eyewashes and/or showers
- Replenishing spill control supplies
- Replacing used air horns.

12. Logs, Reports, and Record Keeping

The following is a summary of required health and safety logs, reports, and record keeping. The SSO will maintain an on-site file for all the following logs, reports, and records. The CHSO or designee will maintain a parallel file off site.

12.1 Medical and Training Records

Copies or verification of training (40 hour, eight hour, and site-specific training) and medical clearance for hazardous waste site work and respirator use will be maintained by the CHSO and copies provided to the SSO prior to the initiation of work on site.

12.2 On-Site Log

A log of personnel on site each day will be kept by the SSO in a field logbook.

12.3 Exposure Records

All personnel monitoring results, laboratory reports, calculations, and air sampling data sheets will be maintained by the SSO during site work. At the end of the project they may be maintained in employee files if deemed necessary by the CHSO.

12.4 Accident/Incident Reports

GEI will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage. The report shall be made to the GEI PM verbally within two hours of the incident. The PM will inform the CHSO and the Director of Human Resources and a Project-Specific National Grid Representative for the incident within 2 hours of the incident. An Incident Report Form (see **Appendix J**) will be completed and submitted to the CHSO and the Director of Human Resources and Project-Specific National Grid Representative within 24 hours of the incident. The incident investigation during Site work will follow the Incident Reporting Program.

12.5 OSHA Form 300

An OSHA Form 300 will be maintained at the by the GEI CHSO. All recordable injuries or illnesses for GEI personnel will be recorded on this form.

12.6 Hazard Communication Program/MSDS

Material Safety Data Sheets (MSDSs) will be obtained for applicable substances and included in the site hazard communication file.

12.7 Work Permits

All work permits, including confined space entry, hot work, lockout/tagout, and line-breaking permits will be maintained in the project files. Copies of the work permits will also be provided to the SSO, and the National Grid Project Manager.

13. Field Personnel Review

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of this HASP for the Fulton Municipal Works Former MGP site. It is maintained on site by the SSO as a project record. Each field team member shall sign this section after training on the contents of this HASP has been completed. Site workers must sign this form after site-specific training is completed and before being permitted to work on site.

I have read, or have been informed of, the Health and Safety Plan and understand the information presented. I have also completed site-specific training for the work detailed in the project Work Plan. I will comply with the provisions contained therein.

PRINT NAME	SIGNATURE	DATE

PRINT NAME	SIGNATURE	DATE

PRINT NAME	SIGNATURE	DATE

APPENDIX A

ORGANIZATIONAL STRUCTURE/ CONTACT INFORMATION

National Grid
Contact Information

Name	Title	Contact Information
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Name	Title	Contact Information
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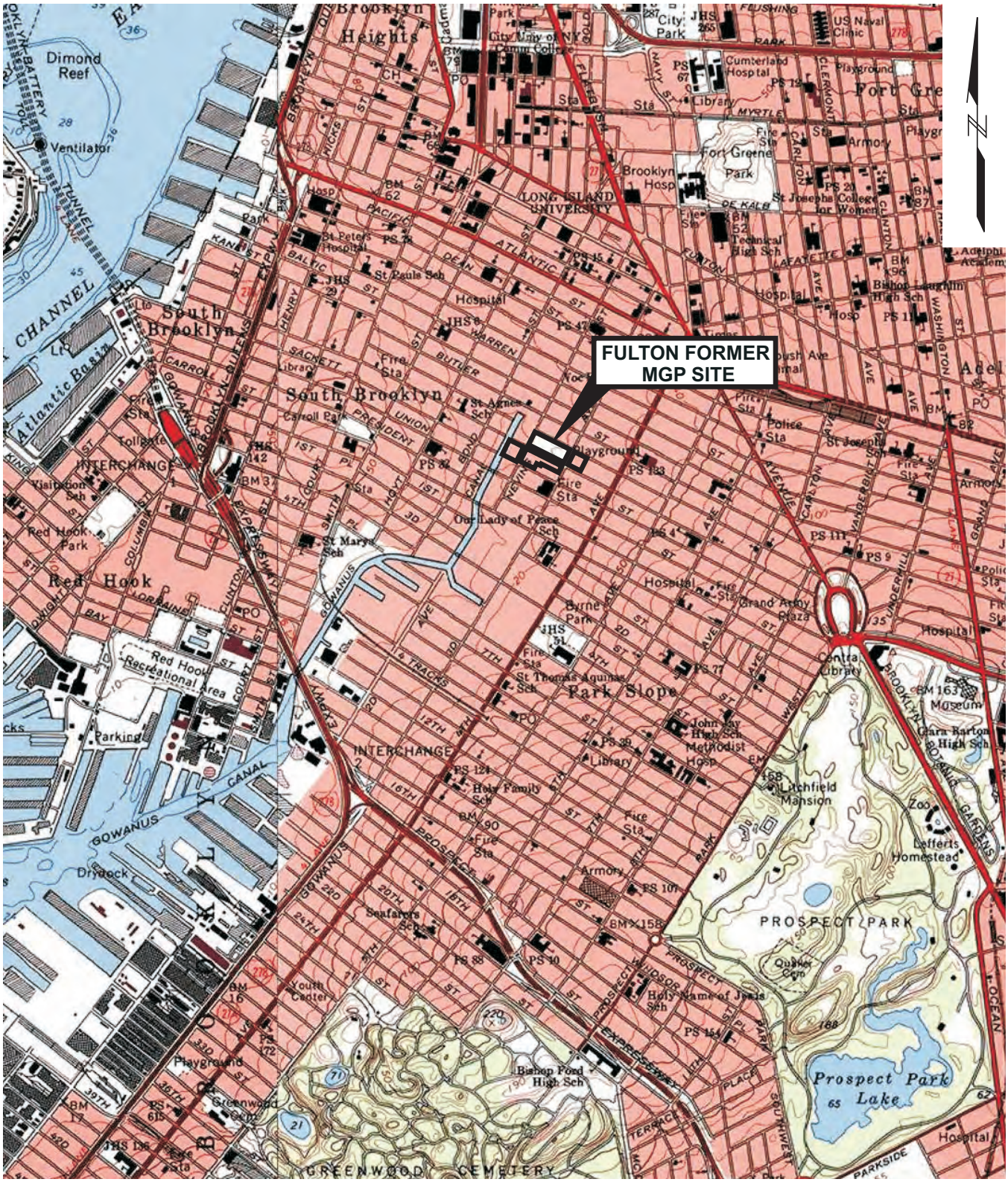
TBD	Project Manager	Office: Mobile: E-mail:
TBD	Field Team Leader/ Site Safety Officer (SSO)	Office: Mobile: E-mail:

APPENDIX B

SITE-SPECIFIC INFORMATION



SOURCE:
Map created with TOPO! ® ©2001 National Geographic (www.nationalgeographic.com/topo)

FINAL IRM PRE-DESIGN INVESTIGATION WORK PLAN
FULTON MUNICIPAL WORKS FORMER MGP
BOROUGH OF BROOKLYN, NEW YORK

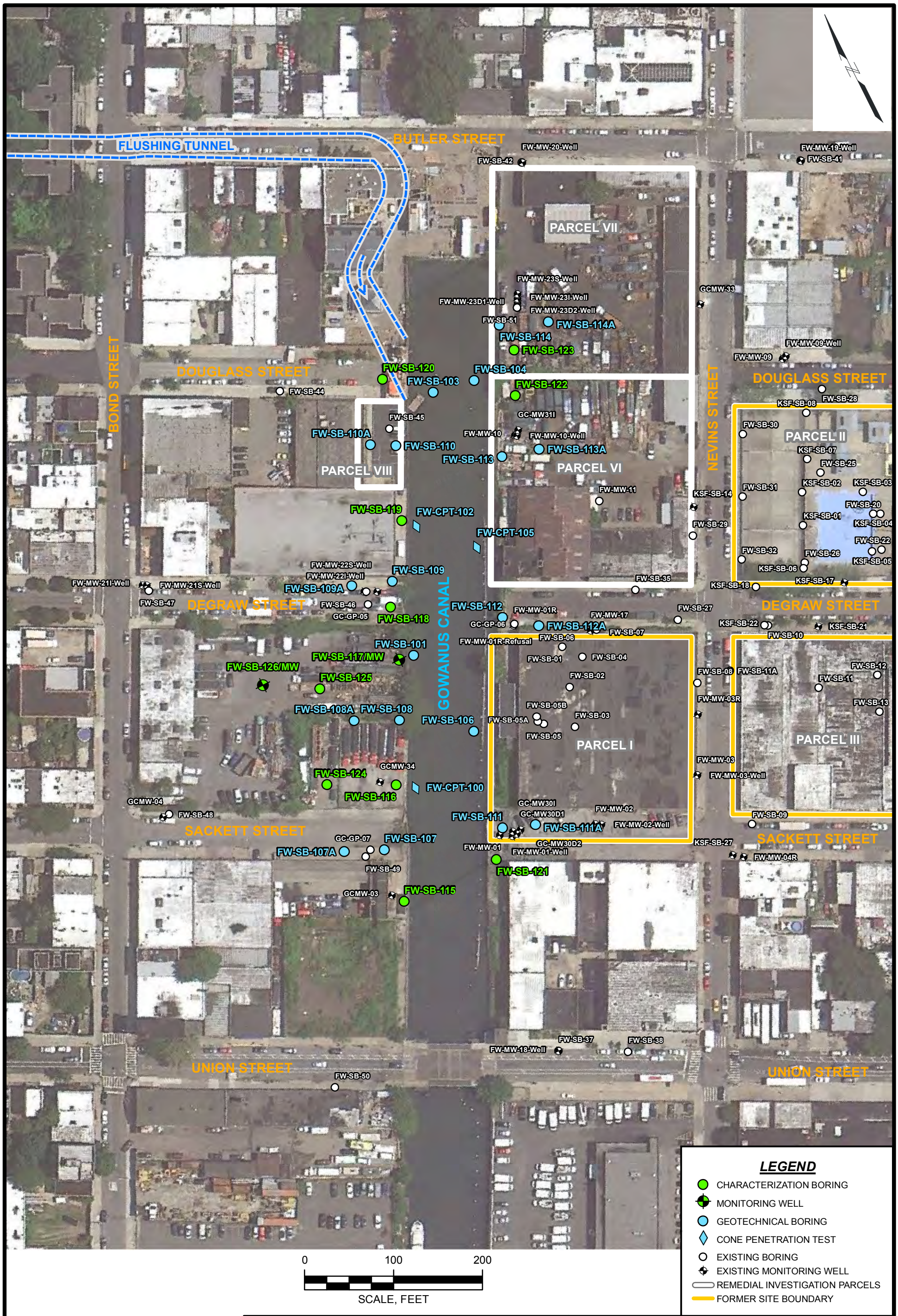
nationalgrid

GEI Consultants

SITE LOCATION MAP

Project 093020-2-1202 | March 2012 | Figure 1

I:\Project\National Grid\Fulton\Remedial Design\PDI Work Plan\Fulton-Site Location.cdr



SOURCES:

1. PHOTOGRAPH OBTAINED FROM GOOGLE ™ EARTH PRO, © 2011, GOOGLE IMAGERY DATE 06/17/10. ACCESSED ON 7/28/11.

FINAL IRM PRE-DESIGN INVESTIGATION WORK PLAN
FULTON MUNICIPAL WORKS FORMER MGP
BOROUGH OF BROOKLYN, NEW YORK

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PROPOSED EXPLORATION LOCATIONS

Project 093020-2-1202 | March 2012 | Figure 3

J:\Projects\National_Grid\Fulton\Geotech_Inv\Proposed_LocationsV2.mxd

Start **537 Sackett St**
Brooklyn, NY 11217
End **506 6th St**
Brooklyn, NY 11215
Travel **1.5 mi – about 5 mins**

Notes Figure 2: Directions to the Hospital

537 Sackett St
Brooklyn, NY 11217
Drive: 1.5 mi – about 5 mins

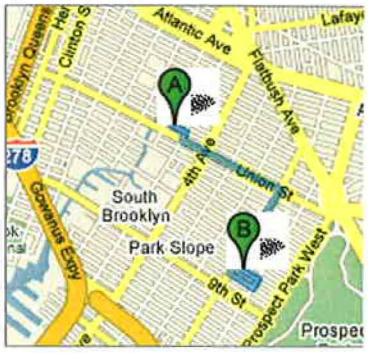
1.	Head **southeast** on **Sackett St** toward **3rd Ave**	433 ft
2.	Turn **right** at **3rd Ave**	256 ft
3.	Turn **left** at **Raul Vasquez Jr Pl/Union St** Continue to follow Union St	0.6 mi 2 mins
4.	Turn **right** at **7th Ave**	0.5 mi 2 mins
5.	Turn **left** at **7th St**	0.1 mi 1 min
6.	Turn **left** at **8th Ave**	259 ft
7.	Turn **left** at **6th St**	0.1 mi

506 6th St
Brooklyn, NY 11215

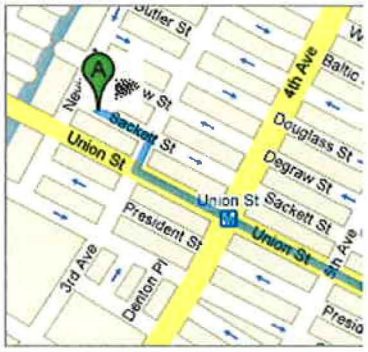
These directions are for planning purposes only. You may find that construction projects, traffic, or other events may cause road conditions to differ from the map results.

Map data ©2008 NAVTEQ™

Overview



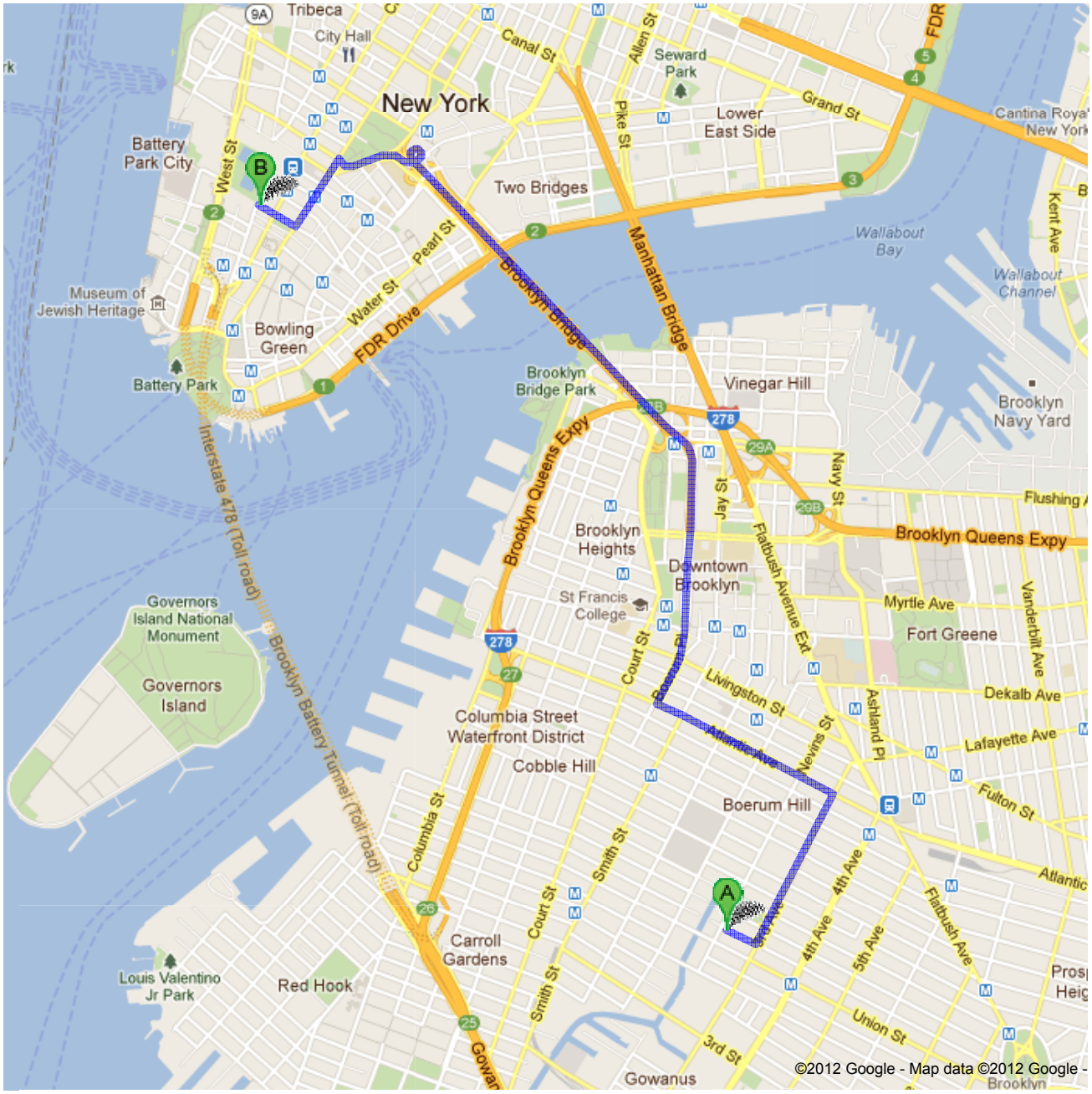
Start



End

Map data ©2008 NAVTEQ™

Directions to Concentra Medical Center
130 Liberty Street, New York, NY 10006 - (212) 346-0077
3.8 mi – about **11 mins**



537 Sackett St, Brooklyn, NY 11217

	1. Head **southeast** on **Sackett St** toward **3rd Ave**	go 0.1 mi total 0.1 mi
	2. Take the 1st left onto **3rd Ave** About 1 min	go 0.5 mi total 0.6 mi
	3. Turn left onto **Atlantic Ave** About 2 mins	go 0.6 mi total 1.2 mi
	4. Turn right onto **Boerum Pl** About 1 min	go 0.2 mi total 1.4 mi
	5. Continue onto **Adams St** About 1 min	go 0.3 mi total 1.7 mi
	6. Continue onto **Brooklyn Bridge** About 2 mins	go 1.3 mi total 3.0 mi
	7. Take the **Park Row S** exit on the left	go 0.2 mi total 3.2 mi
	8. Merge onto **Avenue of the Finest/Park Row** Continue to follow Park Row About 1 min	go 0.2 mi total 3.4 mi
	9. Slight right to stay on **Park Row**	go 157 ft total 3.4 mi
	10. Turn left onto **Broadway** About 1 min	go 0.2 mi total 3.7 mi
	11. Turn right onto **Liberty St** Destination will be on the left About 1 min	go 0.1 mi total 3.8 mi

Concentra Medical Center
130 Liberty Street, New York, NY 10006 - (212) 346-0077

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2012 Google

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

APPENDIX C

MATERIAL SAFETY DATA SHEETS (MSDSs)

Genium Publishing Corp.
One Genium Plaza
Schenectady, NY 12304-4690
(518) 377-8854

Material Safety Data Sheet Collection

Methanol

MSDS No. 354

Date of Preparation: 11/77 Revision: E, 3/98

Section 1 - Chemical Product and Company Identification 51

Product/Chemical Name: Methanol **Chemical Formula:** CH_4O or CH_3OH **CAS Number:** 67-56-1

Synonyms: carbinol; Coat-B1400; Colonial Spirits; Columbian Spirit; EPA pesticide chemical code 053801; methyl alcohol; methyl hydrate; methyl hydroxide; monohydroxymethane; pyroligneous spirit; pyroxylic spirit; pyroxylic spirits; Surflo-B17; wood alcohol; wood naphtha; wood spirit

Derivation: Prepared by wood pyrolysis; non-catalytic oxidation of hydrocarbons; as a by-product in the fisher-tropsch synthesis; or by reduction of carbon monoxide.

General Use: Used as an industrial solvent; starting material for organic synthesis; antifreeze for windshield washer fluid; in fuel antifreezes; gasoline octane booster; fuel for stoves; extractant for oils; denaturing ethanol; softening agent; food additive; in paint, varnish removers, and embalming fluids; in the manufacture of photographic film, celluloid, textile soap, wood stains, coated fabrics, shatterproof glass, paper coating, waterproofing formulations, artificial leather, dyes.

Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Methanol, ca 100% vol

Trace Impurities (Grade A): Acetone and aldehydes < 30 ppm, acetic acid < 30 ppm

OSHA PELs
8- hr TWA: 200 ppm (260 mg/m^3)
Vacated 1989 Final Rule Limits:
TWA: 200 ppm (260 mg/m^3)
STEL: 250 ppm (325 mg/m^3)

ACGIH TLVs*
TWA: 200 ppm (262 mg/m^3), *Skin*
STEL: 250 ppm (328 mg/m^3)

NIOSH REL
10- hr TWA: 200 ppm (260 mg/m^3), *Skin*
STEL: 250 ppm (325 mg/m^3)

IDLH Level
6000 ppm

DFG (Germany) MAK
TWA: 200 ppm (260 mg/m^3), *Skin*
Category II, 1: Substances with systemic effects; onset of effect ≤ 2 hr; half life < 2 hr
Embryo/Fetus Risk of Damage Classification C†

Peak Exposure Limit:
400 ppm (520 mg/m^3), 30 min, average value. 4/shift

*There are also ACGIH Biological Exposure Indices (BEIs™).

†There is no reason to fear risk of damage to developing embryo or fetus when MAK or BAT values are observed.

Section 3 - Hazards Identification

ANSI Signal Word: Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Methanol is a colorless liquid with a slight alcohol odor when pure, or disagreeably pungent odor when crude. It is irritating to the eyes, skin, and respiratory tract. Exposure may result in headache, visual disturbance, blindness, and respiratory failure. Reproductive effects have been reported in animal testing. This flammable liquid is a moderate explosion hazard. When heated to decomposition, methanol emits carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Wilson Risk Scale
R 1
I 3
S 2*
K 3
*Skin absorption

HMIS
H 2*
F 3
R 0
PPE†
*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption

Target Organs: Eyes, skin, central nervous system (CNS), gastrointestinal (GI) tract, respiratory system

Acute Effects

Inhalation: Irritation, breathing difficulty, headache, drowsiness, vertigo, light-headedness, nausea, vomiting, acidosis (decreased blood alkalinity), visual disturbance, and at high concentrations, CNS damage, convulsions, circulatory collapse, respiratory failure, coma and blindness can result from inhalation of methanol vapor. Concentration ≥ 200 ppm may cause headache; 50,000 ppm can cause death within 1-2 hrs. **Eye:** Contact with liquid may result in irritation, inflamed lids, light sensitization, and superficial lesions. **Skin:** Contact may cause irritation, dermatitis, swelling, scaling, and systemic effects listed under inhalation. **Ingestion:** GI irritation and systemic effects (see Inhalation). Symptoms may be delayed 18-48 hours. Fatal dose: 2-8 ounces.

Carcinogenicity: IARC, NTP, and OSHA do not list methanol as a carcinogen. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Chronic Effects:** Exposure to methanol vapors has caused conjunctivitis, headache, giddiness, insomnia, GI disturbance, impaired vision. CNS damage is also likely. Methanol is slowly eliminated from the body; exposure is considered cumulative over the short term.

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Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. **Eye Contact:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation develops. **Skin Contact:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting. ***After first aid, get appropriate in-plant, paramedic, or community medical support.*** **Note to Physicians:** Follow emesis with rehydration, correction of acidosis, and folate to enhance formate oxidation. Consider IV administration of ethanol (if blood methanol >20 mg/dL) to show metabolic oxidation of methanol. Assay formic acid in urine, blood pH and plasma bicarbonate.

Section 5 - Fire-Fighting Measures

Flash Point: 54 °F (12 °C) **Flash Point Method:** CC **Burning Rate:** 1.7 mm/min
Autoignition Temperature: 867 °F (464 °C) **LEL:** 6.0% v/v **UEL:** 36% v/v
Flammability Classification: OSHA Class IB Flammable Liquid.

NFPA

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, fog or alcohol-resistant foam. A water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.
Unusual Fire or Explosion Hazards: Can form explosive mixtures in the air. The heavier-than-air vapors of methanol may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire. **Hazardous Combustion Products:** Heating methanol to decomposition can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes. **Fire-Fighting Instructions:** *Do not* scatter material with any more water than needed to extinguish fire. *Do not* release runoff from fire control methods to sewers or waterways. **Fire-Fighting Equipment:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Isolate spill area for at least 330-660 feet (100-200 m) in all directions. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. **Small Spills:** Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Use clean non-sparking tools to collect absorbed material. **Large Spills, Containment:** Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. **Cleanup:** Ground all equipment. Use non-sparking tools. **Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers. **Storage Requirements:** Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors. **Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.106) for Class 1B Flammable Liquids.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. **Ventilation:** Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. **Administrative Controls:** Enclose operations and/or provide local explosion-proof exhaust ventilation at the site of chemical release. Where possible, transfer methanol from drums or other storage containers to process containers. Minimize sources of ignition in surrounding areas. **Respiratory Protection:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations ≤ 2000 ppm, use a supplied air respirator; ≤ 5000 ppm, supplied air (SA) respirator in continuous flow mode; ≤ 6000 ppm, SA respirator with tight-fitting face mask operated in continuous flow mode, or SCBA with full facepiece, or SA respirator with full facepiece; > IDLH/unknown/emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or SA respirator with full facepiece operated in pressure-demand

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or other positive-pressure mode in combination with auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For escape, use an appropriate escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Protective Clothing/Equipment:** Wear chemically protective gloves, boots, aprons, and gauntlets of butyl rubber, Teflon™, Viton™, Saranex™, 4H™, Responder™, Trellchem HPS™, or Tychem 10000™ (Breakthrough Time (BT) >8 hr) to prevent skin contact. Natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl alcohol and CPF 3™ may degrade after contact and are not recommended. Wear splash-proof chemical safety goggles, and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, washing facilities available in work area. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance and Odor: Colorless; slight alcohol odor when pure, disagreeably pungent odor when crude
Odor Threshold Range: 13.1150 to 26840 mg/m^3
Vapor Pressure: 127 mm Hg at 77 °F (25 °C)
Vapor Density (Air=1): 1.11
Saturated Vapor Density (air=1.2 kg/m^3, 0.075 lb./ft^3): 1.221 kg/m^3
Formula Weight: 32.04
Density: 0.796 g/mL at 59 °F (15 °C)
Specific Gravity (H_2O=1, at 4 °C): 0.81 at 0 °C/4 °C
Bulk Density: 6.59 lbs/gal at 68 F (20 °C)
pH: Slightly acidic
Water Solubility: Miscible
Other Solubilities: Ethanol, acetone, benzene, chloroform, DMSO, ether, ketones, most organic solvents.
Boiling Point: 148 °F (64.7 °C) at 760 mm Hg
Freezing Point: -144.04 °F (-97.8 °C)
Viscosity: 0.614 mPa sec
Refractive Index: 1.3292 at 68 °F (20 °C)/D
Surface Tension: 22.61 dynes/cm
Ionization Potential (eV): 10.84
Henry's Law Constant (H): 4.55 x10^{-6} atm-m^3/mole at 77 °F (25 °C)
Octanol/Water Partition Coefficient: log K_{ow} = -0.77
Soil Sorption Coefficient (log K_{oc}): 0.44

Section 10 - Stability and Reactivity

Stability: Methanol is stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Include beryllium dihydride, metals (potassium, magnesium), oxidants (barium perchlorate, bromine, chlorine, hydrogen peroxide, sodium hypochlorite, phosphorus trioxide), potassium tertbutoxide, carbon tetrachloride and metals, chloroform and heat, diethyl zinc, alkyl aluminum salts, acetyl bromide, chloroform and sodium hydroxide, cyanuric chloride, nitric acid, chromic anhydride, lead perchlorate.
Conditions to Avoid: Vapor inhalation, oxidizers. **Hazardous Decomposition Products:** Thermal oxidative decomposition of methanol can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Section 11- Toxicological Information

Toxicity Data:*

Reproductive Effects:
Rat (female), oral: 7500 mg/kg, administered during gestational days 17-19 produced effects on newborn - behavioral.
Rat (female), oral: 35295 mg/kg administered during gestational days 1-15 produced effects on the fertility index; pre-implantation mortality; and post-implantation mortality.
Rat (female), inhalation: 20000 ppm/7 hr, administered during gestational days 1-22 produced specific developmental abnormalities - musculoskeletal system; cardiovascular (circulatory) system; urogenital system.
Rat (male), oral: 200 ppm/20 hr, 78 weeks prior to mating produced paternal effects - testes, epididymis, sperm duct.
Multiple Dose Toxicity Data:
Rat, oral: 12 g/kg/8 weeks intermittently produced toxic effects: behavioral - ataxia; behavioral - alteration of operant conditioning.
Rat, inhalation: 50 mg/m^3/12 hr/13 weeks intermittently produced degenerative changes to brain and coverings; muscle contraction or spasticity.
Rat, inhalation: 2610 ppm/6 hr/4 weeks intermittently produced toxic effects: endocrine - changes in spleen weight.
Eye Effects:
Rabbit, standard Draize test: 100 mg/24 hr resulted in moderate irritation.

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Section 11- Toxicological Information, continued

Toxicity Data:*

Skin Effects:
Rabbit, standard Draize test: 20 mg/24 hr resulted in moderate irritation.

Acute Oral Effects:
Human, oral, LD_{Lo}: 428 mg/kg produced toxic effects: behavioral - headache; lungs, thorax, or respiration - other changes.
Human, oral, LD_{Lo}: 143 mg/kg produced optic nerve neuropathy, dyspnea, nausea or vomiting.
Rat, oral, LD_{50}: 5628 mg/kg

Acute Dermal Effects:
Monkey, skin, LD_{Lo}: 393 mg/kg
Rabbit, skin, LD_{50}: 15800 mg/kg

Acute Inhalation Effects:
Human, inhalation, TC_{Lo}: 300 ppm produced visual field changes, headache; lungs, thorax, or respiration - other changes.
Rat, inhalation, LC_{50}: 64000 ppm/4 hr

Mutagenicity:
Human, lymphocyte: 300 mmol/L resulted in DNA inhibition.
Rat, oral: 10 µmol/kg resulted in DNA damage.

* See NIOSH, *RTECS* (PC1400000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Trout, LC_{50}: 8,000 mg/L/48 hr; *Pimephales promelas* (fathead minnow) LC_{50}: 29.4 g/L/96 hr.

Environmental Fate: Bioconcentration (BCF, estimated at 0.2) is not expected to be significant. Physical removal from air can occur via rainfall. Relatively rapid evaporation from dry surfaces is likely to occur.

Environmental Degradation: If released to the atmosphere, it degrades via reaction with photochemically produced hydroxyl radicals with an approximate half-life of 17.8 days. If released to water or soil, biodegradation is expected to occur.

Soil Adsorption/Mobility: A low Koc indicates little sorption and high mobility in the soil column.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Methanol
Shipping Symbols: D
Hazard Class: 3
ID No.: UN1230
Packing Group: II
Label: FLAMMABLE LIQUID
Special Provisions (172.102): T*

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 1 L
b) Cargo Aircraft Only: 60 L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: 40

Section 15 - Regulatory Information

EPA Regulations:
Listed and Classified as a RCRA Hazardous Waste (40 CFR 261.33): Characteristic of Ignitability
RCRA Hazardous Waste Number: U154
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) specific per (3) CAA, Sec. 112; (4) RCRA, Sec. 3001
CERCLA Final Reportable Quantity (RQ), 5000 lb (2268 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 1, 73, 99, 103, 124, 136, 149, 176, 190, 209, 216, 217, 218, 222, 223, 224, 227, 228, 230
Prepared By..... HM Spliethoff, MS
Industrial Hygiene Review..... PA Roy, MPH, CIH
Medical Review..... T Thoburn, MD, MPH

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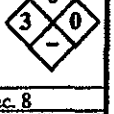
Section 1. Material Identification

Nitric Acid (HNO_3) Description: A solution of nitrogen dioxide in water commercially available in many concentrations. Derived by oxidation of ammonia by catalytic process (heated platinum catalyst); or by direct synthesis, combining atmospheric nitrogen and oxygen in an electric arc (an expensive process, thus largely abandoned). HNO_3 is usually found in conjunction with nitrogen dioxide, which is considered more hazardous. Used in fertilizer production (ammonium nitrate), in photoengraving, steel etching, explosives (TNT, nitroglycerin, trinitrophenol); manufacture of metallic nitrates, sulfuric acid, aqua regia and oxalic acid, jewelry, various dyes and dyestuffs, pharmaceuticals; as a laboratory reagant, in metallurgy (*mainly* as a pickling agent) and the printing industy.
Other Designations: CAS No. 7697-37-2, aqua fortis, aqua regia, azotic acid, engravers nitrate, hydrogen nitrate, red fuming nitric acid (RFNA), white fuming nitric acid (WFNA).
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for suppliers list.

Cautions: Nitric acid is a corrosive, strong oxidizer that causes irritation or severe burns to the skin, eyes, and respiratory tract. Exposures to high levels of the concentrated acid can be fatal. Increases the flammability of combustibles. Use extreme caution when handling HNO_3.

R	2	HMIS		NFPA	
I	4	H	3*	*Fuming* nitric acid	
S	4	F	0		
K	0	R	1		
		PPE**			

R	2	HMIS		*> 40%* nitric acid	
I	4	H	3*		
S	4	F	0		
K	0	R	1		
		PPE**			

R	2	HMIS		*≤ 40%* nitric acid	
I	3	H	3*		
S	3	F	0		
K	0	R	0		
		PPE**			

* Chronic effects ** See Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Nitric acid, various %. Commercially available in nearly all concentrations; most common are 56 and 68%. RFNA (85%), WFNA (97.5%).

1991 OSHA PELs
8-hr TWA: 2 ppm (5 mg/m³)
15-min STEL: 4 ppm (10 mg/m³)

1990 IDLH Level
100 ppm

1990 NIOSH REL
8-hr TWA: 2 ppm (5 mg/m³)
15-min STEL: 4 ppm (10 mg/m³)

1992-93 ACGIH TLVs
TWA: 2 ppm (5.2 mg/m³)
STEL: 4 ppm (10 mg/m³)

1990 DFG (Germany) MAK
2 ppm (5 mg/m³)
Category I: local irritants
Peak Exposure Limit: 2 ppm
5 min momentary value, 8 per shift

1985-86 Toxicity Data*
Man, unreported route, LD_{Lo}: 110 mg/kg; toxic effects not yet reviewed
Rat, oral, TD_{Lo}: 5275 g/kg administered from 1 to 21 days of pregnancy caused post-implantation mortality and specific developmental abnormalities of the musculoskeletal system.
Rat, inhalation, LC_{50}: 67 ppm (NO_2)/4 hr; toxic effects not yet reviewed

* See NIOSH, *RTECS* [QU5775000 (nitric acid), QU5900000 (RFNA), QU6000000 (WFNA)] , for additional reproductive and toxicity data.

Section 3. Physical Data

Boiling Point: 186.8 °F (86 °C)
Melting Point: -43.6 °F (-42 °C)
Vapor Pressure: 67% HNO_3 = 6.8 mm Hg at 68 °F (20 °C); 95 to 98% = 113 at 100.4 °F (38 °C)
Saturated Vapor Density (Air = 1.2 kg/m³): 1.212 kg/m³ or 0.0757 lb/ft³ (67 % HNO_3)
pH: 1

Molecular Weight: 63.02
Density: 1.50269 at 77/39.2 °F (25/4 °C)
Water Solubility: Soluble (releases heat)
Ionization Potential: 11.95 eV

Appearance and Odor: Transparent, clear to yellow, fuming liquid with an acrid, suffocating odor which darkens to a brownish color on aging and exposure to light. "Fuming" nitric acid is red-brown in color.

Section 4. Fire and Explosion Data

Flash Point: Noncombustible	**Autoignition Temperature:** Noncombustible	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: For small fires (< 40% HNO_3), use dry chemical, carbon dioxide (CO_2), water spray, or regular foam. For large fires, use water spray, fog, or regular foam. For small fires (> 40% HNO_3), use water spray, dry chemical, or soda ash. For large fires, flood area with water (*do not* get inside HNO_3 containers). Apply water from as far a distance as possible.
Unusual Fire or Explosion Hazards: HNO_3 is noncombustible but is an oxidizer which increases fire involving combustibles and can initiate an explosion. It releases flammable hydrogen gas in contact with many metals.
Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing is not effective for fires involving nitric acid. Acid-resistant clothing is needed. Apply cooling water to sides of containers until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. *Do not* release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Nitric acid decomposes in air and in contact with light and organic matter. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Nitric acid reacts explosively with combustibles, organics or readily oxidizable materials such as wood, turpentine, metal powder and hydrogen sulfide, carbides, cyanides, and alkalies; causes spattering with strong bases; is corrosive to paper, cloth and most metals (except aluminum, gold, platinum, thorium, and tantalum. Will also attack some forms of plastics, rubber, and coatings. There are at least 150 chemicals and chemical combinations which are incompatible with nitric acid. HNO_3 reacts with water to produce heat and toxic corrosive fumes. Refer to *Genium* references 126 and 159 for further detail. **Conditions to Avoid:** Avoid exposure to moisture, heat, and incompatibles.
Hazardous Decomposition Products: Thermal oxidative decomposition of HNO_3 produces nitrogen peroxide and toxic, irritating nitrogen oxides.

Section 6. Health Hazards Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list nitric acid as a carcinogen.
Summary of Risks: Nitric acid is very corrosive to the skin, eyes, digestive and respiratory tract or any tissue it comes in contact with. 58 to 68% (nitric acid) vapors are moderately irritating and can't be tolerated at high concentrations. 95% (nitric acid) vapors cause severe irritation at very low levels and the liquid causes 2nd and 3rd degree burns on short contact with skin or eyes. Vapor inhalation may cause pulmonary edema (fluid in lungs) leading to death. HNO_3 vapor or mist can slowly corrode teeth when chronically exposed. **Medical Conditions Aggravated by Long-Term Exposure:** Chronic respiratory diseases. **Target Organs:** Eyes, skin, respiratory tract, teeth.

Continue on next page

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Section 6. Health Hazard Data, continued

Primary Entry Routes: Inhalation, ingestion, skin and eye contact. **Acute Effects:** Inhalation symptoms may take several hours and include throat and nose irritation, cough, chest pain, difficulty breathing, salivation, giddiness, nausea, muscular weakness, ulceration of nasal mucous membranes, pulmonary edema, and chemical pneumonia. Skin contact is moderately irritating to severely corrosive depending on % of nitric acid. Burns may penetrate deeply causing ulcers. Skin may be stained yellowish brown. Dilute solutions cause irritation and tend to harden the epithelium (outer skin layer) without destroying it. HNO_3 liquid causes yellow discoloration of the eyes and severe burns which may result in permanent damage, i.e., sight loss. Ingestion produces immediate pain and digestive tract burns followed by throat swelling, convulsions, risk of stomach perforation (causing a rigid abdomen) and possible coma. **Chronic Effects:** Repeated inhalation of low concentrations may cause chronic bronchitis, tooth erosion, and/or appetite loss. Repeated exposure to $NO_{(x)}$ such as produced by thermal decomposition of HNO_3 is implicated in chronic lung diseases.

FIRST AID

Eyes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing (*do not force removal if stuck to skin*). Rinse with flooding amounts of water for at least 15 min. Apply a 5% triethanolamine solution to affected area. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute followed by lime milk or milk of magnesia. Do not induce vomiting. *Do not* give sodium bicarbonate or attempt to neutralize the acid.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Observe for several hours since symptoms such as pulmonary edema may be delayed.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should wear fully-encapsulating vapor-protective clothing. Use water spray to cool and disperse vapor. Keep combustibles away from spilled material. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in dry containers for disposal. For large spill, flush with water to containment area and neutralize with agricultural (slaked) lime, sodium bicarbonate, crushed limestone, soda ash, or lime. Report any release in excess of 1000 lb. Control runoff and dike for disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a SARA Extremely Hazardous Substance (40 CFR 355), TPQ: 1000 lb
Listed as a RCRA Hazardous Waste (40 CFR 261.22): No. D001, Characteristic of corrosivity
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311(b)(4)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)
Listed as a Process Safety Hazardous Chemical (29 CFR 1910.119), TQ: 500 lb

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For < 50 ppm, use any supplied-air respirator operated in a continuous-flow mode. For < 100 ppm, use any supplied-air respirator or SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear acid-proof gloves, boots, aprons, and gauntlets to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in aluminum, stainless steel, or glass containers on a cement floor in a cool, dry, well-ventilated area away from incompatibles (Sec. 5). Dike around storage tanks with large kirbs or stills to retain the acid in event of leakage. Keep neutralization agents on hand and install a fire hydrant in storage area. (See NFPA Code 43A). **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the eyes, skin, respiratory tract and teeth. Pulmonary function tests (FEV< FVC) are helpful. Educate workers about the hazardous properties of nitric acid.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: *, †, ‡, §, ¥, ψ, ϕ
DOT Hazard Class: 8
ID No.: UN1826 (*†), UN1796 (‡§), UN2031 (¥ψ), UN2032 (ϕ)
DOT Packing Group: I (†§¥ϕ), II (*‡ψ)
DOT Packaging Label: Corrosive (*‡¥ψ), Corrosive, Oxidizer (†§), Corrosive, Oxidizer, Poison (ϕ)
Special Provisions (172.102): B2, T12, T27 (*); T12, T27 (†); B2, T12, T27 (‡); T12, T27 (§); B12, B53, T9, T27 (¥); B2, B12, B53, T9, T27(ψ); 2, B9, B32, B74, T38, T43, T45(ϕ)

Packaging Authorizations
a) Exceptions: None
b) Non-bulk Packaging: 173.158 (*†‡§¥ψ), 173.227 (ϕ)
c) Bulk Packaging: 173.242 (*‡ψ), 173.243 (†§¥), 173.244(ϕ)

Quantity limitations
a) Passenger Aircraft or Railcar: Forbidden
b) Cargo Aircraft Only: 30L (*‡ψ), 2.5L (†§¥), Forbidden (ϕ)

Vessel Stowage Requirements
a) Vessel stowage: D
b) Other: 40(*); 40, 66, 89 (†); 40 (‡); 40, 66, 89 (§); 110, 111 (¥); 110, 111 (ψ); 40, 66, 74, 89, 90, 95 (ϕ)

* Nitrating acid mixtures spent, < 50% HNO_3
† Nitrating acid mixtures spent, > 50% HNO_3
‡ Nitrating acid mixtures, < 50% HNO_3
§ Nitrating acid mixtures, > 50% HNO_3
ψ Nitric acid other than red fuming, < 70% HNO_3
¥ Nitric acid other than red fuming, > 70% HNO_3
ϕ Nitric acid, red fuming.

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 136, 139, 140, 148, 149, 153, 159, 162, 163, 164, 167, 168, 171, 174, 175
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** W Silverman, MD

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MATERIAL SAFETY DATA SHEET: CRYSTAL SIMPLE GREEN®

I. PRODUCT & COMPANY INFORMATION

PRODUCT NAME: **CRYSTAL SIMPLE GREEN®**

OTHER NAMES: **CRYSTAL SIMPLE GREEN® - SPECIALIZED CLEANER / DEGREASER**
SIMPLE GREEN SAFETY TOWELS (fluid only)

COMPANY NAME: **SUNSHINE MAKERS, INC.**
15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 • 562-795-6000
Fax: 562-592-3034
Website: www.simplegreen.com

Version No. 4006
Issue Date: January 2002

For 24-hour emergency, call Chem-Tel, Inc.: 800-255-3924

USE OF PRODUCT: A specialized cleaner and degreaser for use in the industrial and institutional workplace..

II. INGREDIENT INFORMATION

The only ingredient of Crystal Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<6%) (Butyl Cellosolve; CAS No. 111-76-2): the OSHA PEL and ACGIH TLV is 25 ppm (skin). Note, however, that Butyl Cellosolve is only one of the raw material ingredients that undergo processing and dilution during the manufacture of Crystal Simple Green®. Upon completion of the manufacturing process, Crystal Simple Green® does not possess the occupational health risks associated with exposure to undiluted Butyl Cellosolve. Verification of this is contained in the independent test results detailed under "Toxicological Information" on Page 3 of this MSDS.

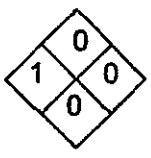
The Butyl Cellosolve in Crystal Simple Green® is part of a chemical category (glycol ethers) regulated by the Emergency Planning and Community Right-to-Know Act (SARA, Title III, section 313); therefore, a reporting requirement exists. Based upon chemical analysis, Crystal Simple Green® contains no known EPA priority pollutants, heavy metals, or chemicals listed under RCRA, CERCLA, or CWA. Analysis by TCLP (Toxicity Characteristic Leaching Procedure) according to RCRA revealed no toxic organic or inorganic constituents.

All components of Crystal Simple Green® are listed on the TSCA Chemical Substance Inventory.

III. HAZARDS IDENTIFICATION

UN Number: Not required
Dangerous Goods Class: Nonhazardous

Hazard Rating (NFPA/HMIS)
Health = 1* Reactivity = 0
Fire = 0 Special = 0



Rating Scale
0 = minimal 1 = slight
2 = moderate 3 = serious
4 = severe

*Mild eye irritant, non-mutagenic and non-carcinogenic. **None of the ingredients in Crystal Simple Green® are regulated or listed as potential cancer agents by Federal OSHA, NTP, or IARC.**

IV. FIRST AID MEASURES

SYMPTOMS OF OVEREXPOSURE AND FIRST AID TREATMENT

Eye contact: Reddening may develop. Immediately rinse the eye with large quantities of cool water; continue 10-15 minutes or until the material has been removed; be sure to remove contact lenses, if present, and to lift upper and lower lids during rinsing. Get medical attention if irritation persists.

Skin contact: Minimal effects, if any; rinse skin with water, rinse shoes and launder clothing before reuse. Reversible reddening may occur in some dermal-sensitive users; thoroughly rinse area and get medical attention if reaction persists.

Swallowing: Essentially non-toxic. Give several glasses of water to dilute; do not induce vomiting. If stomach upset occurs, consult physician.

Inhalation: Non-toxic. Exposures to concentrate-mist may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.

V. FIRE FIGHTING MEASURES

Crystal Simple Green® is stable, not flammable, and will not burn.

Flash Point/Auto-Ignition: Not flammable.

Flammability Limits: Not flammable.

Extinguishing Media: Not flammable/nonexplosive. No special procedures required.

Special Fire Fighting Procedures: None required.

VI. ACCIDENTAL RELEASE MEASURES

Recover usable material by convenient method; residual may be removed by wipe or wet mop. If necessary, unrecoverable material may be washed to drain with large quantities of water.

VII. HANDLING, STORAGE & TRANSPORT INFORMATION

No special precautions are required. **This product is non-hazardous for storage and transport according to the U.S. Department of Transportation Regulations.** Crystal Simple Green® requires no special labeling or placarding to meet U.S. Department of Transportation requirements.

UN Number: Not required

Dangerous Goods Class: Nonhazardous

VIII. EXPOSURE CONTROLS

Exposure Limits: The Crystal Simple Green® formulation presents no health hazards to the user when used according to label directions for its intended purposes. Mild skin and eye irritation is possible (please see Eye contact and Skin contact in Section IV.).

Ventilation: No special ventilation is required during use. Large-scale uses indoors should provide an increased rate of air exchange.

Human Health Effects or Risks from Exposure: Adverse effects on human health are not expected from Crystal Simple Green®, based upon twenty years of use of Simple Green without reported adverse health incidence in diverse population groups, including extensive use by inmates of U.S. Federal prisons in cleaning operations.

Crystal Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate-mist.

Crystal Simple Green® is not likely to irritate the skin in the majority of users. Repeated daily application to the skin without rinsing, or continuous contact of Crystal Simple Green® on the skin may lead to temporary, but reversible, irritation.

Medical Conditions Aggravated by Exposure: No aggravation of existing medical conditions is expected; dermal-sensitive users may react to dermal contact by Crystal Simple Green®.

IX. PERSONAL PROTECTION

Precautionary Measures: No special requirements under normal use conditions.
Eye Protection: Caution, including reasonable eye protection, should always be used to avoid eye contact where splashing may occur.
Skin Protection: No special precautions required; rinse completely from skin after contact.
Respiratory Protection: No special precautions required except during large-scale spray applications where spray mist levels are high.
Work and Hygienic Practices: Wash or rinse hands before touching eyes or contact lenses. Follow standard hygienic practices for handling cleaning agents.

X. PHYSICAL AND CHEMICAL PROPERTIES

Appearance/odor::	Clear liquid	Vapor Pressure:	18 mm Hg @ 20 °C; 23.5 mm Hg @ 26 °C
Specific Gravity:	1.020	Vapor Density:	1.3 (air = 1)
pH of concentrate:	9.35	Density:	8.5 lbs./gallon
Evaporation:	>1 (butyl acetate = 1)		
Boiling Point:	100.6 °C (212 °F)		
Freezing Point:	-9 °C (16 °F) If product freezes, it will reconstitute without loss of efficacy when brought back to room temperature and agitated.		

VOC Composite Partial Pressure: 0 mm Hg @ 20 °C
Volatile Organic Compounds (VOCs): 0 g/L per ASTM Method D-2369. Per California AQMD's VOC test method, product must be diluted at least 2 parts of water to 1 part Crystal Simple Green® in order to meet SCAQMD Rule 1171 & Rule 1122 and BAAQMD Regulation 8-16 VOC requirements for solvent cleaning operations.
Water Solubility: Completely soluble in water.
Detection: Crystal Simple Green® has a characteristic odor that is not indicative of any hazardous situation.

XI. STABILITY AND REACTIVITY INFORMATION

Nonreactive. Crystal Simple Green® is stable, even under fire conditions, and will not react with water or oxidizers. Hazardous polymerization will not occur.

XII. TOXICOLOGICAL INFORMATION

The information and conclusions cited in this section are based on data and testing of Simple Green®. The data are directly applicable to Crystal Simple Green® because, except for the fragrance and dyes which have been removed, it contains the same ingredients as Simple Green®.

Nonhuman Toxicity

Acute Mortality Studies:
Oral LD_{50} (rat): >5.0 g/kg body weight // Dermal LD_{50} (rabbit): >2.0 g/kg body weight

Dermal Irritation: Only mild, but reversible, irritation was found in a standard 72-hr test on rabbits. A value of 0.2 (non-irritating) was found on a scale of 8.

Eye Irritation: With or without rinsing with water, the irritation scores in rabbits at 24 hours did not exceed 15 (mild irritant)
on a scale of 110.

Subchronic dermal effects: No adverse effects, except reversible dermal irritation, were found in rabbits exposed to Simple Green® (up to 2.0 g/kg/day for 13 weeks) applied to the skin of 25 males and 25 females. Only female body weight gain was affected. Detailed microscopic examination of all major tissues showed no adverse changes.

Fertility Assessment by Continuous Breeding: The Simple Green® formulation had no adverse effect on fertility and reproduction in CD-1 mice with continuous administration for 18 weeks, and had no adverse effect on the reproductive performance of their offspring.

XIII. BIODEGRADABILITY AND ENVIRONMENTAL TOXICITY INFORMATION

Biodegradability:
Like Simple Green®, Crystal Simple Green® is readily decomposed by naturally occurring microorganisms. The biological oxygen demand (BOD), as a percentage of the chemical oxygen demand (COD), after 4, 7, and 11 days was 56%, 60%, and 70%, respectively. Per OECD Closed Bottle Test, Crystal Simple Green® meets OECD and EPA recommendations for ready biodegradability.

In a standard biodegradation test with soils from three different countries, Butyl Cellosolve reached 50% degradation in 6 to 23 days, depending upon soil type, and exceeded the rate of degradation for glucose, which was used as a control for comparison.

Environmental Toxicity Information:
Crystal Simple Green® is considered practically non-toxic per EPA's aquatic toxicity scale.

XIV. DISPOSAL CONSIDERATIONS

Crystal Simple Green® is fully water soluble and biodegradable and will not harm sewage-treatment microorganisms if disposal by sewer or drain is necessary. Dispose of in accordance with all applicable local, state, and federal laws.

XV. OTHER INFORMATION

Containers:	Crystal Simple Green® residues can be completely removed by rinsing with water; the container may be recycled or applied to other uses.
Contact Point:	Sunshine Makers, Inc., Research and Development Division: 562-795-6000.

***** NOTICE *****

All information appearing herein is based upon data obtained by the manufacturer and recognized technical sources. Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of this information, Sunshine Makers, Inc. or its distributors extends no warranties, makes no representations and assumes no responsibility as to the suitability of such information for application to purchaser's intended purposes or for consequences of its use.

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Material Safety Data Sheets Collection:

Sheet No. 467
Automotive Gasoline, Lead-free

Issued: 10/81 Revision: A, 9/91

Section 1. Material Identification

35

Automotive Gasoline, Lead-free, Description: A mixture of volatile hydrocarbons composed mainly of branched-chain paraffins, cycloparaffins, olefins, naphthenes, and aromatics. In general, gasoline is produced from petroleum, shale oil, Athabasca tar sands, and coal. Motor gasolines are made chiefly by cracking processes, which convert heavier petroleum fractions into more volatile fractions by thermal or catalytic decomposition. Widely used as fuel in internal combustion engines of the spark-ignited, reciprocating type. Automotive gasoline has an octane number of approximately 90. A high content of aromatic hydrocarbons and a consequent high toxicity are also associated with a high octane rating. Some gasolines sold in the US contain a minor proportion of tetraethyllead, which is added in concentrations not exceeding 3 ml per gallon to prevent engine "knock." However, methyl-tert-butyl ether (MTBE) has almost completely replaced tetraethyllead.

R 1
I 2
S 2*
K 4
* Skin absorption

NFPA

HMIS
H 2
F 3
R 1
PPG†
† Sec. 8

Other Designations: CAS No. 8006-61-9, benzin, gasoline, gasolene, motor spirits, natural gasoline, petrol.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Inhalation of automotive gasoline vapors can cause intense burning in throat and lungs, central nervous system (CNS) depression, and possible fatal pulmonary edema. Gasoline is a dangerous fire and explosion hazard when exposed to heat and flames.

Section 2. Ingredients and Occupational Exposure Limits

Automotive gasoline, lead-free*

1990 OSHA PELs
8-hr TWA: 300 ppm, 900 mg/m³
15-min STEL: 500 ppm, 1500 mg/m³

1990-91 ACGIH TLVs
TWA: 300 ppm, 890 mg/m³
STEL: 500 ppm, 1480 mg/m³

1990 NIOSH REL
None established

1985-86 Toxicity Data*
Man, inhalation, TC_{Lo}: 900 ppm/1 hr; toxic effects include sense organs and special senses (conjunctiva irritation), behavioral (hallucinations, distorted perceptions), lungs, thorax, or respiration (cough)
Human, eye: 140 ppm/8 hr; toxic effects include mild irritation
Rat, inhalation, LC_{50}: 300 g/m³/5 min

* A typical modern gasoline composition is 80% paraffins, 14% aromatics, and 6% olefins. The mean benzene content is approximately 1%. Other additives include sulfur, phosphorus, and MTBE.
† See NIOSH, *RTECS* (LX3300000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: Initially, 102 °F (39 °C); after 10% distilled, 140 °F (60 °C); after 50% distilled, 230 °F (110 °C); after 90% distilled, 338 °F (170 °C); final boiling point, 399 °F (204 °C)
Vapor Density (air = 1): 3.0 to 4.0
Density/Specific Gravity: 0.72 to 0.76 at 60 °F (15.6 °C)
Water Solubility: Insoluble

Appearance and Odor: A clear (gasoline may be colored with dye), mobile liquid with a characteristic odor recognizable at about 10 ppm in air.

Section 4. Fire and Explosion Data

Flash Point: -45 °F (-43 °C)	Autoignition Temperature: 536 to 853 °F (280 to 456 °C)	LEL: 1.3% v/v	UEL: 6.0% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or alcohol foam as extinguishing media. Use of water may be ineffective to extinguish fire, but use water spray to knock down vapors and to cool fire-exposed drums and tanks to prevent pressure rupture. Do not use a solid stream of water since it may spread the fuel.
Unusual Fire or Explosion Hazards: Automobile gasoline is an OSHA Class IB flammable liquid and a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow to an ignition source and flash back. Automobile gasoline can also react violently with oxidizing agents.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode, and full protective clothing. When the fire is extinguished, use nonsparking tools for cleanup. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Automotive gasoline is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Automotive gasoline can react with oxidizing materials such as peroxides, nitric acid, and perchlorates.
Conditions to Avoid: Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition of automotive gasoline can produce oxides of carbon and partially oxidized hydrocarbons.

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Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC list gasoline as a possible human carcinogen (Group 2B). Although the IARC has assigned an overall evaluation to gasoline, it has not assigned an overall evaluation to specific substances within this group (inadequate human evidence).
Summary of Risks: Gasoline vapors are considered moderately poisonous. Vapor inhalation can cause central nervous system (CNS) depression and mucous membrane and respiratory tract irritation. Brief inhalations of high concentrations can cause a fatal pulmonary edema. Reported responses to gasoline vapor concentrations are: 160 to 270 ppm causes eye and throat irritation in several hours; 500 to 900 ppm causes eye, nose, and throat irritation, and dizziness in 1 hr; and 2000 ppm produces mild anesthesia in 30 min. Higher concentrations are intoxicating in 4 to 10 minutes. If large areas of skin are exposed to gasoline, toxic amounts may be absorbed. Repeated or prolonged skin exposure causes dermatitis. Certain individuals may develop hypersensitivity. Ingestion can cause CNS depression. Pulmonary aspiration after ingestion can cause severe pneumonitis. In adults, ingestion of 20 to 50 g gasoline may produce severe symptoms of poisoning.
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Skin, eye, respiratory and central nervous systems.
Primary Entry Routes: Inhalation, ingestion, skin contact.
Acute Effects: Acute inhalation produces intense nose, throat, and lung irritation; headaches; blurred vision; conjunctivitis; flushing of the face; mental confusion; staggering gait; slurred speech; and unconsciousness, sometimes with convulsions. Ingestion causes inebriation (drunkenness), vomiting, dizziness, fever, drowsiness, confusion, and cyanosis (a blue to dark purplish coloration of skin and mucous membrane caused by lack of oxygen). Aspiration causes choking, cough, shortness of breath, increased rate of respiration, excessively rapid heartbeat, fever, bronchitis, and pneumonitis. Other symptoms following acute exposure include acute hemorrhage of the pancreas, fatty degeneration of the liver and kidneys, and passive congestion of spleen.
Chronic Effects: Chronic inhalation results in appetite loss, nausea, weight loss, insomnia, and unusual sensitivity (hyperesthesia) of the distal extremities followed by motor weakness, muscular degeneration, and diminished tendon reflexes and coordination. Repeated skin exposure can cause blistering, drying, and lesions.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Give conscious victim a mixture of 2 tablespoons of activated charcoal mixed in 8 oz of water to drink. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Use nonsparking tools. Take up small spills with sand or other noncombustible adsorbent. Dike storage areas to control leaks and spills. Follow applicable OSHA regulations (29 CFR 1910.120).
Aquatic Toxicity: Bluegill, freshwater, LC_{50}, 8 ppm/96 hr.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.21): Characteristic of ignitability
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. There are no specific NIOSH recommendations. However, for vapor concentrations not immediately dangerous to life or health, use chemical cartridge respirator equipped with organic vapor cartridge(s), or a supplied-air respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Materials such as neoprene or polyvinyl alcohol provide excellent/good resistance for protective clothing. **Note:** Resistance of specific materials can vary from product to product.
Ventilation: Provide general and local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IB liquid. Outside or detached storage preferred.
Engineering Controls: Avoid vapor inhalation and skin or eye contact. Consider a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Indoor use of this material requires explosion-proof exhaust ventilation to remove vapors. Only use gasoline as a fuel source due to its volatility and flammable/explosive nature. Practice good personal hygiene and housekeeping procedures. Wear clean work clothing daily.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Gasoline (*including casing-head and natural*)
DOT Hazard Class: Flammable liquid
ID No.: UN1203
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Gasoline
IMO Hazard Class: 3.1
ID No.: UN1203
IMO Label: Flammable liquid
IMDG Packaging Group: II

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 140, 143, 146, 153, 159
Prepared by: M Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS

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APPENDIX D

COMMUNITY AIR MONITORING PLAN

Community Air Monitoring Plan
Fulton Municipal Works Former MGP
Pre-Design Investigation
Brooklyn, New York

In accordance with NYSDEC and NYSDOH requirements for a Community Air Monitoring Plan (CAMP), a perimeter air-monitoring plan will be implemented at the site during each phase of the field activities. The objective of the perimeter air-monitoring plan is to provide a measure of protection for the downwind community (i.e., off-site receptors, including residences and businesses and on-site workers not involved with the site field activities) from potential airborne contaminant releases as a direct result of field activities. The perimeter air-monitoring plan is a stand-alone document and will be available on site. The VOC Monitoring, Response Levels, and Actions are presented as follows.

Air Monitoring Response Levels and Actions

VOCs	
Response Level	**Actions**
>5 ppm above background for 15-minute average	▪ Temporarily halt work activities ▪ Continue monitoring ▪ If VOC levels decrease (per instantaneous readings) below 5 ppm over background, work activities can resume
Persistent levels >5 ppm over background <25 ppm	▪ Halt work activities ▪ Identify source of vapors ▪ Corrective action to abate emissions ▪ Continue monitoring ▪ Resume work activities if VOC levels 200 feet downwind of the property boundary or half the distance to the nearest potential receptor is <5 ppm for a 15-minute average ▪ If VOC levels are >25 ppm at the perimeter of the work area, activities must be shutdown

Particulates	
>100 mcg/m^3 above background for 15-minute average or visual dust observed leaving the site	▪ Apply dust suppression ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 mcg/m^3 above upwind levels and no visual dust leaving site
>150 mcg/m^3 above background for 15-minute average	▪ Stop work ▪ Re-evaluate activities ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 mcg/m^3 above upwind levels and no visual dust leaving site

Sources:

New York State Department of Health Community Air Monitoring Plan, June 20, 2000.

New York State Department of Environmental Conservation Division Technical and Administrative Guidance Memorandum - Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites, October 27, 1989.

During drilling, excavating, and materials handling operations, the air in work areas will also be sampled periodically for the presence of contaminants. A portable photoionization detector (PID) will be utilized to periodically monitor the levels of organic vapors in the ambient air and a Mini RAM™ PM-10 (or equivalent) particle detector will be used to count inhalable particles (0.1-10 micrometer range) of dust during the field work. PID and Mini RAM readings will be taken hourly during excavation or more frequently if air quality measurements approach action levels as defined herein. Measurements will be monitored from the breathing zone (four to five feet above ground level) at worker locations to determine working conditions (and whether there is a need to change levels of worker protection).

In addition to VOCs and particulates, cyanide will be monitored in the work zone. The cyanide monitoring methods will be determined prior to mobilization, but at a minimum, will include Drager® tube sampling.

In order to make a conservative assessment of when different levels of respiratory protection are needed during the field work, it will be assumed that the organic vapors detected by the air monitoring instruments consist of the most toxic volatile compounds expected to be found on the site. Preliminary evaluation of the risks expected at the site indicates that the most toxic volatiles that are probably present are VOCs (particularly BTEX). Based on data published by the Occupational Safety and Health Administration (OSHA) and the American Conference of Government Industrial Hygienists (ACGIH), and GEI's experience with MGP wastes, the following PPE will be employed when the given concentrations of organic vapor are detected in the breathing zone.

Compound of Concern	**Level D**	**Level C**	**Level B**
Chemical Name	**M<X**	**X<M<Y**	**M>Y**
BTEX and other photoionizable VOCs	M <5 ppm	5 ppm <M <50 ppm	M >50 ppm

Where: M = concentration of organic vapor measured in the field
X,Y = concentrations at which different levels of respiratory protection are necessary.

The PPE requirements may be modified based on compound-specific monitoring results information, with the written approval of the Corporate Health and Safety Specialist (CHSS).

Respiratory protection from dusts will be required when inhalable particulate concentrations from potentially contaminated sources exceed 150 $\mu g/m^3$.

Odors or dusts derived from site contaminants may cause nausea in some site workers, even though the contaminants are at levels well below the safety limits as defined above.

Workers may use dust masks or respirators to mitigate nuisance odors with the approval of the SSO.

Whenever practical, work areas should be positioned upwind of organic vapor and dust sources to reduce the potential for worker exposure.

APPENDIX E

GOWANUS CANAL SEDIMENT AND SURFACE WATER DATA

Summary of Sediment Analytical Results
Winter 2011
Gowanus Canal
Brooklyn, New York

Sample Name:	NG-GC-SD301	NG-GC-SD302	NG-GC-SD303	NG-GC-SD304
Sample Depth (feet):	(0-0.5)	(0-0.5)	(0-0.5)	(0-0.5)
Sample Date:	2/22/2011	2/22/2011	2/22/2011	2/22/2011
Pathogens				
C. perfringens (cfu/g)	**40000**	**28000**	**32000**	**45000**
Coliphage, Male Specific (PFU/1 mL)	**65**	**3**	0 U	0 U
Coliphage, Somatic (PFU/1 mL)	**69**	**1**	0 U	0 U
Cryptosporidium (Oocysts/g)	0 U	0 U	0 U	0 U
E.Coli (MPN/g)	**3500**	**866.4**	**75.9**	**143.9**
Enterococci (MPN/g)	**141000**	**376.2**	**149.5**	**163.1**
Fecal Coliform (MPN/g)	**350**	**866**	**75.9**	**144**
Giardia (Cysts/g)	0 UJ	0 U	0 U	0 U
Plaque forming virus (PFU/187 mL)	0 U	0 U	0 U	0 U
Viruses (PFU/187 mL)	NA	NA	NA	NA
Viruses (pos/neg)	neg	neg	neg	neg

Notes:

cfu/g - colony forming units per gram
MPN/g - most probable number per gram
Oocysts/g - Oocysts per gram
PFU plaque forming unit
NA - not analyzed

Bolding indicates a detected concentration
Red text indicates an analyte was not detected in any sample

Validator Qualifiers:

U - indicates not detected to the reporting limit for organic analysis and the method detection limit for inorganic analysis
UJ - not detected at or above the reporting limit shown and the reporting limit is estimated

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Note that the letters designating the screening values that are exceeded are marked in parenthesis after the results. The list of screening values and the prioritization scheme can be found in Tables 4-2 and 4-3, respectively. Appendix C contains the detailed list of values.

The letters designating the screening values for each media are also presented below for ease of reference:

Medium	Evaluation Criteria		
	Human Health Risk	Ecological Risk	General
Sediment - surface in canal	A	R	
Sediment – CSOs	A	R	
Sediment – subsurface soft	A	R	
Sediment – subsurface native	A	R	
Surface water in canal - dry and wet events	T	S	
Surface water – CSOs	T	S	
Surface water - pipe outfalls	T	S	
Tissue	M	U, V, W, X, Y, Z	
Groundwater			N1, O1,O2
Soil			Q
Air	P		

1. For surface sediment, surface water, soft and native sediment, and air, the samples are listed based on their distance from the head of the canal. For the remaining media, the samples are listed in chronological order based on their number.
2. The list of analytes is based on the target list identified in the QAPPs developed for the project.
3. Two sets of tables are provided – first set includes all results. Second set only lists detected concentrations and highlights the concentrations that exceed standards / criteria.
4. Exceedance of one standard / criteria is bolded. Exceedance of two standards / criteria is enclosed in a rectangle. The criteria that are exceeded are noted in parenthesis after the result.
5. Blank means that the compound was not detected.
6. "- -" in the results means that a result was not available.
7. "- -" in the total concentrations means that a total value was not calculated. Total concentrations were not calculated for locations where one of the results that needed to be included in the total is rejected.
8. "*" Asterisk denotes that compound does not have a screening value.
9. For soil sampling locations where multiple samples were collected at the same interval, the VOC sample depth is shown to differentiate between the two samples.
10. The following results were not available at the time of preparation of this draft RI report:
    a. Surface water dry weather sampling – the cyanide results for eight locations, seven of which are reference locations (322, 326, 327, 328, 329, 330, 333, and 336).
11. The following abbreviations appear in the Appendix I data tables:
    a. N-Normal sample
    b. FD-Field duplicate
    c. S-Split
    d. ND – not detected, generally used to populate fields for summed values where constituent compounds were all below detection limit
    e. mg/kg – milligrams/kilogram

f. µg/kg – micrograms/kilogram
g. mg/l – milligrams/liter
h. µg/l – micrograms/liter
i. µg/m3 – micrograms/cubic meter

12. Data qualifiers used include:
    a. J – Concentration estimated.
    b. NJ - Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity.
    c. R – Rejected.
    d. U – detected. May also indicate "not detected at significantly greater than that in an associated blank".
    e. UJ - Not detected, quantitation limit is estimated.
    f. [null] – Detected.

TABLE I-3A
Pesticide Concentrations in Surface Sediments
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		301	302	303	304	305	306	307A	307B	308A	308A	308B	309	310	311	312	314	314	313
Sample Number:		GC-SD301-0.0-0.5	GC-SD302-0.0-0.5	GC-SD303-0.0-0.5	GC-SD304-0.0-0.5	GC-SD305-0.0-0.5	GC-SD306-0.0-0.5	GC-SD307A-0.0-0.5	GC-SD307B-0.0-0.5	GC-SD308A-0.0-0.5	D-062310-01	GC-SD308B-0.0-0.5	GC-SD309-0.0-0.5	GC-SD310-0.0-0.5	GC-SD311-0.0-0.5	GC-SD312-0.0-0.5	GC-SD314-0.0-0.5	D-06182010-01	GC-SD313-0.0-0.5
Sample Depth:		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date:		6/23/2010	6/17/2010	6/17/2010	6/17/2010	6/17/2010	6/17/2010	6/17/2010	6/18/2010	6/23/2010	6/23/2010	6/24/2010	6/18/2010	6/24/2010	6/23/2010	6/23/2010	6/18/2010	6/18/2010	6/18/2010
Sample Type:		N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	FD	N
Parameter	**Units**	**Pesticides**																	
Aldrin	ug/kg	250 UJ	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 UJ	2.1 UJ	430 UJ	4.2 U	5.9 UJ	390 UJ	440 UJ	430 U	430 U	2.7 U
Alpha BHC	ug/kg	250 U	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 U	2.1 U	430 U	4.2 U	5.9 UJ	390 U	440 U	430 U	430 U	2.7 U
Alpha endosulfan	ug/kg	250 U	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 U	2.1 U	430 U	4.2 U	5.9 UJ	390 U	440 U	430 U	430 U	2.7 U
Alpha-chlordane	ug/kg	250 UJ	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 UJ	**14 J**	430 UJ	4.2 U	**6.7 J**	390 UJ	440 UJ	430 U	430 U	2.7 U
Beta BHC	ug/kg	250 UJ	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 UJ	2.1 UJ	430 UJ	4.2 U	5.9 UJ	390 UJ	440 UJ	430 U	430 U	2.7 U
Beta endosulfan	ug/kg	480 UJ	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 U	410 UJ	**13 J**	840 UJ	8.2 U	11 UJ	760 UJ	850 UJ	830 U	840 U	5.3 U
Delta BHC	ug/kg	250 UJ	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 UJ	2.1 UJ	430 UJ	4.2 U	5.9 UJ	390 UJ	440 UJ	430 U	430 U	2.7 U
Dieldrin	ug/kg	480 U	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 U	410 U	23 R	840 U	8.2 U	11 UJ	760 U	850 U	830 U	840 U	5.3 U
Endosulfan sulfate	ug/kg	480 UJ	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 U	410 UJ	**21 J**	840 UJ	8.2 U	11 UJ	760 UJ	850 UJ	830 U	840 U	5.3 U
Endrin	ug/kg	480 U	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 U	410 U	4.1 U	840 U	8.2 U	11 UJ	760 U	850 U	830 U	840 U	5.3 U
Endrin aldehyde	ug/kg	480 UJ	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 U	410 UJ	4.1 UJ	840 UJ	8.2 U	11 UJ	760 UJ	850 UJ	830 U	840 U	5.3 U
Endrin ketone	ug/kg	480 UJ	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 U	410 UJ	4.1 UJ	840 UJ	8.2 U	11 UJ	760 UJ	850 UJ	830 U	840 U	5.3 U
Gamma BHC	ug/kg	250 U	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 U	2.1 U	430 U	4.2 UJ	5.9 UJ	390 U	440 U	430 U	430 U	2.7 U
Gamma-chlordane	ug/kg	250 UJ	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	**5.9 NJ**	210 UJ	**29 J**	430 UJ	4.2 U	**11 J**	390 UJ	440 UJ	430 U	430 U	2.7 U
Heptachlor	ug/kg	250 U	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 U	2.1 U	430 U	4.2 U	5.9 UJ	390 U	440 U	430 U	430 U	2.7 U
Heptachlor epoxide	ug/kg	250 UJ	4.5 UJ	4.6 UJ	5.9 UJ	5 UJ	6.2 UJ	4.3 UJ	4.6 U	210 UJ	2.1 UJ	430 UJ	4.2 U	5.9 UJ	390 UJ	440 UJ	430 U	430 U	2.7 U
Methoxychlor	ug/kg	2,500 U	45 UJ	46 UJ	59 UJ	50 UJ	62 UJ	43 UJ	46 U	2,100 U	**33 J**	4,300 U	42 U	59 UJ	3,900 U	4,400 U	4,300 U	4,300 U	27 U
P,P'-DDD	ug/kg	480 UR	**21 NJ**	8.8 UR	11 UR	9.7 UR	12 UR	8.4 UR	**7.9 NJ**	410 UR	**16 NJ**	840 UR	8.2 UR	**13 NJ**	760 UR	850 UR	830 UR	840 UR	5.3 UR
P,P'-DDE	ug/kg	480 UJ	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 UJ	410 UJ	**16 NJ**	840 UJ	8.2 U	11 UJ	760 UJ	850 UJ	830 U	840 U	5.3 U
P,P'-DDT	ug/kg	480 U	8.7 UJ	8.8 UJ	11 UJ	9.7 UJ	12 UJ	8.4 UJ	8.9 U	410 U	4.1 U	840 U	8.2 U	11 UJ	760 U	850 U	830 U	840 U	5.3 U
Toxaphene	ug/kg	25,000 U	450 UJ	460 UJ	590 UJ	500 UJ	620 UJ	430 UJ	460 U	21,000 U	210 U	43,000 U	420 U	590 UJ	39,000 U	44,000 U	43,000 U	43,000 U	270 U
Total DDTs	ug/kg	---	**21**	---	---	---	---	---	**7.9**	---	**32**	---	---	**13**	---	---	---	---	---

TABLE I-3A
Pesticide Concentrations in Surface Sediments
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		316	315	315	317	318	319	320	321	322	324	324	323	325	326	327	328	329	330
Sample Number:		GC-SD316-0.0-0.5	GC-SD315-0.0-0.5	D-06182010-02	GC-SD317-0.0-0.5	GC-SD318-0.0-0.5	GC-SD319-0.0-0.5	GC-SD320-0.0-0.5	GC-SD321-0.0-0.5	GC-SD322-0.0-0.5	GC-SD324-0.0-0.5	D-06212010-01	GC-SD323-0.0-0.5	GC-SD325-0.0-0.5	GC-SD326-0.0-0.5	GC-SD327-0.0-0.5	GC-SD328-0.0-0.5	GC-SD329-0.0-0.5	GC-SD330-0.0-0.5
Sample Depth:		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date:		6/21/2010	6/18/2010	6/18/2010	6/22/2010	6/22/2010	6/22/2010	6/22/2010	6/21/2010	6/22/2010	6/21/2010	6/21/2010	6/22/2010	6/21/2010	6/17/2010	6/17/2010	6/18/2010	6/18/2010	6/18/2010
Sample Type:		N	N	FD	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N
Parameter	**Units**	**Pesticides**																	
Aldrin	ug/kg	530 U	300 U	270 U	380 UJ	480 UJ	320 UJ	280 UJ	4.9 U	5.5 UJ	5.2 U	3.9 U	3.6 UJ	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Alpha BHC	ug/kg	530 U	300 U	270 U	380 U	480 U	320 U	280 U	4.9 U	5.5 U	5.2 U	3.9 U	3.6 U	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Alpha endosulfan	ug/kg	530 U	300 U	270 U	380 U	480 U	320 U	280 U	4.9 U	5.5 U	5.2 U	3.9 U	3.6 U	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Alpha-chlordane	ug/kg	530 U	300 U	270 U	380 UJ	480 UJ	320 UJ	280 UJ	4.9 U	5.5 UJ	5.2 U	3.9 U	3.6 UJ	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Beta BHC	ug/kg	530 U	300 U	270 U	380 UJ	480 UJ	320 UJ	280 UJ	4.9 U	5.5 UJ	5.2 U	3.9 U	3.6 UJ	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Beta endosulfan	ug/kg	1,000 U	590 U	530 U	740 UJ	940 UJ	630 UJ	550 UJ	9.4 U	11 UJ	10 U	7.7 U	6.9 UJ	7.8 U	9.2 UJ	10 UJ	6.5 U	7 U	10 U
Delta BHC	ug/kg	530 U	300 U	270 U	380 UJ	480 UJ	320 UJ	280 UJ	4.9 U	5.5 UJ	5.2 U	3.9 U	3.6 UJ	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Dieldrin	ug/kg	1,000 U	590 U	530 U	740 U	940 U	630 U	550 U	9.4 U	11 U	10 U	7.7 U	6.9 U	7.8 U	9.2 UJ	10 UJ	6.5 U	7 U	10 U
Endosulfan sulfate	ug/kg	1,000 U	590 U	530 U	740 UJ	940 UJ	630 UJ	550 UJ	9.4 U	11 UJ	10 U	7.7 U	6.9 UJ	7.8 U	9.2 UJ	10 UJ	6.5 U	7 U	10 U
Endrin	ug/kg	1,000 U	590 U	530 U	740 U	940 U	630 U	550 U	9.4 U	11 U	10 U	7.7 U	6.9 U	7.8 U	9.2 UJ	10 UJ	6.5 U	7 U	10 U
Endrin aldehyde	ug/kg	1,000 U	590 U	530 U	740 UJ	940 UJ	630 UJ	550 UJ	9.4 U	11 UJ	10 U	7.7 U	6.9 UJ	7.8 U	9.2 UJ	10 UJ	6.5 U	7 U	10 U
Endrin ketone	ug/kg	1,000 U	590 U	530 U	740 UJ	940 UJ	630 UJ	550 UJ	9.4 U	11 UJ	10 U	7.7 U	6.9 UJ	7.8 U	9.2 UJ	10 UJ	6.5 U	7 U	10 U
Gamma BHC	ug/kg	530 U	300 U	270 U	380 U	480 U	320 U	280 U	4.9 U	5.5 U	5.2 U	3.9 U	3.6 U	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Gamma-chlordane	ug/kg	530 U	300 U	270 U	380 UJ	480 UJ	320 UJ	280 UJ	4.9 U	5.5 UJ	5.2 U	3.9 U	3.6 UJ	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Heptachlor	ug/kg	530 U	300 U	270 U	380 U	480 U	320 U	280 U	4.9 U	5.5 U	5.2 U	3.9 U	3.6 U	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Heptachlor epoxide	ug/kg	530 U	300 U	270 U	380 UJ	480 UJ	320 UJ	280 UJ	4.9 U	5.5 UJ	5.2 U	3.9 U	3.6 UJ	4 U	4.7 UJ	5.4 UJ	3.3 U	3.6 U	5.3 U
Methoxychlor	ug/kg	5,300 U	3,000 U	2,700 U	3,800 U	4,800 U	3,200 U	2,800 U	49 U	55 U	52 U	39 U	36 U	40 U	47 UJ	54 UJ	33 U	36 U	53 U
P,P'-DDD	ug/kg	1,000 UR	**1,100 NJ**	**1,000 NJ**	740 UR	940 UR	630 UR	550 UR	9.4 UR	11 UR	10 UR	7.7 UR	6.9 UR	7.8 UR	9.2 UR	10 UR	6.5 UR	7 UR	10 UR
P,P'-DDE	ug/kg	1,000 U	590 U	530 U	740 UJ	940 UJ	630 UJ	550 UJ	9.4 U	11 UJ	10 U	7.7 U	6.9 UJ	13 R	9.2 UJ	10 UJ	6.5 U	7 U	10 U
P,P'-DDT	ug/kg	1,000 U	590 U	530 U	740 U	940 U	630 U	550 U	9.4 U	11 U	10 U	7.7 U	6.9 U	7.8 U	9.2 UJ	10 UJ	6.5 U	7 U	10 U
Toxaphene	ug/kg	53,000 U	30,000 U	27,000 U	38,000 U	48,000 U	32,000 U	28,000 U	490 U	550 U	520 U	390 U	360 U	400 U	470 UJ	540 UJ	330 U	360 U	530 U
Total DDTs	ug/kg	---	**1,100**	**1,000**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TABLE I-3A
Pesticide Concentrations in Surface Sediments
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		**331**	**332**	**333**	**334**	**335**
Sample Number:		**GC-SD331-0.0-0.5**	**GC-SD332-0.0-0.5**	**GC-SD333-0.0-0.5**	**GC-SD334-0.0-0.5**	**GC-SD335-0.0-0.5**
Sample Depth:		**0-0.5**	**0-0.5**	**0-0.5**	**0-0.5**	**0-0.5**
Sample Date:		**6/18/2010**	**6/18/2010**	**6/18/2010**	**6/18/2010**	**6/17/2010**
Sample Type:		**N**	**N**	**N**	**N**	**N**
Parameter	**Units**	**Pesticides**				
Aldrin	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Alpha BHC	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Alpha endosulfan	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Alpha-chlordane	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Beta BHC	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Beta endosulfan	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
Delta BHC	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Dieldrin	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
Endosulfan sulfate	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
Endrin	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
Endrin aldehyde	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
Endrin ketone	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
Gamma BHC	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Gamma-chlordane	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Heptachlor	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Heptachlor epoxide	ug/kg	3.7 U	2.7 U	4.2 U	2.1 U	4.5 UJ
Methoxychlor	ug/kg	37 U	27 U	42 U	21 U	45 UJ
P,P'-DDD	ug/kg	7.2 UR	5.2 UR	8.1 UR	4.1 UR	8.8 UR
P,P'-DDE	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
P,P'-DDT	ug/kg	7.2 U	5.2 U	8.1 U	4.1 U	8.8 UJ
Toxaphene	ug/kg	370 U	270 U	420 U	210 U	450 UJ
Total DDTs	ug/kg	---	---	---	---	---

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TABLE I-3B
Pesticide Concentrations in Surface Sediments, Exceedances of Standards and Criteria
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		302	307B	308A	310	315	315
Sample Number:		GC-SD302-0.0-0.5	GC-SD307B-0.0-0.5	D-062310-01	GC-SD310-0.0-0.5	GC-SD315-0.0-0.5	D-06182010-02
Sample Depth:		0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Sample Date:		6/17/2010	6/18/2010	6/23/2010	6/24/2010	6/18/2010	6/18/2010
Sample Type:		N	N	FD	N	N	FD
Parameter	**Units**	**Pesticides**					
Alpha-chlordane	ug/kg			14 J (R)	6.7 J (R)		
Beta endosulfan	ug/kg			13 J (R)			
Endosulfan sulfate	ug/kg			21 J			
Gamma-chlordane	ug/kg		5.9 NJ (R)	29 J (R)	11 J (R)		
Methoxychlor	ug/kg			33 J			
P,P'-DDD	ug/kg	21 NJ (R)	7.9 NJ (R)	16 NJ (R)	13 NJ (R)	1,100 NJ (R)	1,000 NJ (R)
P,P'-DDE	ug/kg			16 NJ (R)			
Total DDTs	ug/kg	21 (R)	7.9 (R)	32 (R)	13 (R)	1,100 (R)	1,000 (R)

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TABLE I-23A
Pesticide Concentrations in Surface Water
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		301	301	302	302	303	303	303	304	304	305	305	306	306	307A	307A	307B	307B	308A
Sample Number:		GC-SW301-0.5-DW	GC-SW301-0.5-WW	GC-SW302-0.5-DW	GC-SW302-0.5-WW	GC-SW303-0.5-DW	GC-SW303-0.5-WW	D-07132010-01	GC-SW304-0.5-DW	GC-SW304-0.5-WW	GC-SW305-0.5-DW	GC-SW305-0.5-WW	GC-SW306-0.5-DW	GC-SW306-0.5-WW	GC-SW307A-0.5-DW	GC-SW307A-0.5-WW	GC-SW307B-0.5-DW	GC-SW307B-0.5-WW	GC-SW308A-0.5-DW
Weather:		DRY	WET	DRY	WET	DRY	WET	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY
Sample Date:		6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010
Sample Type:		N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N
Parameter	**Units**	**Pesticides**																	
Aldrin	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha endosulfan	ug/l	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U
Alpha-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta endosulfan	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Delta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin ketone	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Gamma BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Gamma-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	ug/l	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
P,P'-DDD	ug/l	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR
P,P'-DDE	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
P,P'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Toxaphene	ug/l	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total DDTs	ug/l	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TABLE I-23A
Pesticide Concentrations in Surface Water
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		308A	308B	308B	309	309	310	310	310	311	311	312	312	312	314	314	313	313	316
Sample Number:		GC-SW308A-0.5-WW	GC-SW308B-0.5-DW	GC-SW308B-0.5-WW	GC-SW309-0.5-DW	GC-SW309-0.5-WW	GC-SW310-0.5-DW	GC-SW310-0.5-WW	D-07132010-02	GC-SW311-0.5-DW	GC-SW311-0.5-WW	GC-SW312-0.5-DW	GC-SW312-0.5-WW	D-06192010-02	GC-SW314-0.5-DW	GC-SW314-0.5-WW	GC-SW313-0.5-DW	GC-SW313-0.5-WW	GC-SW316-0.5-DW
Weather:		WET	DRY	WET	DRY	WET	DRY	WET	WET	DRY	WET	DRY	WET	DRY	DRY	WET	DRY	WET	DRY
Sample Date:		7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010
Sample Type:		N	N	N	N	N	N	N	FD	N	N	N	N	FD	N	N	N	N	N
Parameter	**Units**	**Pesticides**																	
Aldrin	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha endosulfan	ug/l	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U
Alpha-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta endosulfan	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Delta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin ketone	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Gamma BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Gamma-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	ug/l	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
P,P'-DDD	ug/l	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 UR	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR
P,P'-DDE	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
P,P'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Toxaphene	ug/l	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total DDTs	ug/l	---	---	---	---	ND	---	ND	---	---	ND	---	ND	---	---	---	---	---	---

TABLE I-23A
Pesticide Concentrations in Surface Water
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		316	316	315	315	317	317	318	318	318	319	319	319	320	320	321	321	322	322
Sample Number:		GC-SW316-0.5-WW	D-06192010-03	GC-SW315-0.5-DW	GC-SW315-0.5-WW	GC-SW317-0.5-DW	GC-SW317-0.5-WW	GC-SW318-0.5-DW	GC-SW318-0.5-WW	D-06192010-04	GC-SW319-0.5-DW	GC-SW319-0.5-WW	D-07132010-03	GC-SW320-0.5-DW	GC-SW320-0.5-WW	GC-SW321-0.5-DW	GC-SW321-0.5-WW	GC-SW322-0.5-DW	GC-SW322-0.5-WW
Weather:		WET	DRY	DRY	WET	DRY	WET	DRY	WET	DRY	DRY	WET	WET	DRY	WET	DRY	WET	DRY	WET
Sample Date:		7/13/2010	6/19/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	6/19/2010	7/13/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010
Sample Type:		N	FD	N	N	N	N	N	N	FD	N	N	FD	N	N	N	N	N	N
Parameter	**Units**	**Pesticides**																	
Aldrin	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha endosulfan	ug/l	0.05 UR	0.05 U	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 U	0.05 UR	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR
Alpha-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta endosulfan	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Delta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin ketone	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Gamma BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Gamma-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	ug/l	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
P,P'-DDD	ug/l	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 UR	0.1 UR	0.1 U	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR
P,P'-DDE	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
P,P'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Toxaphene	ug/l	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total DDTs	ug/l	---	---	---	---	---	ND	---	ND	---	---	---	ND	---	---	---	---	---	---

TABLE I-23A
Pesticide Concentrations in Surface Water
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		324	324	324	323	323	325	326	326	327	327	328	328	329	329	329	330	330	331
Sample Number:		GC-SW324-0.5-DW	GC-SW324-0.5-WW	D-07132010-04	GC-SW323-0.5-DW	GC-SW323-0.5-WW	GC-SW325-0.5-DW	GC-SW326-0.5-DW	GC-SW326-0.5-WW	GC-SW327-0.5-DW	GC-SW327-0.5-WW	GC-SW328-0.5-DW	GC-SW328-0.5-WW	GC-SW329-0.5-DW	GC-SW329-0.5-WW	D-06192010-01	GC-SW330-0.5-DW	GC-SW330-0.5-WW	GC-SW331-0.5-DW
Weather:		DRY	WET	WET	DRY	WET	DRY	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	DRY	WET	DRY
Sample Date:		6/19/2010	7/13/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	6/19/2010	7/13/2010	6/19/2010
Sample Type:		N	N	FD	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Parameter	**Units**	**Pesticides**																	
Aldrin	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha endosulfan	ug/l	0.05 U	0.05 UR	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 U	0.05 UR	0.05 U
Alpha-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta endosulfan	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Delta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin ketone	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Gamma BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Gamma-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	ug/l	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
P,P'-DDD	ug/l	0.1 UR	0.1 U	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 UR	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR	0.1 UR
P,P'-DDE	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
P,P'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Toxaphene	ug/l	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total DDTs	ug/l	---	ND	ND	---	ND	---	---	ND	---	ND	---	---	---	---	---	---	---	---

TABLE I-23A
Pesticide Concentrations in Surface Water
Gowanus Canal Remedial Investigation
Brooklyn, New York

Station Location:		331	332	332	333	333	334	334	335	335	336	336
Sample Number:		GC-SW331-0.5-WW	GC-SW332-0.5-DW	GC-SW332-0.5-WW	GC-SW333-0.5-DW	GC-SW333-0.5-WW	GC-SW334-0.5-DW	GC-SW334-0.5-WW	GC-SW335-0.5-DW	GC-SW335-0.5-WW	GC-SW336-0.5-DW	GC-SW336-0.5-WW
Weather:		WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET
Sample Date:		7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010	6/19/2010	7/13/2010
Sample Type:		N	N	N	N	N	N	N	N	N	N	N
Parameter	**Units**	**Pesticides**										
Aldrin	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Alpha endosulfan	ug/l	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR	0.05 U	0.05 UR
Alpha-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Beta endosulfan	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Delta BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin ketone	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Gamma BHC	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Gamma-chlordane	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	ug/l	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
P,P'-DDD	ug/l	0.1 UR	0.1 UR	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 U	0.1 UR	0.1 U
P,P'-DDE	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
P,P'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Toxaphene	ug/l	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total DDTs	ug/l	---	---	ND	---	ND	---	ND	---	ND	---	ND

APPENDIX F

COLD STRESS PROGRAM

COLD STRESS GUIDLINES		
Form	**Signs & Symptoms**	**Care**
Mild Hypothermia	▪ Body Temp 98-90°F ▪ Shivering ▪ Lack of coordination, stumbling, fumbling hands ▪ Slurred speech ▪ Memory loss ▪ Pale, cold skin	▪ Move to warm area ▪ Stay active ▪ Remove we clothes and replace with dry clothes of blankets ▪ Cover the head ▪ Drink warm (not hot) sugary drink
Moderate Hypothermia	▪ Body temp 90-86°F ▪ Shivering stops ▪ Unable to walk or stand ▪ Confused irrational	▪ All of the above, plus: ▪ Call 911 ▪ Cover all extremities complexly ▪ Place very warm objects, such as hot packs on the victim's head, neck, chest and groin
Severe Hypothermia	▪ Body temp 86-78°F ▪ Severe muscle stiffness ▪ Very sleepy or unconscious ▪ Ice cold skin ▪ Death	▪ Call 911 ▪ Treat victim very gently ▪ Do not attempt to re-warm
Frostbite	▪ Cold, tingling, stinging or aching feeling in the frostbitten area, followed by numbness ▪ Skin color turns red, then purple, then white or very pale skin ▪ Cold to the touch ▪ Blisters in severe cases	▪ Call 911 ▪ Don not rub the area ▪ Wrap in soft cloth ▪ If help is delayed, immerse in warm, not hot, water
Trench Foot	▪ Tingling, itching or burning sensation ▪ Blisters	▪ Soak feet in warm water, then wrap with dry cloth bandages ▪ Drink a warm sugary drink

APPENDIX G

HEAT STRESS PROGRAM

HEAT STRESS GUIDELINES			
Form	**Signs & Symptoms**	**Care**	**Prevention[3]**
HEAT RASH	Tiny red vesicles in affected skin area. If the area is extensive, sweating can be impaired.	Apply mild lotions and cleanse the affected area.	Cool resting and sleeping areas to permit skin to dry between heat exposures
HEAT CRAMPS	Spasm, muscular pain (cramps) in stomach area and extremities (arms and legs).	Provide replacement fluids with minerals (salt) such as Gatorade.	Adequate salt intake with meals1 ACCLIMATIZATION[2]
HEAT EXHAUSTION	Profuse sweating, cool (clammy) moist skin, dizziness, confusion, pale skin color, faint, rapid shallow breathing, headache, weakness, muscle cramps.	Remove from heat, sit or lie down, rest, replace lost water with electrolyte replacement fluids (water, Gatorade) take frequent sips of liquids in amounts greater than required to satisfy thirst.	ACCLIMATIZATION[2] Adequate salt intake with meals 1 only during early part of heat season. Ample water intake, frequently during the day
HEAT STROKE	HOT Dry Skin. Sweating has stopped. Mental confusion, dizziness, nausea, severe headache, collapse, delirium, coma.	HEAT STROKE IS A MEDICAL EMERGENCY - Remove from heat. - COOL THE BODY AS RAPIDLY AS POSSIBLE by immersing in cold (or cool) water, or splash with water and fan. Call for Emergency Assistance. Observe for signs of shock.	ACCLIMATIZATION[2] Initially moderate workload in heat (8 to 14 days). Monitor worker's activities.

Footnotes:

1.) American diets are normally high in salt, sufficient to aid acclimatization. However, during the early part of the heat season, (May, June), one extra shake of salt during one to two meals per day may help, so long as this is permitted by your physician. Check with your personal physician.

2.) ACCLIMATIZATION - The process of adapting to heat is indicated by worker's ability to perform hot jobs less fluid loss, lower concentrations of salt loss in sweat, and a reduced core (body) temperature and heart rate.

3.) Method to Achieve Acclimatization - Moderate work or exercise in hot temperatures during early part of heat season. Adequate salt (mineral) and water intake. Gradually increasing work time in hot temperatures.

Avoid alcohol. Normally takes eight to 14 days to achieve acclimatization. Lost rapidly, if removed from strenuous work (or exercise) in hot temperature for more than approximately five days.

APPENDIX H

UNITED STATES COAST GUARD SAFE BOATING PRACTICES

U.S.Department
of Transportation
United States
Coast Guard

DECEMBER 1986
(reprinted Mar 1990)

Boating Safety Circular 64

A SHORT HISTORY OF THE BOATING SAFETY CIRCULAR

The first Boating Safety Circular was published on November 1, 1969 and to quote from the Foreword to that issue:

"The Commandant, U.S. Coast Guard has established the Boating Safety Circular as a means to "pass the word" to boat and equipment manufacturers, distributors, dealers, and to certain others concerned with boating safety. The need for a way to do this became evident soon after the establishment of the Office of Boating Safety [now the Office of Navigation Safety and Waterway Services]. Many letters we received asked for explanations of various rules and regulations for pleasure craft or requested information which would be of general interest. This Circular will give us the means to communicate better on these matters and help us all to work toward our common goal of safe boating. The Boating Safety Circulars are informational only -- nothing appearing in them will establish or change any law or regulations -- and will be of direct value as a source of information on established or proposed regulations or standards. They will improve coordination and help us to provide better service to the public. The Circular will not be a regular periodical, but will be issued from time to time as needed to maintain good communications. Issues will be consecutively numbered so that readers will know if an issue has failed to reach them."

Although we have changed our layout from time to time, tried various issue number systems and made the Circular a quarterly rather than an "as needed" publication, very little has changed in the purpose of the Boating Safety Circular or in its content. Because of increased interest in the Circular and numerous requests for back issues, in addition to our regular features, this issue contains a compendium of articles from all previous BSCs which contain material we still consider important.

Some of the articles on the following pages have been edited to include stories covering the same subjects published in later issues. Others have been rewritten to reflect changes in applicability, availability of materials and differences in technology or the "state of the art." Although each article ends with a reference to the issue in which it appeared for the benefit of readers who want to review them, we will no longer provide copies of back issues.

AN ACCIDENT WAITING TO HAPPEN REMEMBER YOUR SOUND SIGNALS IN RESTRICTED VISIBILITY

About a year ago a 110 foot crewboat servicing offshore oil rigs in the Gulf of Mexico rammed a fishing party boat that was at anchor with 20 passengers on board. The operators of both vessels were to blame for this accident in which the fishing boat sank and one passenger drowned.

The crewboat operator, who relied totally upon his vessel's radar as a means of maintaining a proper lookout, was travelling at a speed of about 18 knots in a fog that had reduced visibility to a quarter of a mile. The operator apparently

Inside:

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Carbon Monoxide	31

overlooked the possibility that other vessels could be in the vicinity and might not present as strong an image on the radarscope as that of a drilling rig or a production platform.

The fishing vessel was anchored in the fog and the operator had not sounded the required signals. The operator mistakenly believed that the Navigation Rules required sounding fog signals only when other vessels were around. Furthermore, he failed to sound the required signals when he first noticed the contact on his own vessel's radar approximately 10 minutes before the fatal collision.

In fact, the Rules are very specific about when signals must be sounded, their interval and their duration. Rule 35 of the Navigation Rules states, in part, that:

In or near an area of restricted visibility, during daylight hours or at night, the following signals must be sounded:

The operator of a power-driven vessel making way through the water must sound one prolonged blast at intervals of not more than 2 minutes.

The operator of a power-driven vessel underway, but stopped and making no way through the water, must sound at intervals of not more than 2 minutes, two prolonged blasts in succession with an interval of about 2 seconds between them.

The operator of a sailing vessel, a vessel engaged in fishing and a vessel engaged in towing or pushing another vessel must sound at intervals of not more than 2 minutes, three blasts in succession -- one prolonged followed by two short blasts. The operator of a vessel engaged in fishing, when at anchor, and the operator of a vessel restricted in its ability to maneuver when carrying out work at anchor, must sound the same signal, one prolonged followed by two short blasts.

The operator of a vessel at anchor must at intervals of not more than one minute ring the bell rapidly for about 5 seconds. A vessel at anchor may also sound three blasts in succession -- one short, one prolonged and one short blast to give warning of its position and of the possibility of collision to an approaching vessel.

The operator of a vessel of less than 12 meters in length is not required to give the above signals, but if they are not, some other efficient sound signal must be made at intervals of not more than 2 minutes.

All operators of recreational boats are reminded of the importance of sounding proper signals while underway or at anchor during periods of limited visibility. Boat operators in the Gulf of Mexico are asked to be particularly careful to sound proper signals under such conditions because of the large number of high speed vessels servicing offshore structures.

The Coast Guard publishes these rules in a book titled "NAVIGATION RULES, INTERNATIONAL AND INLAND" (COMDTINST M16672.2A) which may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The current price is $6.50 per copy and the stock number is 050-012-00192-8. The book may be ordered in two ways -- by telephone or mail. To order by telephone, call (202) 783-3238, ask for the book by name, and give the stock number. You may pay using your VISA or MasterCard.

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Boating Safety Circulars are for information only. No Federal statute or regulation is established or changed in this circular

VESSEL	SIGNAL DURATION	SIGNAL INTERVAL
POWER-DRIVEN UNDERWAY	ONE PROLONGED BLAST ZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]	EVERY 2 MINUTES
POWER-DRIVEN AT REST	TWO PROLONGED BLASTS ZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds] 2 second pause ZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds]	EVERY 2 MINUTES
SAILING VESSEL VESSEL FISHING VESSEL PUSHING OR TOWING	ONE PROLONGED & TWO SHORT BLASTS ZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds] ZZZZ [one second] ZZZZ [one second]	EVERY 2 MINUTES
FISHING WHEN AT ANCHOR RESTRICTED IN ABILITY TO MANEUVER	ONE PROLONGED & TWO SHORT BLASTS ZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds] ZZZZ [one second] ZZZZ [one second]	EVERY 2 MINUTES
VESSEL AT ANCHOR or to give warning of position and possibility of collision to approaching vessel:	RING BELL RAPIDLY FOR 5 SECONDS ONE SHORT BLAST, ONE LONG BLAST AND ONE SHORT BLAST ZZZZ [one second] ZZZZZZZZZZZZZZZZZZZZZZZZ [4 - 6 seconds] ZZZZ [one second]	EVERY 1 MINUTE AS NECESSARY
LESS THAN 12 METERS IN LENGTH	SOME TYPE OF SOUND SIGNAL	EVERY 2 MINUTES

U.S. Department
of Transportation
**United States
Coast Guard**

OCTOBER 1989

Boating Safety Circular 69

"A cup of gasoline spilled in the bilges has the potential explosive power of 15 sticks of dynamite!"

So said a Coast Guard pamphlet, "Ventilation Systems for Small Craft"(CG-395) published more than 20 years ago. *Fifteen* sticks of dynamite? Asked for their opinions, boat manufacturers and boat owners, State boating law authorities, Coast Guard Auxiliarists, etc., would all disagree. Judging from the number of letters and telephone calls we receive each year, they also disagree on the ventilation system requirements for various boats.

Historically, the regulations covering ventilation began as an operator requirement. Like the early regulations which required all boat operators to carry life preservers, operators of most gasoline powered motorboats (except open boats) built after April 25, 1940 were required to equip every engine and fuel tank compartment with a natural ventilation system. Boat builders and operators could supplement a boat's ventilation system by installing a bilge blower; however, a bilge blower is part of a powered ventilation system. Powered ventilation was not required by regulation until 1980.

Subpart 25 of Subchapter C of Title 46, Code of Federal Regulations contains regulations covering ventilation applicable to uninspected recreational motorboats manufactured before August 1980, when ventilation became a manufacturer requirement. According to paragraph 25.40-1:

46 CFR 25.40 -1 Tank and engine spaces.

(a) All motorboats or motor vessels, except open boats, the construction or decking over of which is commenced after April 25, 1940, and which use fuel having a flashpoint of 100 degrees fahrenheit, or less, shall have at least two ventilator ducts, fitted with cowls or their equivalent, for the efficient removal of explosive or flammable gases from the bilges of every engine and fuel tank compartment. There shall be at least one exhaust duct installed so as to extend from the open atmosphere to the lower portion of the bilge and at least one intake duct installed so as to extend to a point at least midway to the bilge or at least below the level of the carburetor air intake. The cowls shall be located and trimmed for maximum effectiveness and in such a manner so as to prevent displaced fumes from being recirculated.

(b) As used in this section, the term "open boats" means those motorboats or motor vessels with all engine and fuel tank compartments, and other spaces to which explosive or flammable gases and vapors may flow, open to the atmosphere and so arranged as to prevent the entrapment of such gases and vapors within the vessel.

(c) Where alterations are needed for existing motorboats or motor vessels to comply with the requirements in this section, such alterations shall be accomplished as soon as practicable but in any case shall be completed by June 1, 1966.

In June 1966 the Coast Guard published the pamphlet, CG-395, which contained what many would consider an exaggerated comparison between 15 sticks of dynamite and a cup of spilled gasoline. More importantly, however, the pamphlet also defined an "open boat" as one which meets each of the following conditions:

1. Engine and fuel tank compartments shall have as a minimum 15 square inches of open area directly exposed to the atmosphere for each cubic foot of net compartment volume.

2. There must be no long or narrow unventilated spaces accessible from such compartments in which a flame front could propagate.

3. Long, narrow compartments (such as side panels), if joining engine or fuel compartments and

Inside:

"No Certificate? - No Numbers!" 11

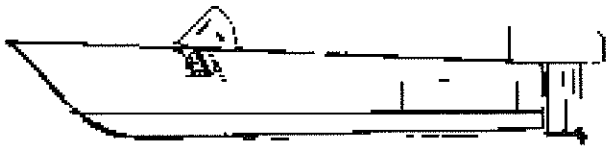
Construction begun after April 25, 1940 but before July 31, 1978

Applicable to: All motorboats or motor vessels using **gasoline** as a fuel.

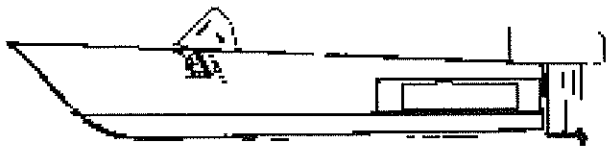
Exceptions: "Open boats." "Open boats" means those motorboats or motor vessels with all engine and fuel tank compartments, and other spaces to which explosive or flammable gases and vapors from these compartments may flow, open to the atmosphere and so arranged as to prevent the entrapment of such gases and vapors within the vessel.

Natural Ventilation System Required For: Every engine and fuel tank compartment.

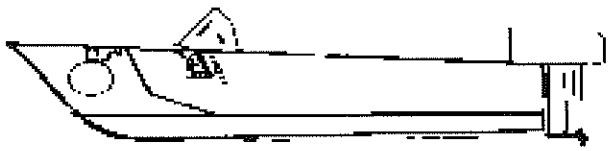
Open Motorboat
Natural Ventilation? ***No.***



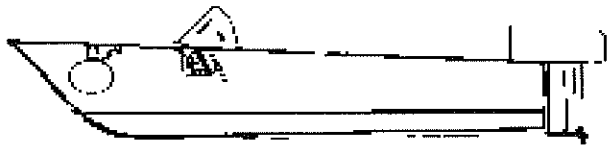
Open Motorboat with Portable Tank
Natural Ventilation? ***No.***



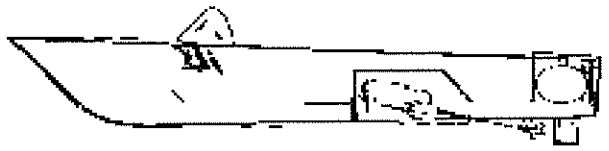
Portable Tank in Enclosed Compartment
Natural Ventilation? ***Yes.***



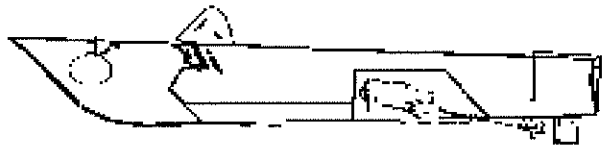
Permanent Tank
Natural Ventilation? ***Yes.*** Fuel tank compartment is not "open to the atmosphere"



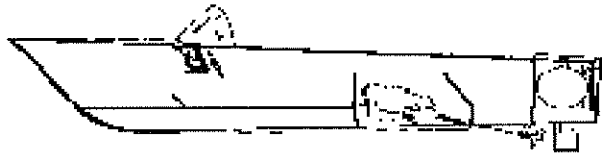
Permanent Tank
Natural Ventilation? ***No.*** Boat meets definition of "open boat".



Permanent Tank and Engine Compartments
Natural Ventilation? ***Yes.***



Permanent Tank and Engine Compartments
Natural Ventilation? ***Yes.*** Since fuel tank and engine are installed in separate compartments, then **each** compartment requires a separate natural ventilation system



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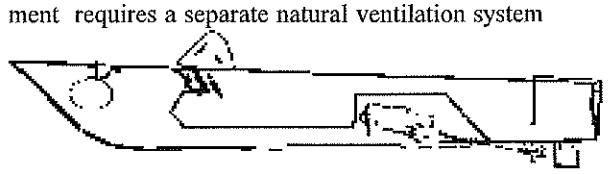
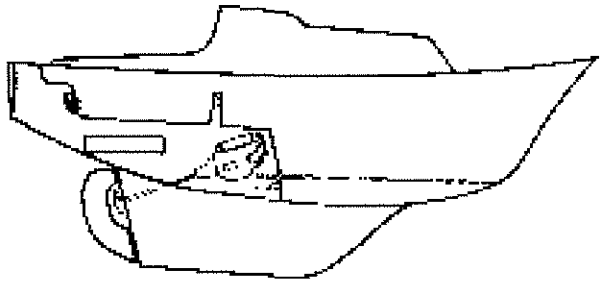
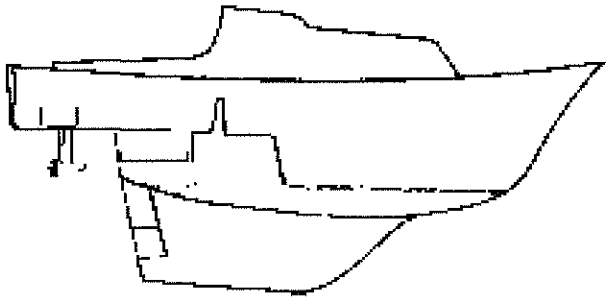


Permanent Tank and Engine Compartment
Natural Ventilation? ***Yes.***

Construction begun after April 25, 1940 but before July 31, 1978



Permanent Tank and Engine Compartment
Natural Ventilation? ***Yes.***



Portable Tank in Enclosed Compartment
Natural Ventilation? ***Yes.***

Natural Ventilation System Requirements: At least two ventilator ducts, fitted with cowls or their equivalent, for the efficient removal of explosive or flammable gases. There shall be at least one exhaust duct installed so as to extend from the open atmosphere to the lower portion of the bilge and at least one intake duct installed so as to extend to a point at least midway to the bilge or at least below the level of the carburetor air intake. The cowls shall be located and trimmed for maximum effectiveness and in such a manner so as to prevent displaced fumes from being recirculated.

not serving as ducts thereto, shall have at least 15 square inches of open area per cubic foot provided by frequent openings along the full length of the compartment formed.

In March 1977, the Coast Guard published an Advance Notice of Proposed Rulemaking soliciting comments on the need for regulations which would require *powered* ventilation systems on gasoline powered inboard and inboard/outdrive boats to lessen the possibility of fire and explosions which were the primary cause of property damage and the second greatest cause of personal injury from boating accidents. The effectiveness of the existing natural ventilation regulations had been questioned in a 1975 report based upon information from two independent research projects. The report showed that a natural ventilation system is effective only when a boat is moving fast enough to force air through the ventilation ducts, or when the wind is at sufficient velocity and direction to blow through the ducts. The report concluded that there was a definite need for some type of forced ventilation on boats to remove explosive and flammable gases before the engine is started. Boating accident statistics indicated that most fires and explosions occurred while the boat was dead in the water after fueling.

In July 1978, the Coast Guard proposed final regulations covering powered ventilation based on the comments received. The Coast Guard believed that the proposed minimum safety standards for ventilation systems, together with the Electrical and Fuel System Standards (published as a separate project in January 1977) would significantly reduce the probability of gasoline vapors collecting in the boat where they could be easily ignited, causing a fire or explosion.

The final rule which was published December 17, 1979 reflected many of the comments received. Comments indicated that the regulations should apply to outboard boats as well as those powered by inboards. Comments also suggested that powered ventilation should be required in engine compartments, and natural ventilation in any compartment where gasoline vapor could be present. The Coast Guard agreed. The regulations would require both powered and natural ventilation systems to be used in compartments that have a permanently installed gasoline engine. Only natural ventilation systems would be required for fuel tank compartments.

The Coast Guard also agreed with comments which suggested that ventilation should not be required for fuel tank compartments where the fuel tank vents to the outside of the boat, since the accumulation of fuel vapors in the compartment was improbable. However, the regulations would require ignition protection of any electrical com-

Construction begun after July 31, 1978 but before August 1, 1980

or which are in compliance with 33 CFR Part 183

Applicable to: All motorboats or motor vessels and all boats as defined in the Federal Boat Safety Act of 1971using **gasoline** for electrical generation, mechanical power or propulsion.

"Boat" means any vessel:

(1) manufactured or used primarily for noncommercial use; or

(2) leased, rented or chartered to another for the latter's noncommercial use; or

(3) engaged in the carrying of six or fewer passengers.

Exceptions: "Open boats."

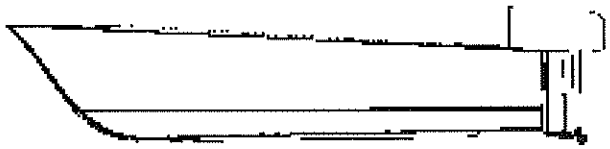
"Open boats" means those motorboats or motor vessels with all engine and fuel tank compartments, and other spaces to which explosive or flammable gases and vapors from these compartments may flow, open to the atmosphere and so arranged as to prevent the entrapment of such gases and vapors within the vessel.

Natural Ventilation System Required For: Every engine and fuel tank compartment except fuel tank compartments that:

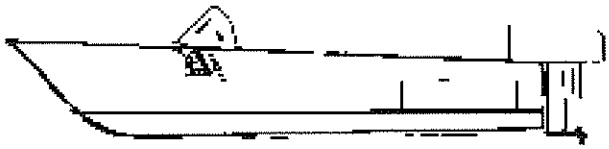
(1) Contain a permanently installed fuel tank if each electrical component is ignition protected in accordance with 33 CFR 183.410(a); and

(2) Contain fuel tanks that vent to the outside of the boat.

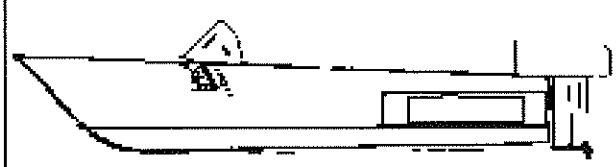
Powered Ventilation System Required For: Every engine compartment (if the boat is built in compliance with 33 CFR Subpart K*).



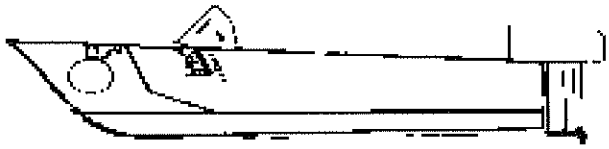
Open Motorboat
Natural Ventilation? ***No.***



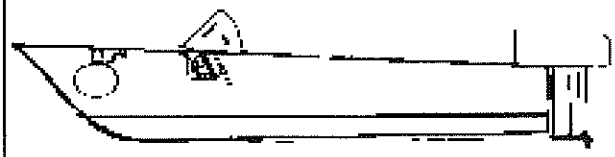
Open Motorboat with Portable Tank
Natural Ventilation? ***No.***



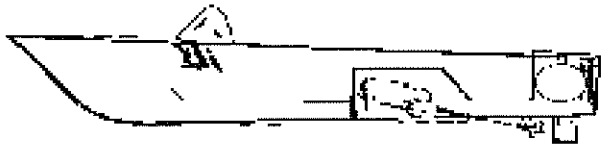
Portable Tank in Enclosed Compartment
Natural Ventilation? ***Yes.***



Permanent Tank
Natural Ventilation? ***Yes.*** Fuel tank compartment is not "open to the atmosphere".
No. If fuel tank vented to outside of boat.



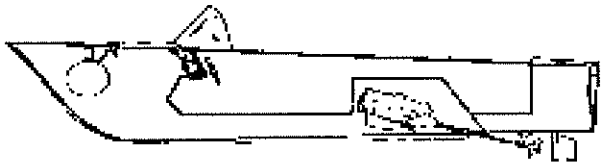
Permanent Tank
Natural Ventilation? ***No.*** Fuel tank compartment is "open to the atmosphere".



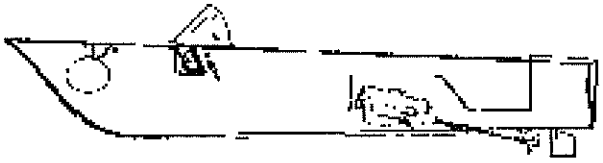
Permanent Tank and Engine Compartment
Natural Ventilation? ***Yes.***
Powered Ventilation? ***Optional*.***

Construction begun after July 31, 1978 but before August 1, 1980

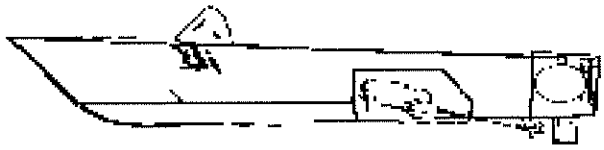
or which are in compliance with 33 CFR Part 183



Permanent Tank and Engine Compartment
Natural Ventilation? ***Yes.***
Powered Ventilation? ***Optional****.

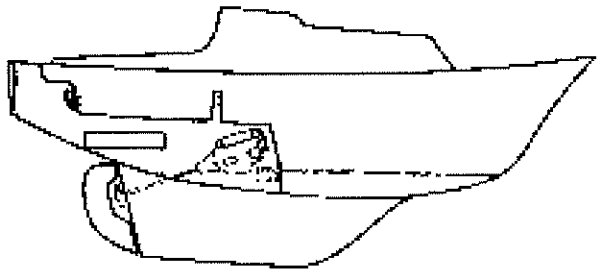


Permanent Tank and Engine Compartments
Natural Ventilation? ***Yes.***
Powered Ventilation? ***Optional*** *.

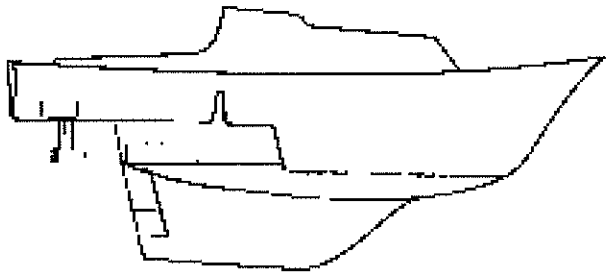


Permanent Tank
Natural Ventilation? ***Yes,*** unless the tank is equipped with a vent to the outside of the boat and fuel tank compartment contains no electrical components.
Engine Compartment
Natural Ventilation? ***Yes.***
Powered Ventilation? ***Optional*** *.

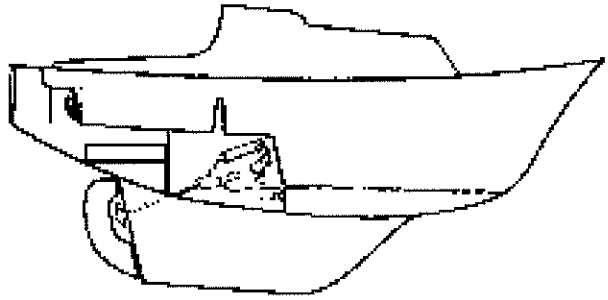
Permanent Tank
Natural Ventilation? ***No.*** Compartment is "open to the atmosphere".
Engine Compartment
Natural Ventilation? ***Yes.***
Powered Ventilation? ***Optional*** *.



Permanent Tank and Engine Compartment
Natural Ventilation? ***Yes.***
Powered Ventilation? ***Optional*** *.



Portable Tank in Enclosed Compartment
Natural Ventilation? ***Yes.***



Permanent Tank
Natural Ventilation? ***Yes,*** *unless the tank is equipped with a vent to the outside of the boat and fuel tank compartment contains no electrical components.*

Engine Compartment
Natural Ventilation? ***Yes.***
Powered Ventilation? ***Optional*** *.

Natural Ventilation System Requirements: At least two ventilator ducts, fitted with cowls or their equivalent, for the efficient removal of explosive or flammable gases.

There shall be at least one exhaust duct installed so as to extend from the open atmosphere to the lower portion of the bilge and at least one intake duct installed so as to extend to a point at least midway to the bilge or at least below the level of the carburetor air intake. The cowls shall be located and trimmed for maximum effectiveness and in such a manner so as to prevent displaced fumes from being recirculated.

ponent in a compartment containing a fuel tank in order to limit the probability of an explosion in the event of a gasoline leak.

The Coast Guard also sought comments on whether interlocks which would prevent the engine ignition system from being energized should be required. Several comments objected to interlocks because they could cause confusion when a boat has to be started quickly in an emergency. Some manufacturers submitted sales literature indicating that interlocks were available in the market. Since there were recognizable problems associated with interlocks and the Coast Guard's policy is to impose the minimum requirements necessary to achieve an adequate level of safety, no interlocks were required for propulsion engines or auxiliary generators.

The Coast Guard Ventilation Standard applicable to manufacturers of all boats which have gasoline engines for electrical generation, mechanical power or propulsion was published December 17, 1979. The standard applied to all boats built after July 31, 1980, except manufacturers were given the option of electing to comply with the standard any time after July 31, 1978.

Concurrently, the Coast Guard amended the ventilation regulations in 46 CFR Part 25 to make the existing regulations agree with the new ventilation regulations. According to the two new paragraphs (d) and (e) in 46 CFR Part 25.40-1:

> (d) Boats as defined in the Federal Boat Safety Act of 1971 built after July 31, 1980 or which are in compliance with 33 CFR Part 183 are excepted from these requirements.
>
> (e) Boats as defined in the Federal Boat Safety Act of 1971 built after July 31, 1978 are excepted from the requirements of paragraph (a) for fuel tank compartments that:
>
> (1) Contain a permanently installed fuel tank if each electrical component is ignition protected in accordance with 33 CFR 183.410(a); and
>
> (2) Contain fuel tanks that vent to the outside of the boat.

With the addition of paragraph (d) above, boats built after July 31, 1978, but before August 1, 1980, can have very different ventilation systems (See "Puzzle"). These differences would explain the multitude of opinions on the type of ventilation that is actually required in various boats.

The third effect of the ventilation regulations

THE 1979 MODEL YEAR PUZZLE

You are a State Marine Police Officer inspecting a boat for compliance with the ventilation regulations or a Coast Guard Auxiliarist conducting a Courtesy Motorboat Examination (CME). The boat is inboard powered and was manufactured in August 1978 (a 1979 model). The engine is in one compartment and the fuel tank is located in a separate compartment which is not "open to the atmosphere".

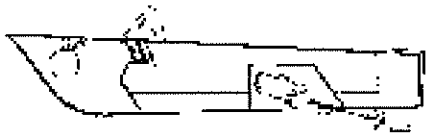
What are the applicable ventilation regulations?

The boat's ventilation system could consist of:

(1) Natural ventilation in each compartment meeting 46 CFR 25.40-1(a):

". . . at least two ventilator ducts, fitted with cowls or their equivalent, for the efficient removal of explosive or flammable gases from the bilges of every engine and fuel tank compartment. "

(2) Alternatively, the manufacturer could have built the boat in compliance with the Ventilation Standard as allowed under *subparagraph (d)* of 46 CFR 25.40-1. The boat would have a blower and natural ventilation in the engine compartment and might or might not have natural ventilation in the fuel tank compartment, depending upon whether any electrical components in the compartment were ignition-protected in accordance with 33 CFR 183.410(a).



(3) Third, the boat could have had a blower and natural ventilation in the engine compartment and the fuel tank compartment could have been equipped with natural ventilation meeting subparagraph 25.40-1(a) or (e). However, unlike alternative (2) above, the blower could have been supplemental equipment. As we explained earlier, until August 1980, all boats had to have natural ventilation, but builders and owners could supplement a boat's ventilation system by installing a blower. Since powered ventilation did not become mandatory until August 1980, the mere presence of a blower in a 1979 model boat does not necessarily mean that it complies with the Ventilation Standard in 33 CFR Subpart K.

(4) Finally, the manufacturer could have built the boat with natural ventilation in the engine compartment and installed a natural ventilation system meeting the requirements of *subparagraph (e)* of 46 CFR 25.40-1 in the fuel tank compartment.

A possibility of four different ventilation systems in one 1979 model year boat! No wonder there's confusion among those who are enforcing the ventilation regulations on just which requirements *do* apply.

Construction begun after July 31, 1980

Applicable to: All boats as defined in the Federal Boat Safety Act of 1971 that have **gasoline** engines for electrical generation, mechanical power or propulsion.

"Boat" means any vessel:

(1) manufactured or used primarily for noncommercial use; or

(2) leased, rented or chartered to another for the latter's noncommercial use; or

(3) engaged in the carrying of six or fewer passengers.

Powered Ventilation System Required For: Each compartment in a boat that has a permanently installed gasoline engine with a cranking motor for remote starting.

Exceptions: A compartment containing permanently installed gasoline engine equipped with a cranking motor (remote starting) which is "open to the atmosphere." "Open to the atmosphere" means a compartment that has at least 15 square inches of open area directly exposed to the atmosphere for each cubic foot of net compartment volume. Note: Suppose a permanently installed engine lacks remote starting, i.e., it is started by a hand crank on the engine. Removal of the engine cover or box to start the engine makes the engine compartment "open to the atmosphere" and powered ventilation is not required.

Natural Ventilation System Required For: Each compartment in a boat that:

(1) Contains a permanently installed gasoline engine;

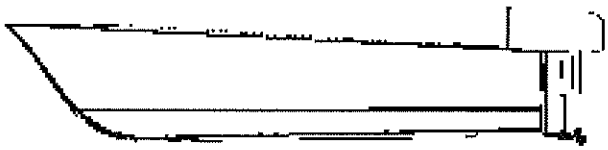
(2) Has openings between it and a compartment that requires ventilation, where the aggregate area of those openings exceeds 2 percent of the area between the compartments. The exception is an accommodation compartment above a compartment requiring ventilation that is separated from the compartment requiring ventilation by a deck or other structure

(3) Contains a permanently installed fuel tank and an electrical component that is not ignition-protected in accordance with 33 CFR 183.410(a);

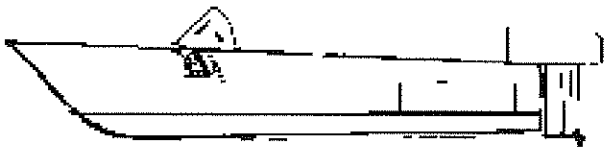
(4) Contains a fuel tank that vents into that compartment; or

(5) Contains a non-metallic fuel tank meeting certain technical requirements concerning permeability provided in the regulations

Exceptions: Compartment is "open to the atmosphere."

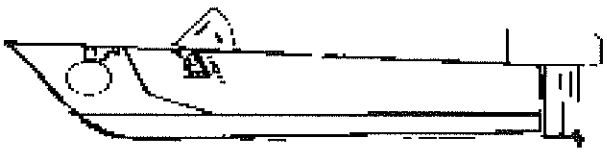


Open boat
Powered Ventilation? ***No.***
Natural Ventilation? ***No.***



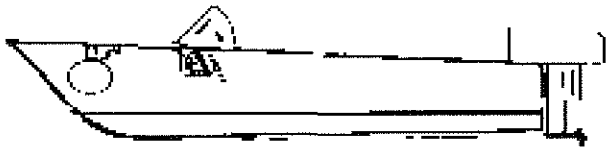
Open boat with Portable Tank
Powered Ventilation? ***No.***
Natural Ventilation? ***No.***

Portable Tank in Enclosed Compartment
Powered Ventilation? ***No.***
Natural Ventilation? ***Yes.*** Fuel tank compartment is not "open to the atmosphere".

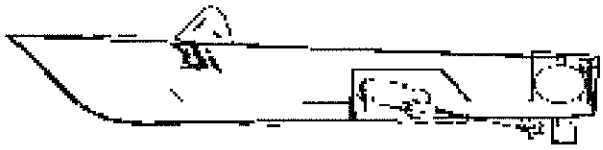


Permanent Tank
Powered Ventilation? ***No.*** If fuel tank vented to outside of boat.
Natural Ventilation? ***Yes.*** Fuel tank compartment is not "open to the atmosphere".

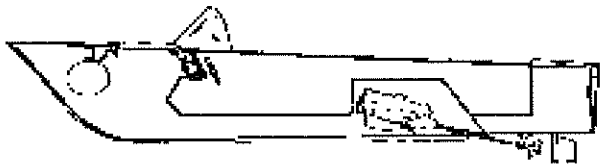
Construction begun after July 31, 1980



Permanent Tank
Powered Ventilation? ***No.***
Natural Ventilation? ***No.*** Fuel tank compartment is "open to the atmosphere".

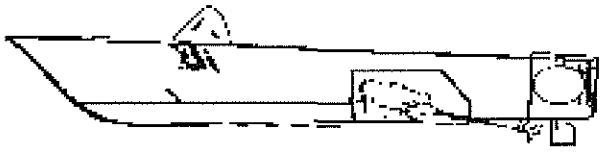


Permanent Tank and Engine Compartment
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***.

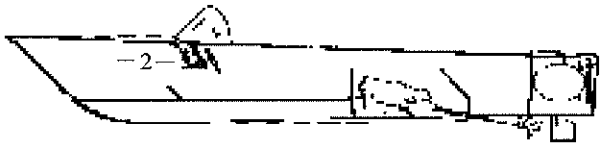


Permanent Tank and Engine Compartment
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***

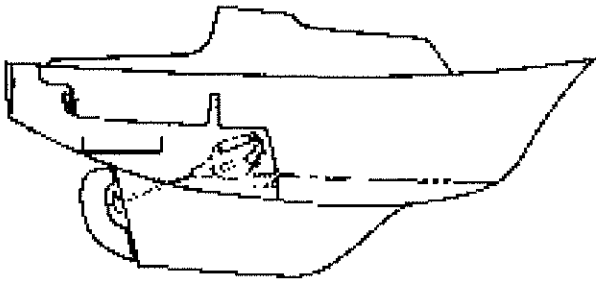
Permanent Tank and Engine Compartments
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***



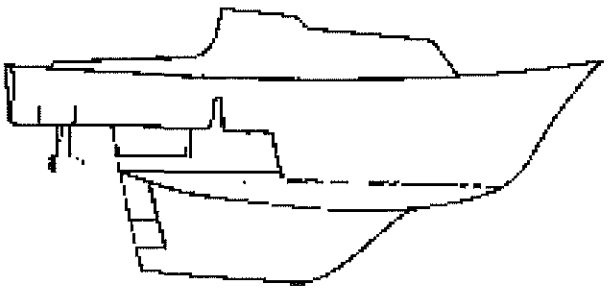
Permanent Tank
Powered Ventilation? ***No.***
Natural Ventilation? ***No.*** *Unless fuel tank compartment contains electrical components which are not ignition-protected.* Note: this boat subject to Fuel Standard and tank required to be vented to outside.
Engine Compartment
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***



Permanent Tank
Powered Ventilation? ***No.***
Natural Ventilation? ***No.*** *Compartment is "open to the atmosphere" and helm station electrical components ignition-protected, i.e., they are at least two feet from gasoline fuel sources.*
Engine Compartment
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***

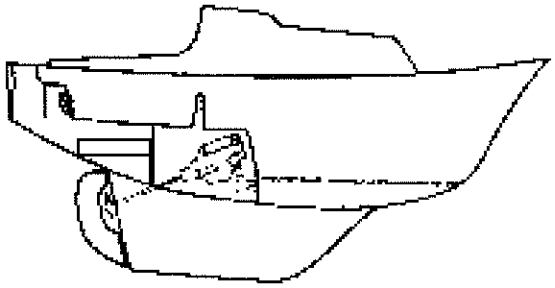


Permanent Tank and Engine Compartment
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***

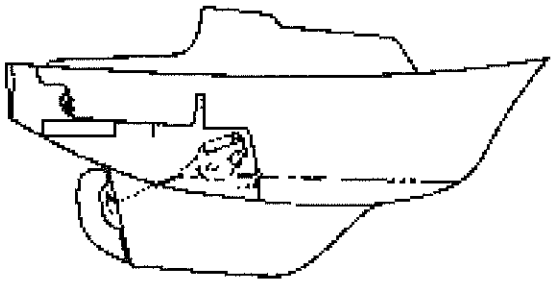


Portable Tank in Enclosed Compartment
Powered Ventilation? ***No.***
Natural Ventilation? ***Yes.*** Fuel tank compartment is not "open to the atmosphere".

Construction begun after July 31, 1980



Permanent Tank
Powered Ventilation? ***No.***
Natural Ventilation? ***No.*** Fuel tank compartment contains electrical components which are ignition-protected, i.e., they are higher than the gasoline fuel source and installed in an enclosure.
Engine Compartment
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***



Permanent Tank
Powered Ventilation? ***No.***
Natural Ventilation? ***Yes.*** Fuel tank compartment contains electrical components which are not ignition-protected, i.e., they are within two feet of the gasoline fuel source and are not installed in an enclosure.
Engine Compartment
Powered Ventilation? ***Yes.***
Natural Ventilation? ***Yes.***

Note: These boats are subject to the Fuel System Standard and their fuel tanks are required to be vented to the outside.

Powered Ventilation System Requirements:

An exhaust blower system consisting of one or more exhaust blowers. Each intake duct for an exhaust blower must be in the lower one-third of the compartment and above the normal accumulation of bilge water.

Natural Ventilation System Requirements:

A natural ventilation system consisting of:

(1) A forward facing* supply opening or duct from the atmosphere (located on the exterior surface of the boat) or from a ventilated compartment or from a compartment that is open to the atmosphere; and

*** Note: The requirement for supply openings to face forward was removed for boats built after March 1987.**

(2) An exhaust opening into another ventilated compartment or an exhaust duct to the atmosphere.

(3) Each exhaust opening or exhaust duct must originate in the lower one third of the compartment.

(4) Each supply opening or supply duct and each exhaust opening or exhaust duct in a compartment must be above the normal accumulation of bilge water.

(5) The minimum internal cross-sectional area of each supply opening or duct and each exhaust opening or duct must exceed 3.0 square inches.

[There are additional technical requirements concerning minimum aggregate internal cross-sectional areas of supply openings and ducts and exhaust openings and ducts]
[There are additional technical requirements concerning minimum aggregate internal cross-sectional areas of terminal fittings for flexible ventilation ducts.]

More complete information and illustrations covering the Ventilation System Standard applicable to boats manufacturerd after March 1987 may be obtained by requesting a copy of the Ventilation System Compliance Guideline from the American Boat and Yacht Council, 405 Headquarters Drive, Suite 3, Millersville, Maryland 21108. There is a $10.00 charge (which includes postage and handling) for the guideline, payable by check or money order.

published December 17, 1979 was the establishment of a new Subpart D - Ventilation in Part 175 of Title 33. Part 175 was created in March 1973 to prescribe operator equipment carriage requirements, e.g. PFD carriage requirements, applicable to boats as defined in the Federal Boat Safety Act of 1971. According to the new Subpart D:

175.201 Ventilation

No person may operate a boat built after July 31, 1980, that has a gasoline engine for electrical generation, mechanical power or propulsion unless it is equipped with an operable ventilation system that meets the requirements of 33 CFR 183.610(a), (b), (d), (e) and (f) and 183.620(a).

As a result of this change in the regulations, boat owners must ensure that when replacing any components in the ventilation system of a boat built after July 31, 1980, replaced components are similar to those which were originally installed by the boat manufacturer.

On June 23, 1986, the Coast Guard proposed amendments to the Ventilation Standard in 33 CFR Part 183. Section 183.620(b) prescribed construction and testing requirements for natural ventilation systems. Section 183.620(b)(1) required that each supply opening in a natural ventilation system face forward and be located on the exterior surface of the boat. Tests had shown that many openings act as ventilation openings in the boat and the direction in which openings are facing has less impact on the effectiveness of the natural ventilation system than does the overall configuration of the boat. The Coast Guard proposed removal of the requirement for these openings to face forward

The Coast Guard also proposed removal of Section 183.620(b)(2) which required testing to ensure that air flowed into or out of the supply or exhaust openings of a natural ventilation system when the boat was in a wind flowing from bow to stern at a velocity of 10 miles per hour and the engine was not operating. Coast Guard tests had also shown that the airflow velocity inside a properly installed natural ventilation system may be so minimal and variable as to strain the ability of conventional airflow measuring devices. All 27 of the comments were received were in favor of the proposed amendments. These amendments were published as a final rule October 23, 1986 with an effective date of August 1, 1987; however, an exemption to the effective date allowed the construction of boats without forward facing supply openings in their natural ventilation systems as early as March 1987.

Operators of Boats Built After July 31, 1980

Applicable to: Operators of all boats as defined in the Federal Boat Safety Act of 1971 that have **gasoline** engines for electrical generation, mechanical power or propulsion.

"Boat" means any vessel:

(1) manufactured or used primarily for noncommercial use; or
(2) leased, rented or chartered to another for the latter's noncommercial use; or
(3) engaged in the carrying of six or fewer passengers.

33 CFR 175.201 Ventilation: No person may operate a boat built after July 31, 1980, that has a gasoline engine for electrical generation, mechanical power or propulsion unless it is equipped with an operable ventilation system that meets the requirements of 33 CFR 183.610(a), (b), (d), (e) and (f) and 183.620(a).

Practical Effect: On a boat built after July 31, 1980, the regulations prohibit the alteration of a natural or powered ventilation system, except for replacement of worn out system components. Replaced components must be similar to those which were originally installed by the boat manufacturer.

A boat's ventilation system includes the exhaust blower label. Each boat that is required to have an exhaust blower must have a label that:

(1) Is located as close as practicable to each ignition switch;
(2) Is in plain view of the operator; and
(3) Has at least the following information:

-WARNING -

GASOLINE VAPORS CAN EXPLODE. BEFORE STARTING ENGINE OPERATE BLOWER FOR 4 MINUTES AND CHECK ENGINE COMPARTMENT BILGE FOR GASOLINE VAPORS.

"NO CERTIFICATE?" — "NO NUMBERS!"

When a boat manufacturer or importer sells a recreational boat, the company should provide a Certificate of Origin to the purchaser. The purchaser needs a Certificate of Origin to obtain a title or register a boat with State numbering authorities. The procedure is the same as when an automobile is purchased. In the boating world this document is also often called a Manufacturer's Statement of Origin, Master Builders Certificate, Carpenters Certificate, etc. They are all the same thing.

We receive numerous complaints from owners who are unable to register their boats and obtain State registration numbers because they do not have a Certificate of Origin. The State authorities tell many of these people to request a form from Coast Guard Merchant Vessel Documentation offices called a "Builders Certification," which the Coast Guard offices use to establish the fact that vessels intended for documentation were U.S. manufactured. It is not necessary to use the "Builders Certification" form for boats which will be registered in a State.

To eliminate confusion, printed below is a prototype Manufacturer's Certificate of Orgin for the use of recreational boat builders and importers. Copy this form, or use it as a model for designing your own. Put your company logo on it if you want to. Just try to make sure you complete a Certificate of Origin and that the form accompanies each boat you build. This will make it much easier for the eventual first purchasers of your products to title and register their boats.

MANUFACTURER'S CERTIFICATE OF ORIGIN

1. Vessel Data:

Hull Identification Number: _____

Model Name: _____

Length: _____ Beam: _____ Draft: _____

Place of Construction: _____

Hull Material:

☐ Wood ☐ Steel ☐ Aluminum ☐ Fiberglass ☐ Other

2. Certification:

I _____ Do Hereby Certify that the facts recited herein are true and that I have personal knowledge of these facts because I:

☐ A. Personally performed the construction

☐ B. Supervised the construction at and on behalf of

_____

(Name of Company)

Signature: _____

Date: _____

The following is an excerpt from an actual Coast Guard Marine Casualty Report.

TWO DEAD — FOUR RESCUED AFTER SEVEN HOURS IN THE WATER

Four fishermen spent the night clinging to the capsized 29-foot pleasure craft "REEL ACTION." Bodies of two companions trapped in the cabin were recovered by divers in waters four miles off the coast of Ocean City, NJ, on 10 September 1988.

"...the proximate cause of the casualty was the failure of the operator to recognize the meaning of the navigation lights."

A 29-foot sport fisherman with six men aboard left Ocean City, New Jersey at 11:30 p.m. for a popular offshore fishing spot in the Atlantic. Just after midnight the two men at the helm sighted a large unknown vessel displaying three white lights in a vertical line. Neither man knew what the three lights indicated.

Assuming the unknown vessel to be a large fishing boat or passenger ferry, the "REEL ACTION," underway at 10 knots, altered course, intending to pass astern. Unfortunately, the other vessel was neither a fishing boat nor a ferry. She was a 63-foot tug towing two large barges.

When the 29-foot sport fisherman passed astern of the tug, she crossed the towline at about a 45 degree angle and became fouled. She was turned sharply to port, pulled stern-first by the towline and eventually broke free. But the "REEL ACTION" did not escape a collision with the oncoming barges. Four men were thrown into the water — the other two never surfaced.

" the two . . . had a great deal of experience . . . neither had any formal boating or navigation training.

A little knowledge would probably have prevented this accident. The Coast Guard's Marine Casualty Report confirmed this. The proximate cause of the casualty was the failure of those navigating the "REEL ACTION" to recognize the meaning of the navigation lights displayed on the other vessel. Also, even though both vessels had VHF radios, neither attempted communication with the other.

Between them, the two men at the helm of the 29-foot sport fisherman had a great deal of experience in small boats, but neither had any formal boating or navigation training. They had just bought the "REEL ACTION" and this was their first venture offshore to go fishing at night. They had plenty of electronics: a VHF-FM radio, a Loran C receiver, a depth finder, and other safety equipment. The most important element they lacked? Experience navigating offshore at night.

They didn't understand the importance of staying out of shipping lanes and away from large ships. They hadn't read or studied the International and Inland Regulations for Preventing Collisions at Sea (the "Rules of the Road"). They should have learned the meanings of the various navigation light displays. They would have been alerted to the fact that when the length of the tow, from the stern of a towing vessel to the after end of her tow exceeds 200 meters, a towing vessel displays three white lights in a vertical line.

Because of their unfamiliarity with navigation lights they did not realize that the tug — with her barges in tow, stretching out nearly half a mile — could sink them. The tug, it turned out, had simply proceeded to her destination. It wasn't until later that the crew on the tug learned the fates of those on board the sport fisherman.

Lesson To Be Learned:

Don't go boating until you know the Rules of the Road.

At night, avoid anchoring or operating in commercial vessel shipping lanes.

If you plan to navigate at night, learn the various navigation light displays, but don't make assumptions. If in doubt, use the VHF radio for communication with another other vessel. (Channel 16 or 13).

Moral To The Story:

KNOW BEFORE YOU GO!
TAKE A BOATING SAFETY COURSE!

WHAT RECREATIONAL BOATERS SHOULD KNOW ABOUT SHARING THE WATER WITH COMMERCIAL BOATS

Safety for the recreational boater begins with an awareness of the constraints under which commercial vessels must operate. Here are some safety tips boaters should know when operating in the vicinity of commercial vessels — not only at sea, but particularly in more congested inland waters.

- Commercial vessels operate 365 days a year, 24 hours a day, in all weather.
- The speed of a ship, towboat or tugboat can be deceptive. A towboat can travel one mile in seven minutes. A big ship even faster. It takes a fast ship only 10 minutes to get from the visible horizon to a boater's location.
- Large ships and tugs pushing or pulling tows must maintain speed to maintain steerage way. They must stay in the channel with sufficiently deep water. A ship that is slowing down does not steer well, because it needs propeller action on the rudder for good steerage response. Most ships require a maneuvering speed of 10 to 15 knots.
- Large ships and tugs pushing or pulling tows running downstream in a swift current have less steerage way than other vessels moving upstream against the current.
- When underway, a large ship requires 4 to 6 minutes to stop even after reversing its engines.
- When a ship's engines are "full astern," in most cases her bow will swing to starboard. A boater near a ship that is going astern should maneuver to the ship's port side.
- Pilots of ships and tugs pushing or pulling tows have a blind spot which can extend for hundreds of feet in front of their vessels.
- In narrow channels "undertow" from a tug or from what she is pushing or pulliing can cause a smaller vessel to be pulled toward the tow.
- Tugs often tow objects on a long submerged line which is difficult to see.
- A tug or its tow can steal the wind from a sailboat.

WHAT RECREATIONAL BOATERS NAVIGATING NEAR COMMERCIAL SHIPPING CAN DO FOR SAFETY

- Commercial vessels are often restricted in their ability to maneuver and therefore have the right of way over all recreational boats (even sailboats).
- Try to avoid large ship channels, but where it is necessary to use such channels, respect the rights of larger vessels: (1) they have the right of way; (2) they are restricted in their ability to maneuver (steer, speed up, slow down or stop); and (3) they require deeper water for safe navigation. Keep to the starboard (the right-hand) side of the channel. If it becomes necessary to cross such a channel, check for other vessels and pass astern of oncoming vessels.
- Designate a lookout, one person in the boat to watch for commercial traffic.
- Boaters navigating frequently amidst commercial vessel traffic should install a VHF radio. Establish "bridge to bridge" communication in tight maneuvering situations.
- Avoid cargo loading docks; use safe anchorages out of navigation channels. Never tie up to a buoy.
- Don't water ski or operate a personal water craft around tows, though a vessel's "undertow" or in ship channels.
- Understand whistle signals. At least five or more short blasts on the whistle is the "danger" signal. Stay clear of vessels sounding this "danger" signal.
- When boating at night, watch for big ships and tugs with tows. Know the meaning of a ship's lighting configuration. Pay particular attention to the sidelights of the other vessel. If both sidelights are visible, your boat is dead ahead — MOVE OUT FAST. A power driven vessel towing astern has two masthead lights in a vertical line — 3 lights in a line if the length of the tow exceeds 200 meters — plus a yellow towing light above the stern light.
- At night, make sure *your* navigation lights are bright and not obscured by flags, sails, other on board equipment or parts of your boat's structure.

U.S. Department of Transportation
United States Coast Guard

AUGUST 1990
(reprinted May 1993)

Boating Safety Circular 70

BACK TO THE BASICS — HIN 101

The HIN regulations are simple when compared to some of the more complex regulations with which everyone involved in boating must comply. Yet we continually receive calls and letters on the subject. Therefore, we'd like to offer this refresher course - HIN 101.

The regulations requiring Hull Identification Numbers (HINs) for recreational boats are intended to provide a uniform positive identification of each boat manufactured in or imported into the United States. The Coast Guard uses the HIN to identify the safety standards that apply to a particular boat and in identifying specific boats involved in a defect notification campaign. The States use the HIN to identify boats for State registration and titling. State marine police units and Federal law enforcement agencies such as the FBI and National Crime Information Center use the HIN to trace stolen boats.

Coast Guard regulations require manufacturers to affix two identical Hull Identification Numbers (HINs) on every recreational boat used or intended to be used on waters subject to Federal jurisdiction. Each Hull Identification Number consists of 12 continuous characters at least one-quarter of an inch in height, uninterrupted by spaces, slashes, hyphens or other symbols.

MANUFACTURER IDENTIFICATION CODE

The first three characters in every HIN are a Manufacturer Identification Code such as **ABC.**

The only way to obtain a Manufacturer Identification Code is to request one from the Coast Guard. The Coast Guard will issue a Manufacturer Identification Code only to U.S. builders of recreational boats and to U.S. importers of foreign-built boats.

U.S. builders and importers may obtain a Manufacturer Identification Code by sending a letter to Commandant (G-NAB-6), U.S. Coast Guard, Washington, D.C. 20593-0001 and requesting one. The letter should briefly describe the types and sizes of boats the company will manufacture or import.

Occasionally companies are purchased and renamed. A corporation is a legal entity which does not cease functioning with a change in its ownership. Therefore, it is responsible for its past production and the Coast Guard will not issue a new Manufacturer Identification Code. On the other hand, if a corporation goes out of business and someone merely "buys" its name and manufacturing assets, then a new business is created. The new business is not obligated to take responsibility for the past production of the defunct corporation, and we will issue a new Manufacturer Identification Code.

In the case of boats imported from Canada, the U.S. importer does not need to obtain a Manufacturer Identification Code or affix the HIN. Manufacturer Identification Codes issued by Transport Canada and HINs affixed to Canadian-built boats are compatible with the U.S. system.

For boats built or imported by an individual for his or her own use, the entire 12 character HIN is assigned by the State boating authorities in the State of principal use.

The HIN regulations do not apply to sailboards; however, we do not prohibit builders of sailboards from applying for Manufacturer Identification

Inside:

Navigation Lights - Sidelights 6
Overcurrent Protection 7
Fuel Filters and Strainers 7

See Note on Page 8

Codes and affixing HIN's if they so desire, but there is no enforcement of the HIN regulation.

The HIN regulations also do not apply to commercial boats. However, with increased emphasis on State registration and titling (many undocumented commercial vessels are registered), and tracing of stolen boats, the Coast Guard encourages manufacturers of commercial boats to affix Hull Identification Numbers.

Again, there is no enforcement of the HIN regulation or enforcement of compliance with the other safety standards applicable to manufacturers of recreational boats. However, this exception to enforcement is dependent upon the builder's proving to the Coast Guard's satisfaction that the company does, in fact, build commercial boats, and is not attempting to circumvent compliance with applicable regulations.

PROBLEMS IN THE FIELD

1. "The Amalgamated Boat Company" decides it's going to start building boats. Amalgamated decides it's going to use "ABC". Unfortunately, the Coast Guard previously assigned "ABC" to the "Allegheny Bateaux Corp." in November 1973. Amalgamated's assigning itself a Manufacturer Identification Code is illegal. **Only the Coast Guard may assign a Manufacturer Identification Code.**

2. "The Three Brothers Canoe Company" applies for a Manufacturer Identification Code and specifically requests "TBC" or "BCC". We will make every effort to accommodate builders with the codes they desire; however, the Coast Guard has been issuing the codes since 1972. Therefore, we can't always issue codes corresponding to every company's initials.

3. Some State boat registration authorities have been unwilling to register boats with a Hull Identification Number in which the third character is a number. They mistakenly assume the HIN regulations prohibit the use of a number in the Manufacturer Identification Code and that someone is doing something illegal.

Some boat manufacturers have more than one plant and need more than one Manufacturer Identification Code. Therefore, the Coast Guard will occasionally assign a code to a builder which has a number in it.

4. Private Label Merchandisers (PLMs) and foreign manufacturers have tried to obtain a Manufacturer Identification Code. The Coast Guard uses the Manufacturer Identification Code to identify the company responsible for defect notification. A

ABC2AB41G091

Private Label Merchandiser is not the physical manufacturer of a boat and the Coast Guard has no legal recourse against a foreign manufacturer whose boats fail to comply with Federal regulations. Therefore, we do not issue Manufacturer Identification Codes to PLMs or foreign builders (only importers).

5. Boat builders frequently change their company names and addresses and continue to manufacture boats using a specific Manufacturer Identification Code. Correspondence with such companies is frequently returned marked "Moved - Left No Address". Builders who change their company names or relocate to new addresses are required to report such changes to the Coast Guard (see 33 CFR 181.33(b)).

HULL SERIAL NUMBERS

Characters four through eight are the hull serial number which must consist of letters of the English alphabet, Arabic numerals, or both, except the letters "I", "O" or "Q" (because of their similarity to the numbers "0" and "1"). The boat manufacturer or importer chooses a boat's hull serial number. This is a typical Manufacturer Identification Code and hull serial number, the first eight characters in a Hull Identification Number: **ABC2AB43.**

PROBLEMS IN THE FIELD

1. Some manufacturers separate the hull serial number from the manufacturer identification code with a space, a slash or a hyphen. A person with criminal intentions can alter a space, a slash or a hyphen to make it a letter or number and create a different hull identification number. Therefore the regulations require 12 characters which run consecutively.

2. Some builders use symbols or lower case letters. The regulations specifically require the use of letters of the English alphabet and/or Arabic numerals and therefore the use of symbols is prohibited. Although the regulations do not specifically require the use of block capital letters of the English alphabet, lower case characters should be avoided, again, because lower case characters can be altered to look like upper case characters. We will consider the need for a change in the regulation if we continue to encounter HINs using lower case

Persons convicted of the alteration of a Hull Identification Number are liable for civil penalties of $2000.

letters.

THE DATE OF CERTIFICATION

The ninth and tenth characters in each Hull Identification Number indicate the month and year of the date of certificaton. **In all other cases characters nine and ten must indicate the date of manufacture, which can be no earlier than the date construction or assembly began and no later than the date the boat leaves the place of manufacture or assembly or is imported into the United States for the purposes of sale.**

Character nine, the month of certification, must be indicated using letters of the English alphabet starting with January as "A" and ending with December as "L":

A	=	**JANUARY**
B	=	**FEBRUARY**
C	=	**MARCH**
D	=	**APRIL**
E	=	**MAY**
F	=	**JUNE**
G	=	**JULY**
H	=	**AUGUST**
I	=	**SEPTEMBER**
J	=	**OCTOBER**
K	=	**NOVEMBER**
L	=	**DECEMBER**

A boat is considered certified to comply with safety standards in effect on the first day of the month shown in the ninth character of the HIN. Character ten is the last digit of the year of certification (or manufacture). This is a typical Manufacturer Identification Code, hull serial number and date of certification of July 1990, the first 10 characters in an HIN: **ABC2AB41G0.**

PROBLEMS IN THE FIELD

There are still some manufacturers who are using the old date of certification format in the HIN. Between 1972 and 1984, a date of December 1972, for example, could have been indicated by either ABC00001<u>1272</u> or ABC00001<u>M73E</u>. **The current regulations covering Hull Identification Numbers apply to boats built on or after August 1, 1984.** Use of either of the old formats for indicating date of certification is no longer legal.

MODEL YEAR

Characters 11 and 12 are the model year of the boat and must be indicated using Arabic numerals for the last two numbers of the model year. Selection of the model year of a boat is up to the boat manufacturer. This is a complete Hull Identification Number with a Manufacturer Identification Code, Hull Serial Number, Date of Certification of July 1990 and 1991 model year: **ABCAB41G091.**

PROBLEMS IN THE FIELD

1. Reports to the Coast Guard indicate that individuals, some of them dealers, are altering the last two characters in the Hull Identification Number to make it appear that a boat is newer. Alteration of a Hull Identification Number without the specific written permission of the Commandant, U.S. Coast Guard is specifically prohibited by Federal statutes and Coast Guard regulations. Persons convicted of the alteration of a Hull Identification Number are liable for civil penalties of $2000.

2. Periodically, we are asked to comment on apparent discrepancies between the date of certification of a boat and the boat's model year. An HIN such as ABC00001H790, for example, indicating a date of certification of August 1987 and a 1990 model year, would appear to be fraudulent. However, there is no violation of Coast Guard regulations with the display of such an HIN.

While the Coast Guard understands the desire to establish a definitive model year for each boat manufactured, date of certification is still the major consideration as far as the last four characters in an HIN and determining compliance with standards is concerned.

Because the HIN regulations require the HIN to be affixed to **the hull**, manufacturers are given maximum flexibility in determining date of certification.

The assembly of a large boat, involves first the hull manufacturer, then subsequent manufacturers of other components subject to Coast Guard safety standards. Thus assembly of a large boat may span several years and an HIN of ABC00001H093, for example, would not involve attempts by a builder to deceive the public.

Also, for many boat manufacturers, hull designs do not change from year to year. A company will use **the same hull design** in 1993 that it uses in

1990 and change other features such as the boat's interior design or type of propulsion unit from model year to model year. If a hull manufactured in 1990 is completed in 1993 with other features consistent with other 1993 boats, the builder has manufactured a 1993 model boat and an HIN of ABC00001H093, for example, should not be considered fraudulent either.

Date of certification must be no earlier than the date on which construction or assembly began and no later than the date on which the boat leaves the place of manufacture or assembly or is imported for the purposes of sale. Determination of model year is left to the boat manufacturer.

ADDITIONAL CHARACTERS

If additional information is displayed on the boat within two inches of the primary Hull Identification Number, that information must be separated from the HIN by means of borders or must be on a separate label so that it will not be interpreted as part of the Hull Identification Number:

ABC3AB43G091 EXTRA INFO

LOCATION

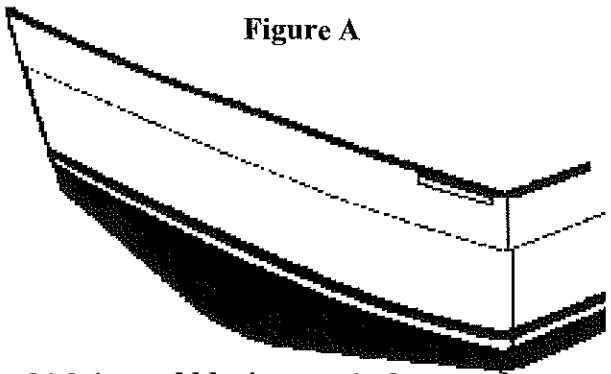
The regulations require the boat manufacturer to affix two identical Hull Identification Numbers, a "Primary HIN" and a "Duplicate HIN" in different locations.

The **Primary Hull Identification Number** must be affixed:

(1) **On boats with transoms**, to the starboard outboard side of the transom within two inches of the top of the transom, gunwale, or hull/deck joint, whichever is lowest (See Figure A).

(2) **On boats without transoms or on boats on**

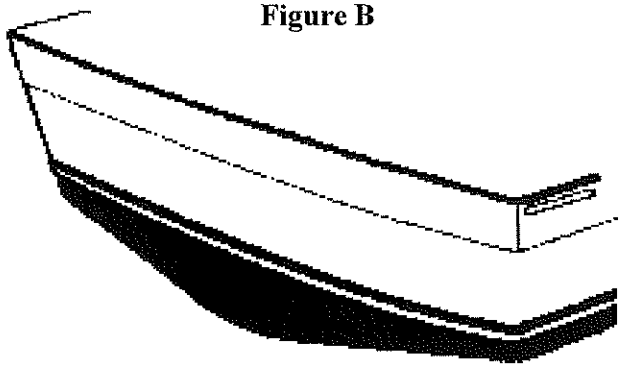
Figure A



which it would be impractical to use the transom, to the starboard outboard side of the hull, aft, within one foot of the stern and within two inches of the top of the hull side, gunwale or hull/deck joint, whichever is lowest (See Fig. B).

(3) **On catamarans or pontoon boats** which have readily replaceable hulls, to the aft crossbeam

Figure B



within one foot of the starboard hull attachment.

The Duplicate Hull Identification Number must be affixed in an unexposed location on the interior of the boat or beneath a fitting or item of hardware. Many builders believe that this implies a requirement for a hidden location for the second HIN.

The Coast Guard recognizes that on some boats there is no place to hide a duplicate HIN. Manufacturers of dinghies with no removable fittings can affix the duplicate HIN to the inboard surface of the hull side beneath a thwart or support for a seat. Manufacturers of small boats which do not have seats should affix the duplicate HIN somewhere on the inboard surface of the hull.

PROBLEMS IN THE FIELD

1. The intent of the regulations is for the Primary HIN to be visible when the boat is in the water. Yet many builders appear to have design teams working day and night trying to find ways to make the Primary HIN invisible to all but the most persistent sleuths. Part of the problem lies in the present popularity of tumblehome sterns, inverted transoms and swim platforms.

These days, just about everybody seems to offer at least one model with an "integrated swim platform". Many designs result in a stern devoid of a vertical plane which one would associate with a definition of the word, "transom," or, if there is a vertical plane, "within two inches of the top" means somewhere underwater (see Figure B.). Owners who needed to physically verify the characters in a Hull Identification Number on one of these boats would have to go for an unplanned swim or haul their boat from the water just to read the HIN.

Some variations on the integrated swim platform are bolted to the transom (optional equipment) and

fit so snugly that they appear to be part of the original hull structure. The only telltale signs to their later addition are the through-bolts in the

Figure C

transom. Once installed, these swim platforms are difficult to remove. Verification of the characters in an HIN affixed to the transom on the hull beneath the bolted on swim platform becomes an even trickier proposition.

The optional location for the Primary HIN on the starboard outboard side of the hull was developed, in part, because of some builders' aesthetic concerns. They felt the HIN location on the transom detracted from the beauty of a traditional varnished mahogany transom. All builders are free to use the location illustrated in Figure B.

2. We frequently receive calls from individuals and from people involved in law enforcement asking us for the location of the Duplicate HIN. The Coast Guard does not record the locations of duplicate Hull Identification Numbers. The only persons who would know are the builders of the boats. We hope that manufacturers who receive such questions try to verify the bona fides of the questioners and thereby thwart boat thieves and other criminals who may be attempting to cover all the bases.

PERMANENCY

Each Hull Identification Number must be carved, burned, stamped, embossed, molded, bonded, or otherwise permanently affixed to the boat so that alteration, removal, or replacement would be obvious. If the number is on a separate plate, the plate must be fastened in such a manner that its removal would normally cause some scarring of or damage to the surrounding hull area. A hull identification number must not be attached to parts of the boat that are removable.

The words "otherwise permanently affixed" and "in such a way that alteration, removal, or replacement would be obvious and evident" are subject to interpretation by the courts. The Coast Guard considers these words to mean that ordinary and reasonable methods must be used which will allow the HIN to remain intact and legible for the useful life of the boat and in a way that would discourage anyone but a skilled boat thief from altering or removing the number.

Our present policy is to accept any reasonable means of affixing a number until such time as its performance indicates that it is not permanent.

PROBLEMS IN THE FIELD

Methods of affixing Hull Identification Numbers which have been found to be unacceptable are:

Use of common embossed plastic marker tape, either stuck on the hull or riveted.

Use of metal plates riveted to the hull. The rivets can be drilled out and a new plate riveted in its place. The metal plate should be fastened by some additional means such as with an epoxy.

Use of individual characters so that individual characters can be removed and replaced.

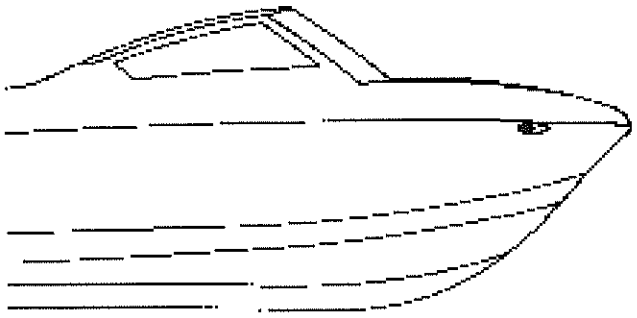
Use of only screws or bolts to attach a plate. Again, the plate should be fastened by some additional means such as with an epoxy.

MINIMUM SIZE

The characters in each Hull Identification Number must be no less than one-quarter inch in height.

NAVIGATION LIGHTS- SIDELIGHTS

During factory and boat show inspections we have observed that many manufacturers of recreational boats do not have a good understanding of the navigation rules governing proper installation of navigation lights. The requirements are found in the Navigation Rules, International-Inland, and in Parts 81, 84 and 89 of Title 33, Code of Federal Regulations. The problem appears to be particularly prevalent for manufacturers located in the western States. Since most manufacturers routinely equip the boats they produce with navigation lights, navigation light installations are routinely inspected and discussed during factory visits and boat shows.



One problem which has increased recently is the installation of flush mounted sidelights in the boat hulls, usually below the rub rail. The illustration shows an example of this type of installation. Many manufacturers build boats using similar sidelight fixture installations. This is a dangerous trend which is likely to end up costing somebody a pile of money when a plaintiff's attorneys go after everyone who might have been for liable for a serious collision.

Sidelights which meet the rules are designed to cover an arc of the horizon, or sector, of 112.5 degrees. Intensities are required to attain a visible range of 1 mile for vessels less than 12 meters (39.4 ft.) and 2 miles for vessels 12 meters or longer. These fixtures are designed for intensities to decrease and reach practical cut-off between 1 and 3 degrees outside their prescribed sector. Sidelight fixtures must be installed parallel with the fore and aft centerline of the vessel and arranged to show an unbroken light from right ahead to 22.5 degrees abaft the beam, a total sector arc of 112.5 degrees.

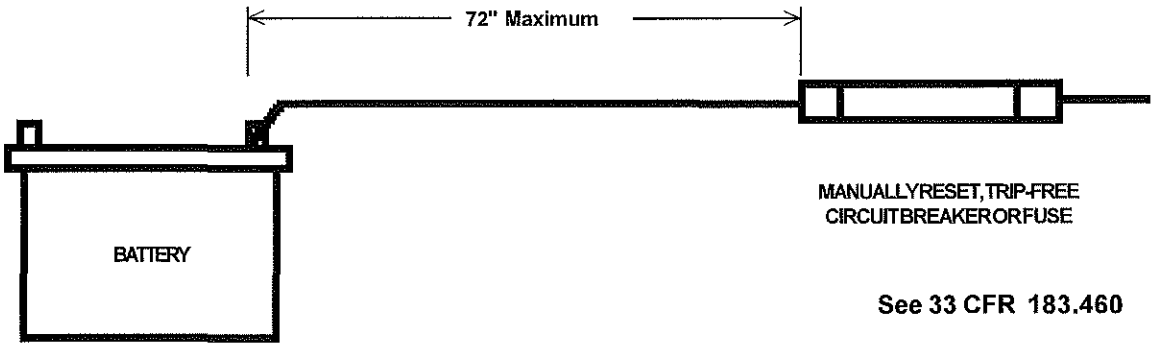
Sidelights that are installed in the contour of the bow without providing a mounting surface tooled to be parallel with the fore and aft centerline of the vessel are not in compliance with the Inland or International Navigation Rules. Depending on the breadth of the vessel near the bow and how far aft from the vessel's stem the lights are mounted, this shift can be more than 20 degrees in some cases. Installing the fixtures too far aft of the vessel's stem may result in the sidelights not being visible from a position dead ahead.

Another factor in proper installation of sidelights is that they must maintain their required minimum intensity in a vertical sector from 5 degrees above to 5 degrees below the horizontal. They must also maintain at least 60 percent of their minimum required intensity from 7.5 degrees above to 7.5 degrees below the horizontal. Installing flush mounted sidelights, designed to be mounted to a vertical surface in the hull contour, without providing a mounting surface tooled to be vertical, shifts the vertical coverage sector. This also results in a noncompliance with the Inland or International Navigation Rules.

Additionally, most of these flush mounted sidelights are installed below the vessel's rub rail. International Navigation Rules require that sidelights be installed above the uppermost continuous deck. Therefore this configuration would not be in compliance with International Navigation Rules.

When separate red and green sidelight fixtures are used, the masthead or all-round white light, whichever configuration is installed, must be located as close as practical to the vessel's fore and aft centerline. For vessels less than 12 meters in length, the masthead or all-round light may be displaced from the fore and aft centerlline providing that the sidelights are contained within a common fixture and mounted on the vessel's fore and aft centerline. The masthead or all-round light must be installed at least one meter (3.3 ft.) above the sidelights.

This article was written by the Coast Guard Short Range Aids to Navigation Division (G-NSR)

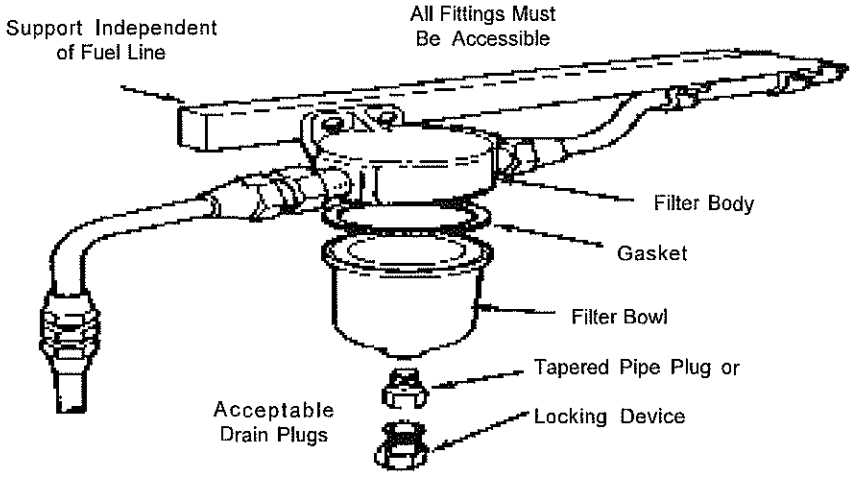


See 33 CFR 183.460

Reports from the Coast Guard Marine Safety Office, Puget Sound indicate that several boat manufacturers are installing marinized engines which do not have a main trip-free circuit breaker or fuse installed anywhere within 72 inches of the storage battery. The marinizers of the engines formerly installed a main circuit breaker, but then ceased doing so (leaving responsibility for compliance to the boat manufacturers). All boat builders are reminded that Section 183.460 of the Electrical System Standard states, in part,

"Each ungrounded output conductor from a storage battery must have a manually reset, trip-free circuit breaker or fuse, unless the output conductor is in the main power feed circuit from the battery to an engine cranking motor. The circuit breaker or fuse must be within 72 inches of the battery measured along the conductor,"

The purpose of the requirement is to protect conductors from excessive current loadings to remove potential fire hazards.

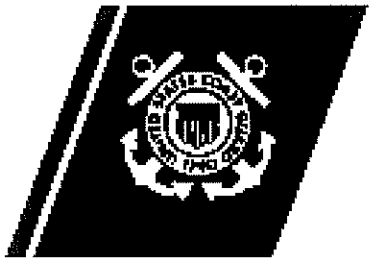


See 33 CFR 183.536
183.556
183.570

Reports from the Coast Guard Marine Inspection Office, Los Angeles/Long Beach indicate that several manufacturers of inboard jet drive model boats are installing in-line metallic fuel filters which are not independently supported. All builders are reminded that according to Section 183.570 of the Fuel System Standard,

"Each fuel filter and strainer must be supported on the engine or boat structure independent from its fuel line connections, unless the fuel filter or strainer is inside a fuel tank."

The purpose of the requirement is to minimize failures of fuel line connections due to vibration.



U.S. Coast Guard

Boating Safety Hotline

•For Boating Safety Recall Information
•To Report Possible Safety Defects in Boats
•For Answers To Boating Safety Questions
•For Information On USCG Boarding Procedures

•Call, Toll Free!

800-368-5647

Note: The stock of original copies of **Boating Safety Circular 70** is exhausted. This is a revised version of **Boating Safety Circular 70**. The original version contained a Defect Notification and Recall Campaign list; a table showing Causes of Boating Accidents in 1989; safety suggestions for boat operators; and a Consumer Fact Sheet covering "Disposal of Plastics and Other Garbage in Waters of the United States". Those articles have been removed because they are no longer considered current or are available from other sources.

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U.S. Department
of Transportation
**United States
Coast Guard**

APRIL 1991

Boating Safety Circular 71

COAST GUARD APPROVAL IS NOT A PRODUCT ENDORSEMENT

Along with all the boat shows in major cities this time of year we get the usual number of enterprising marine product inventors who mistakenly believe that getting an item of equipment "Coast Guard Approved" will help boost sales. Many people mistakenly believe Coast Guard approval is a product endorsement, which may be obtained for any device, as long as there is a potential for improving boating safety. Actually, the Coast Guard approval process involves very different criteria.

A manufacturer's inability to obtain ... approval for a "pocket-size folding boathook" ... does not indicate that such devices do not improve boating safety; only that there are no Coast Guard regulations requiring them on any vessel

First of all, products which may receive Coast Guard approval are limited to various items of lifesaving, firefighting, pollution abatement and miscellaneous equipment required to be used aboard U.S. registered vessels.

The Federal equipment carriage requirements are set forth in the Code of Federal Regulations. Subchapter S of Title 33 - Boating Safety, for example, contains the Coast Guard regulations covering the minimum Federal equipment carriage requirements for recreational boats. Those regulations require recreational boaters to carry Personal Flotation Devices and Visual Distress Signals. By definition, a "Personal Flotation Device" means a device that is approved by the Commandant, and Visual Distress Signals, according to the regulations, must be "of an approved type."

Subchapter C of Title 46 - Uninspected Vessels - contains the operator regulations covering fire extinguishing equipment, backfire flame control and ventilation. Fire extinguishers must also "be of an approved type" and most backfire flame arrester installations must be specifically approved by the Commandant of the Coast Guard.

The purpose of Coast Guard approval is not to provide marketing assistance to manufacturers, but to provide information to owners about safety equipment which has been found to meet the regulatory requirements, i.e., approved equipment has been determined to be in compliance with Coast Guard standards relating to performance, construction or materials. Standards for Coast Guard approved equipment are developed in the same way as they are for recreational boats — through the notice and public comment procedure in the Federal Register.

According to the summary in a Federal Register notice published January 9, 1991, for example, *The Coast Guard seeks to establish standards and procedures for approving gaseous-type fixed fire-extinguishing systems for pleasure craft and other uninspected vessels. Its current rules do allow certain fixed systems, but the ones they allow are too complex and expensive for most uninspected vessels."*

The Coast Guard establishes technical specifications and testing requirements for approved equipment. Equipment manufacturers are responsible for having the testing done, often by an independent laboratory. Coast Guard engineers from the Office of Marine Safety, Security and Environmental Protection evaluate the design features of the device and the laboratory's test report.

If the device passes the tests and meets all of the other requirements, the Coast Guard issues a formal approval certificate with a number that the manufacturer will affix to each approved device of the same design. Coast Guard Approved fire extinguishers, for example, are identified by the following marking on the label: "Marine Type USCG Approved, Size . . ., Type . . .,M162.028/ ... /," etc.

Inside:

VHF Radio Licenses Required 2
Standardization of MSD Pumpout Fittings 3
Federal Requirements vs. CME 4

After a design is formally approved, the manufacturer conducts certain inspections and tests to make sure that production runs of approved items continue to meet the requirements for the device that was originally approved. If the manufacturer changes any part of an approved item, the Coast Guard evaluates the changes before they are included in any device which is claimed to be Coast Guard approved. Sometimes this means that additional testing is required.

In order to keep approvals and certifications current, most are limited to a definite period of time -- usually five years. If there have been no changes in Coast Guard requirements and a manufacturer still produces an item of equipment without modification, the Coast Guard normally grants a five year extension on request.

Periodically, the Coast Guard publishes a book, "Equipment Lists" (COMDTINST M16714.3C is the latest issue) which identifies all of the equipment approved or certified by the Commandant of the Coast Guard for use on commercial vessels and recreational boats. Copies are available from the Superintendent of Documents, U.S. Government Printing Office.

The object of the Coast Guard approval process is to develop safety equipment regulations based on an expected benefit which is justified by the cost. A manufacturer's inability to obtain Coast Guard approval for a "pocket-size folding boathook" or some other such product does not indicate that such devices do not improve boating safety; only that there are no Coast Guard regulations requiring them on any vessel.

Editor's Note: The material for the previous article came from: Coast Guard Approval -- What Does It Mean?" by R.L. Markle which appeared in the Nov/Dec 1988 issue of *Proceedings of the Marine Safety Council*

VHF RADIO LICENSES REQUIRED

Because of hoaxes, interference, and other radio communications problems, the Federal Communications Commission (FCC) and the Coast Guard have agreed to cooperate in a joint effort to improve maritime safety involving the use of radio communications by enforcing existing regulations and increasing public awareness of the rules involving radio.

Problems often occur because mariners are unaware that maritime radio licensing and usage rules even exist. The FCC has agreed to prosecute radio violations based upon evidence supplied by the Coast Guard.

Under 47 CFR 80.405, operators of VHF maritime radios, VHF handheld radios, EPIRBs, radar units or radiotelephones, must have a clearly legible copy of a ship's station license "posted at the principal control point of each station" or, if it cannot be posted, "kept where it will be readily available for inspection." "If a copy is posted, it must indicate the location of the original." CB radios, cellular telephones and receive-only equipment are exempted.

Beginning in October 1991, Coast Guard boarding officers will include a check for the presence of an FCC ship's station license on all boarded vessels equipped with maritime radio and, in the case of no license, will look for evidence that radio equipment was operated, e.g., the boater was heard over VHF radio or observed transmitting. Violations will be reported to the FCC.

Ship's station license applications (FCC Form 506) and information about the operation of maritime radio may be obtained from any FCC field office (listed in the phone books of most major cities). The location of the nearest FCC field office is also available through the Boating Safety Hotline (800-368-5647).

Failure to obtain the proper FCC licensing can result in a criminal misdemeanor with penalties up to $10,000, one year in prison or both.

STANDARDIZATION OF HOLDING TANK PUMPOUT FITTINGS

All vessels which are equipped with an installed toilet system must have a Type I, II or III Marine Sanitation Device (MSD) certified to meet Coast Guard standards attached to the toilet. When the MSD regulations were published in 1975, the intention was to eventually require all vessels to be equipped with a Type II or Type III MSD; however, because of their size, weight and added power requirements, few Type II MSDs are available for small boats (65 feet or less in length).

On January 3, 1977 the Coast Guard published amendments to the MSD regulations:

"§159.12 Certification of certain Type III devices.

(a) The purpose of this section is to provide regulations for certification for certain Type III devices.

(b) Any Type III device is considered certified under this section if:

(1) It is used solely for the storage of sewage and flushwater at ambient air pressure and temperature; and

(2) It is in compliance with §159.53(c).

(c) Any device certified under this section need not comply with the other regulations in this part except as required in paragraphs (b)(2) and (d) of this section and may not be labeled under §159.16.

(d) Each device certified under this section which is installed aboard an inspected vessel must comply with §159.97."

An accidental effect of the amendments was to remove other requirements concerning holding tanks, particularly the need for standardized fittings intended for the removal of wastes at marine pumpout stations. As a result, pumpout facility operators have had to carry a number of different sized fittings and change

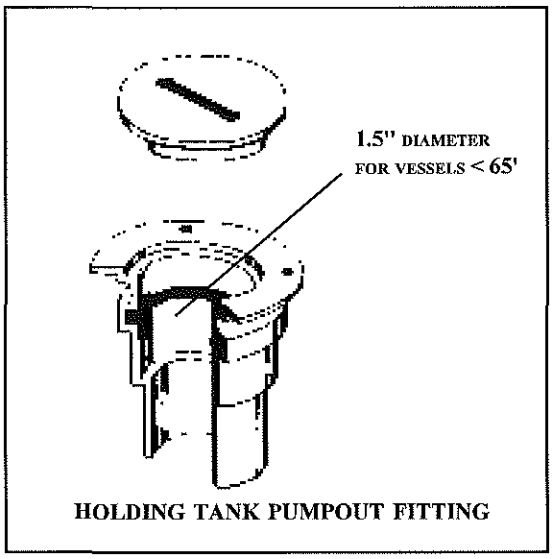
fittings to fit the particular vessel, or use a universal fitting which increases the potential for accidental overboard spillage of wastes and odor seepage.

When the MSD regulations were published, the Coast Guard's original intent was to require the use of standardized sewage discharge fittings on all vessels:

"§159.87 Removal fittings.
If sewage removal fittings are provided with the device, they must be of either 1.5 inch or four inch nominal pipe size."

The 1.5 inch fittings were intended for use aboard small boats (65 feet or less in length) and the four inch fittings aboard larger vessels. The expected types of acceptable fittings included threaded, flanged or quick-disconnect fittings

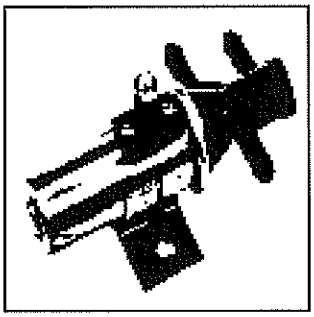
Improved water quality in our lakes, rivers, bays and other estuaries is in everyone's best interests. Efforts are underway to increase the available numbers of marine pumpout facilities and to improve the ease in which wastes are removed from holding tanks. When an opportunity arises, the Coast Guard plans to propose additional amendments to the MSD regulations which will reinstate the requirement for Type III devices to comply with 33 CFR 159.87. In the interim, all boat manufacturers and owners are urged to begin installing holding tank pumpout fittings with inside diameters which are consistent with the intent of the existing regulations. This in turn will enable the industry manufacturing holding tank pumpout fittings to standardize accordingly.



HOLDING TANK PUMPOUT FITTING

FUEL TANK SELECTOR VALVES

Reports from standards personnel from the Coast Guard Marine Safety Office, Los Angeles/Long Beach indicate that some builders of boats with inboard gasoline engines are installing electric solenoid fuel tank selector valves which do not meet the ignition-protection requirements in 33 CFR 183.410(a) or the fire test in 33 CFR 183.590.



Some inboard boats with dual fuel tank installations have a "T" in their fuel distribution lines designed to enable even withdrawal of fuel from both tanks. Many others utilize manual or electric switching fuel valves that designate which tank supplies the fuel inlet on the engine(s).

Some builders in the Los Angeles/ Long Beach area who utilize an *electric* fuel selector valve for this purpose are installing valves intended for the automotive and recreational vehicle market. The particular fuel tank selector valves installed by these manufacturers were not designed for use in marine applications.

Coast Guard regulations require the boat manufacturer to certify that a boat complies with applicable Coast Guard safety standards when sold to the public. In so doing, the boat manufacturer certifies that all of the components on the boat meet the requirements of the regulations.

All boat manufacturers are encouraged to obtain a similar certification or documentation from suppliers of electrical and fuel system components (such as manual and electric fuel tank selector valves), that representative samples of such components have been tested, and will comply with applicable portions of the Coast Guard Electrical and Fuel System Standards.

COMPARING A CME TO THE MINIMUM EQUIPMENT CARRIAGE REQUIREMENTS

From time to time we receive inquiries from boat owners and operators who were surprised to discover that although they carried the minimum number of PFDs, fire extinguishers and Visual Distress Signals required by the Federal regulations, their boats did not pass a Coast Guard Auxiliary Courtesy Marine Examination (CME). Perhaps they were influenced by the fact that some insurance companies reportedly offer reduced rates to owners of boats which have passed the Auxiliary CME.

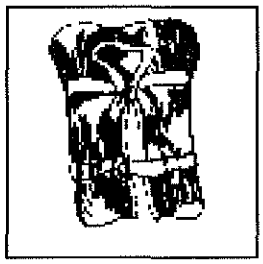
A Courtesy Marine Examination is a check of a boat's safety related equipment by specially trained members of the Coast Guard Auxiliary with the consent of a boat owner or operator. The CME covers both the requirements of Federal and State law and certain additional criteria for safety which have been adopted by the Auxiliary. Boats meeting the Courtesy Marine Examination criteria are awarded an Auxiliary CME "Seal of Safety" decal for the current year.

For the benefit of readers who think their boat's are up to snuff, here's a look at just what the differences are between the minimum Federal equipment carriage requirements and those the Auxiliary uses during a Courtesy Marine Examination.

PFDs

MINIMUM FEDERAL REQUIREMENT

Under the Federal regulations, boats less than 16 feet in length must have one Type I, II, III or IV PFD of a suitable size for each person on board. Boats 16 feet or longer in length must have one Type I, II, or III (wearable) PFD* of a suitable size for each person on board and one Type IV (throwable).



CME REQUIREMENT

For a CME decal boats less than 16 feet in length must be equipped with at least two PFDs, regardless of the number of persons on board. Boats 16 feet or longer in length must have a minimum of three PFDs, two wearable and one throwable, regardless of the number of persons on board. Wearable PFDs must be readily accessible* and throwable PFDs must be immediately available for use.

*Because they come in sizes designed to fit the user, a Type V Personal Flotation Device (hybrid PFD) must be worn by the intended user

Fire Extinguishers

MINIMUM FEDERAL REQUIREMENT

Under the Federal regulations, all motorboats must carry the minimum number of approved hand portable fire extinguishers shown below. Motorboats powered by outboards which are less than 26 feet in length and not carrying passengers for hire need not carry them if their construction will not permit the entrapment of explosive flammable gases or vapors.

CME REQUIREMENT

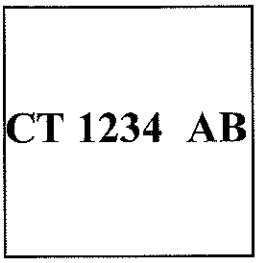
CME requirements exceed the Federal regulations by requiring that all vessels carry a minimum of one B-1 fire extinguisher. Only sailboats less than 16 feet without mechanical propulsion are exempt. To be counted, all HALON extinguishers must have an inspection tag showing that they were inspected within six months of the CME.

VESSEL LENGTH	NO FIXED SYSTEM	WITH FIXED SYSTEM
Less than 26 ft.	1 - B-I	0* (*1 - B-I for CME)
26 ft. to less than 40 ft.	2 - B-I or 1 - B-II	1 - B-I
40 ft. to 65 ft.	3 - B-I or 1 - B-I and 1 - B-II	2 - B-I or 1 - B-II

Numbering

MINIMUM FEDERAL REQUIREMENT

A boat's number must be permanently attached to each side of the forward half of the vessel. Characters read left to right, are plain block letters which contrast with the backgound color, are distinctly visible and legible and no less than 3 inches in height. A space or dash must separate letters from numbers.



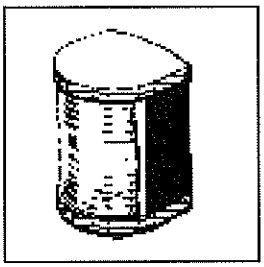
CME REQUIREMENT

CME requirements are the same as the Federal requirements.

Navigation Lights

MINIMUM FEDERAL REQUIREMENT

The Federal regulations do not require a boat that is operated only in the daytime to have navigation lights. See the "Navigation Rules, International - Inland" for a complete explanation of the navigation light requirements.



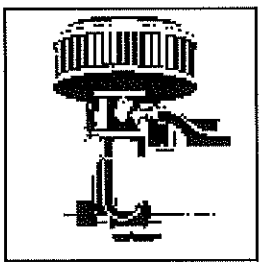
CME REQUIREMENT

If a boat less than 16 feet in length is equipped with navigation lights, they must be properly located. All other vessels must have operable navigation lights of proper configuration to receive a CME decal.

Backfire Flame Arrester

MINIMUM FEDERAL REQUIREMENT

According to Federal regulations, gasoline engines installed in a vessel after April 25, 1940, except outboard motors, must be equipped with an acceptable means of backfire flame control. The device must be suitably attached to the air intake with a flame-tight connection and is required to be Coast Guard approved.



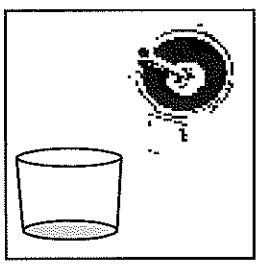
CME REQUIREMENT

Under the CME requirements, all gasoline motorboats, regardless of date of construction or engine installation, must be equipped with a suitable means of backfire flame control.

Dewatering Device

MINIMUM FEDERAL REQUIREMENT

The Federal regulations do not require a bucket or other bailer on unpowered boats or electric bilge pumps on boats with engines; however, they are items of recommended equipment.



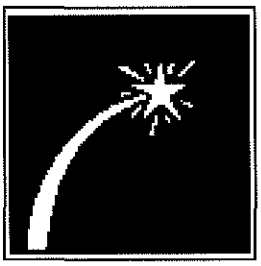
CME REQUIREMENT

All boats must carry at least one effective manual dewatering device (bucket, bailer, scoop, etc.). *This requirement is in addition to* any installed electrical bilge pump that the vessel may have on board. An installed electrical or mechanical bilge pump is not a requirement for award of the CME decal; however, if such a pump is installed it must be in satisfactory operating condition.

Visual Distress Signals

MINIMUM FEDERAL REQUIREMENT

All recreational boats used on coastal waters, the Great Lakes, territorial seas and those waters connected directly to them, up to a point where a body of water is less than two miles wide, must be equipped with Coast Guard approved Visual Distress Signals. Vessels owned in the U.S. operating on the high seas, are also required to carry approved Visual Distress Signals.



CME REQUIREMENT

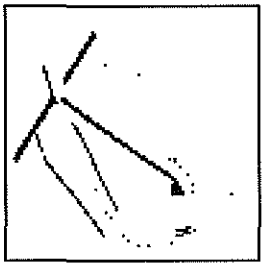
Same as Federal requirements except for vessels operating on inland waters, the Auxiliary CME requires some means of making a suitable day and night visual distress signal. Recommended equipment could include one or more of the following:

NIGHT	DAYLIGHT
Strobe Light	Signal Mirror
Flashlight	Red or Orange Flags
Lantern	

Anchor and Anchor Line

MINIMUM FEDERAL REQUIREMENT

The Federal regulations do not require carriage of an anchor or anchor line; however, they are recommended equipment.



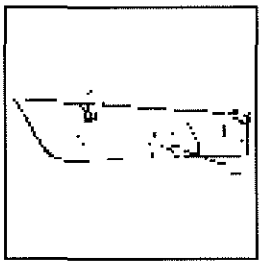
CME REQUIREMENT

To qualify under a CME, the boat must be equipped with an adequate anchor and line of suitable size and length for the particular locality.

Ventilation

MINIMUM FEDERAL REQUIREMENT

The Federal requirements for both natural ventilation and powered ventilation systems are dependent upon when the boat was built, and whether or not a compartment contains an engine, a fuel tank, or an electrical component which is not ignition-protected. See Boating Safety Circular 69 for a complete explanation of the ventilation requirements.



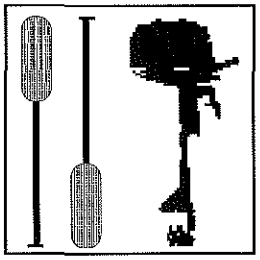
CME REQUIREMENT

CME requirements are the same as the Federal requirements.

Alternate Means of Propulsion

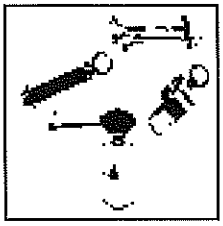
MINIMUM FEDERAL REQUIREMENT

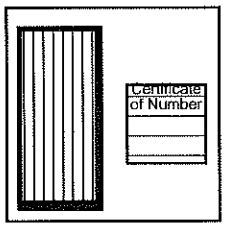
The Federal regulations do not require an alternate means of propulsion; however, an oar or paddle is recommended for vessels which can be propelled by such equipment.



CME REQUIREMENT

All boats less than 16 feet in length must carry a second method of propulsion. A paddle, oar or other suitable device meets this requirement. If an alternate means of *mechanical* propulsion is carried (another outboard or trolling motor), it must use a different fuel tank and starting source from those which are used by the main propulsion motor.

MINIMUM FEDERAL REQUIREMENT	Sound Signals	CME REQUIREMENT
Vessels less than 12 meters (39.4 ft.) are required to carry some means of making an efficient sound signal. Vessels 12 meters (39.4 ft) or more in length are required to carry a power horn or power whistle capable of producing a four second blast, and a bell measuring at least 7.875" at the mouth.		CME requirements are the same as the Federal requirements.

MINIMUM FEDERAL REQUIREMENT	Registration/Documentation Papers	CME REQUIREMENT
The owner/operator of a vessel must carry a valid certificate of number whenever the vessel is in use. The person in command of a documented vessel must have the Certificate of Documentation issued to that vessel on board unless the Certificate is being submitted to a documentation officer.		CME requirements are the same as the Federal requirements.

Miscellaneous CME Requirements

Fuel Systems: Portable fuel tanks (7 gal. capacity or less) must be constructed of sturdy, non-breakable material an in safe condition. Tanks must be free of excessive corrosion and must not leak. Any vents must be capable of being closed and the tank must have a vapor-tight, leak-proof cap.

All tanks must be properly secured in the boat to prevent excessive movement. Permanent fuel tanks (over 7 gallons capacity) and fuel lines must be free of excessive corrosion and not leak. Permanent fuel tanks must be grounded. The fuel fill pipe must be securely fitted to the fuel fill plate and located outside of a closed compartment where any spilled fuel will be directed overboard. A vent terminating outboard of the hull and compartments must lead to each permanent fuel tank.

Note: <u>According to CME requirements, there is no such thing as a portable fuel tank larger than 7 gallons. Therefore, any fuel tank larger than 7 gallons would have to meet all of the requirements for *permanent tanks.*</u>

Seaworthiness: The boat must be free from fire hazards, in good overall condition with the bilges reasonably clean and the visible hull and structures generally sound. The maximum persons capacity and maximum horsepower capacity must not be exceeded.

Note: <u>Some States consider carrying more people or more horsepower than is displayed on the capacity label prima facie evidence of negligent operation and some insurance companies will deny insurance to owners of outboard powered boats which are overpowered.</u>

Galley appliances and their fuel tanks must be properly secured and the system must not leak (no odor of fuel when the system is turned on). There must be no flammable material in the vicinity of stoves or heaters. Adequate ventilation must be provided for appliances and their fuel supplies. Appliance shut-off valves must be readily accessible. Only common appliance fuels must be used. Due to their volatile nature, gasoline, naptha or benzene are prohibited for use as appliance fuels if a boat is to pass a CME.

Wiring must be in good condition and properly installed. No exposed areas or deteriorated insulation is permitted. The electrical system must be protected by fuses or manually reset circuit breakers. Switches and fuse panels must be protected from rain or spray. Batteries must be secured to prevent movement and the terminals covered to prevent accidental arcing.

State requirements: The owner/operator may be required to comply with additional regulations specific to the State in which the vessel is registered or operated. Therefore, the boat will be checked against the requirements of the *State in which the CME is being conducted.*

U.S. Department
of Transportation

**United States
Coast Guard**

**SEPTEMBER 1991
(reprinted May 1993)**

Boating Safety Circular 72

LET'S BE CAREFUL OUT THERE PEOPLE!

The numbers speak for themselves. The typical recreational boater is more likely to have a collision with another vessel or a fixed object than any other type of boating accident. Collisions are the third most frequent cause of fatalities.

During the years 1986 through 1990, 16,835* boats were reported to have been involved in collisions. Almost 9,500 of the people filing accident reports attributed "improper lookout" as being the major cause. The second most frequent cause given was "other vessel or operator at fault."

Perhaps due to the similarities between driving an automobile and operating a boat, there are those who think licensing of boat operators will result in a substantial reduction in the numbers of accidents. Actually, there are far more reasons why the boat operator is more susceptible to having a collision than is the driver of an automobile:

TYPES OF BOATING ACCIDENTS - 1990

	Vessels Involved	Fatalities
TOTALS	**8,591**	**865**
Grounding	390	14
Capsizing	545	289
Swamping/Flooding	252	60
Sinking	210	11
Fire/Explosion (fuel)	274	14
Fire/Explosion (other)	97	2
Collision with another vessel	**4,422**	**81**
Collision with fixed object	**864**	**76**
Collision with floating object	262	13
Falls overboard	451	239
Falls within boat	139	1
Struck by boat or propeller	191	7
Other	470	29
Unknown	24	29

The automobile has a control station designed to provide optimum visibility in all types of driving conditions. Reclining bucket seats, rearview mirrors, windshield wipers and washers, defrosters, etc. are all intended to give the driver of an automobile maximum visibility. The typical boat, however, has a helm seat which is not similarly adjustable, and the operator lacks any additional accessories specifically designed to improve visibility, beyond the possible addition of a windshield wiper.

An automobile is equipped with a braking system that will bring a car to a complete stop within known distances depending on the particular rate of speed, and a steering system which responds instantly to a driver's turning of the steering wheel. The boat, however, is a vehicle which has no similar braking system. The act of coming to a complete stop is further complicated by the effects of way (momentum), windage, tide, current, and waves caused by weather conditions, a boat's own wake or wakes from other vessels. Steering response varies considerably depending upon, type of steering, boat type, hull design, direction of propeller rotation, trim, weight, and speed upon or through the water. These are but a few of the reasons why there are very significant differences between maneuvering a 30-foot tiller-steered sailboat, a 25-foot twin screw cabin cruiser and an outboard powered, 12-foot jonboat.

The typical automobile is equipped with a suspension system designed to minimize discomfort. The driver of an automobile travels an integrated system of paved highways and side streets with lane markings, one way and two way streets, speed limits, and other traffic signs and signals which properly direct vehicles in crossing situations.

Does Your PFD Have a Sunburn 7
Flame Arrester Regulations 8
Consumer Affairs 10
WANTED! 11

See Note on Page 7

*The Coast Guard estimates that it receives reports for only a fraction of reportable accidents.

LEADING CAUSES OF COLLISIONS - 1986 - 1990

BOATS INVOLVED	CAUSES
9,426	Improper lookout
8,616	Other vessel/operator at fault
2,249	Submerged object (logs, rocks, etc.)
1,478	Operator inattention or carelessness
945	Other
754	Strong current, rough water, weather, etc.
721	Speeding
641	Other equipment failure
537	Navigational error
394	Rules of the Road infraction
373	Inexperience of operator
280	Improper navigation lights
214	View obstructed (bow in air, sun glare, bright lights, etc.)
194	Steering system failure (cable, pulleys, fittings, etc.)
176	Loss of stability: strong current, weather, rapids, whitewater, etc.
119	Force of wake or wave striking vessel
68	Poor visibility (rain, fog, darkness, etc.)
50	Throttle failure

The boat operator, however, must make decisions and judgements concerning a boat's operation (speed, course, distance, plan of action, etc.) in relation to wind, water and weather conditions. The boat operator must also detect and avoid other boats approaching at varying speeds from all points of the compass. The boat operator must keep a constant lookout to avoid water skiers, swimmers and other objects above and beneath the surface of the water. In addition, the boat operator is also exposed to various environmental stressors, like glare, heat, fatigue and vibration which are largely absent from the environment to which the driver of an automobile is exposed.

Having established the fact that a boat operator's task in avoiding a collision is clearly more difficult than that of the automobile driver, let's look at how the task is made even more difficult because of certain characteristics involving the design of the boat.

In order to avoid a collision, you have to be able to see out of your boat well enough to be able to make certain judgements about surrounding objects and actions to be taken:

Will you hit an object as you navigate along your current course?

Will another boat hit your boat if both of you continue to travel on your current courses and at your current rates of speed?

To avoid colliding with an object forward of your boat, you need to be able to see the surface of the water from the area immediately in front of your boat to a point on the horizon. After sighting an object and determining what it is, you have to make a conscious decision that you don't want to hit it; a simple task at five knots, but a split-second decision at 30 or 40. You need to be able to see moving objects on both sides of the boat in order to determine whether those objects are moving to a position in front and thus will pose a threat of collision. Although visibility aft is important from the standpoint of keeping a proper lookout, it is most important while you are docking or maneuvering in close quarters.

Windshields

In most powerboats larger than 13 feet in length the operator must look through a windshield. The ability to visually detect objects through a windshield can be substantially reduced due to dirt, glare, reflections from nearby surfaces or condensation. Window frames and other structural obstructions may further limit your visibility.

It's unfortunate that most boats lack windshield washers like those on most cars. Obviously visibility will be impaired by a dirty, cloudy, rain or spray soaked windshield. Windshield surface cleaning prior to and during boat usage is a problem of boat maintenance.

Because light reflects on and off of a surface at the same angle, it is much easier to design and minimize glare and reflection problems for the automobile driver whose eye positions are known and the area of eye positions is small (different sized drivers look through different parts of a windshield). Because a typical boat operator's position varies greatly, i.e., standing sometimes, in lieu of seated, boat operators' eye positions vary much more significantly. This makes it almost impossible to make design changes which will prevent reflections from reaching boat

operators' eyes.

The automotive industry's accomplishments in reducing the effects of glare and reflections on windshields are obvious. Most cars have gray or black windshield wiper brackets, dark colored, textured, horizontal surfaces between the base of the windshield and the instrument panel, and dull finished parts on the instrument panel, radio speaker, steering wheel, or any other interior features which could reflect onto the windshield. The use of similar dull finishes and textured, medium to dark colors, aft of the windshield and forward of the control station *on boats* would greatly reduce glare and reflection problems.

When looking through the windshield, most automobile drivers have an unobstructed view of the road ahead. Boat operators, however, are forced to look around far more obstacles. Windshield wipers are optional equipment on most runabouts and small cabin cruisers and are often owner installed equipment. Both factory installed and owner installed windshield wiper motors are frequently mounted on the top center of the windshield frame. In that location, the wiper motor housing frequently reduces the size of the operator's view through the windshield. Alternatively, with the windshield wiper motor mounted in a corner of the windshield or at the bottom of the windshield frame, the wiper motor housing is out of the line of sight and the wiped area is larger and will provide better foul weather visibility.

Many windshields are divided into several pieces. Each section is surrounded by a frame. Windshield frames on cabin cruisers generally help to support the cabin top, and the flying bridge on boats so equipped. The windshield frames must be sturdy. In addition, mechanical cables and electrical wires must interconnect the upper and lower controls on boats with flying bridges. A housing or tube of some sort to carry the cables and wires is generally located forward of the lower helm station. These are other design problems which limit the boat operator's visibility.

Bow Rails and Stanchions

Many boats with single control stations have a bow rail which blocks the operator's view of a portion of the water surafce forward of the bow when the operator is seated at the control station. Bow rail support stanchions, flag staffs and pennants or burgees are additional obstructions to the operator's field of view. Reflections off chrome or glossy stainless steel fittings may also inhibit the operator's ability to maintain a proper lookout.

Reflective Deck Surfaces

On the typical small cabin cruiser, deck surfaces are generally fiberglass and have the same surface color and texture both forward and aft of the windshield. The color is generally white or a light tint and the surface is generally smooth. White surfaces are coolest in summer. Smooth surfaces are cheapest to produce in fiberglass and are easiest to clean; however, some thought should be given to the glare and reflection problem. Again, the use of a non-gloss or textured surface would help to reduce reflections and

COLLISION ACCIDENT STATISTICS - 1986 - 1990

TYPE OF ACCIDENT	TOTAL	FATALITIES	INJURIES	PROPERTY DAMAGE
		1990		
Collision With Another Vessel	2,242	81	1,376	$7,180,500
Collision With Fixed Object	864	76	545	$2,959,600
Collision With Floating Object	269	13	100	$834,000
		1989		
Collision With Another Vessel	2,039	60	1,265	$6,707,500
Collision With Fixed Object	797	60	509	$2,665,000
Collision With Floating Object	296	8	116	$1,284,900
		1988		
Collision With Another Vessel	2,351	76	1,321	$6,187,900
Collision With Fixed Object	848	78	449	$2,460,400
Collision With Floating Object	376	13	126	$1,193,500
		1987		
Collision With Another Vessel	2,288	80	1,307	$5,893,200
Collision With Fixed Object	853	58	496	$2,124,300
Collision With Floating Object	314	17	93	$1,105,300
		1986		
Collision With Another Vessel	2,108	86	972	$4,9057,900
Collision With Fixed Object	914	79	432	$3,080,800
Collision With Floating Object	276	8	57	$614,700

greatly improve visibility.

Pedestal Seats on Bass Boats

Bass boat manufacturers mount plush, high-backed upholstered armchairs on pedestals forward of the control station. If the chair is turned sideways and locked, the boat operator can move his or her head from side to side and so gain visual access to the water on the other side of the back of the chair. However, if the chair is facing forward, some portion of the operator's forward field of view is permanently obscured. Labels warning bass boat operators to turn or lower their pedestal mounted seats might encourage more people to avoid a dangerous practice.

Exterior Storage Compartments

Cabin cruiser manufacturers and owners frequently mount large storage lockers on the foredecks to store fenders, lines, anchors, etc. Quite often the boxes restrict the field of view from the lower control station. Other manufacturers and owners attach fender stowage brackets to their forward rail stanchions. When fenders are installed in these brackets they too limit the boat operator's field of view.

Navigation and Communications Equipment

Owners mount radar receivers, depth sounders, and other large electronic gear on the operator's side of the windshield on the deck forward of the control station, or attach them to the overhead, making already limited visibility problems even worse.

Passenger Seating

On small outboard powered boats which lack remote steering the operator sits on the rear seat with the passengers sitting on forward seats to balance the load. The same seating configuration is true of bowrider designs. Obviously, the boat operator's forward visibility will be impaired by the people sitting up forward.

On many cabin cruisers passengers have a tendency to favor seating themselves on the leading edge of the forward cabin, often directly in front of the control station position. Both designers, manufacturers, and owners should consider the installation of hatches, grabrails and similar low profile hardware which serves a functional purpose and at the same time discourages would be sightseers or sunbathers from accidentally obscuring the view from the helm.

Seatback Riding To Improve Visibility

Frequently operators' views are so obstructed that when seated at the control station, they cannot see the horizon over the bow. Faced with such a situation the operator will sit on the seat back, the gunwale or stand or crouch at the control station. Unfortunately, these people compromise other safety aspects in order to gain visibility.

When you move from a helm position designed for sit down operation, you move completely away from the control station. Seated on the seatback or gunwale, you may not have a comfortable grip on the wheel and shift and throttle controls may be out of reach. If a situation develops in which you have to maneuver quickly, you might first have to return to a seated position at the control station in order to make a radical alteration of course, or manipulate the shift or throttle controls.

In addition, many marine law enforcement officers consider operation of a vessel while seated on the seatback, gunwale, etc. evidence of negligent operation. The danger of such boat operation is that you might fall overboard and be struck by the boat or its propeller.

Canvas tops and side curtains

When some bimini tops are in the down position, unfurled sections of canvas may hang down obscuring the operator's view through the windshield. Also, the unfurled section may tend to flap about in a headwind. The boat operator's visual attention can be diverted by noise of the flapping of the canvas.

Clear plastic side curtains create other sorts of visual problems. Made of flexible plastic, they are not flat when installed. The wavy surface distorts the view making target identification more difficult than normal. The plastic in side curtains has a tendency to become scratched fairly quickly; prolonged exposure to sunlight makes the material turn yellow.

Bow High Attitude

A planing boat's transition from a displacement mode to up on a plane can also be classified as a visibility problem. In many boats, visibility from the seated helm position is totally obscured while travelling in the transition mode. Sometimes, standing behind the wheel helps maintain forward visibility; however, in some cases, the wheelhouse roof or a canvas top over the cockpit area makes standing impossible. In such cases, forward visibility is obscured for some period each time the boat is brought up on plane. Many boat operators scan the waters ahead then quickly advance the throttle to get up on plane as quickly as possible. Unfortunately, many people operate their boats in the transition attitude for considerable amounts of time.

Use of Sound Signals in Restricted Visibility

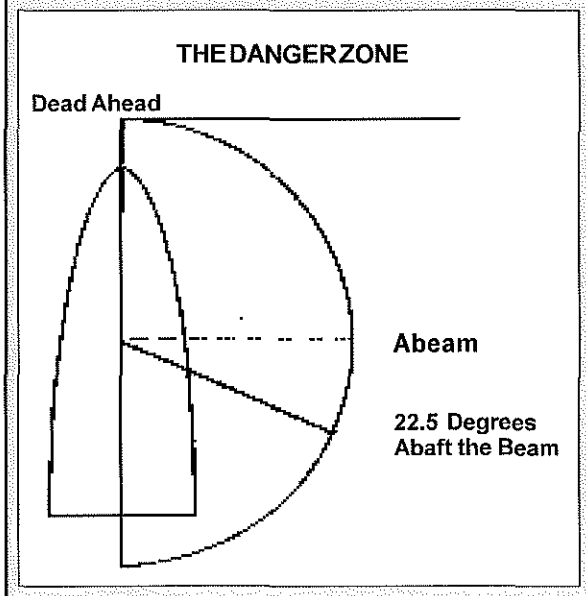
AVOIDING COLLISIONS

1. Always keep a proper lookout. Remember that "improper lookout" and "operator inattention or carelessness" are the most frequent causes for collisions reported to the Coast Guard. If passengers are seated where they block your view from the helm, have them sit someplace else.

2. Become knowledgeable on the Rules of the Road and once you know them, navigate your vessel defensively. Many people report they figured "it was the other guy who would alter course or reduce speed to avoid the collision." The Coast Guard book, "Navigation Rules, International and Inland" (COMDTINST M16672.2A) may be obtained from: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The price is $6.50 per copy and the stock number is 050-012-00192-8. The book may be ordered in two ways -- by telephone or mail. To order by telephone, call (202) 783-3238, ask for the book by name and give the stock number. You may pay using your VISA or MasterCard.

3. Use The Danger Zone Concept. In **Boating Safety Circular 68** we reported on the significance of the "Danger Zone". Most control stations are located on the starboard side of the vessel. Although the danger zone concept is not specifically metioned in the Rules of the Road, it is a very helpful way to remember who has the right-of-way in a crossing situation.

Your boat's danger zone extends from a point dead ahead to a point 22.5 degrees aft of your starboard beam (the same horizontal arc as your boat's green sidelight). If you are underway and you see another vessel within the danger zone, the other vessel probably has the right of way and you must alter course (usually to starboard) or speed to avoid a collision. With most helm stations on the starboard (right-hand) side, the operator has an unobstructed view of the danger zone



4. Keep to the starboard side of a channel giving larger vessels restricted by their draft, the benefit of deeper water in the center of the channel.

5. Operators of powerboats should slow down in congested waterways. The presence or absence of a posted speed limit isn't the only factor you should use in selecting an appropriate speed. Be considerate of slower vessels, and vessels at anchor or under sail whose passengers should be given the minor courtesy of reducing your vessel's wake to a tolerable minimum.

6. Use a setting which minimizes your time in the "bow up" attitude, if your boat has an adjustable motor bracket, trim tabs or an adjustable lower unit.

7. Skippers of sailboats should try to avoid sailing through channels where larger vessels which may be restricted in their ability to maneuver by virtue of their size, windage, draft, susceptibility to current, etc., are least prepared for technicalities involving who has the right-of-way. Sailboarders should remember that they too are subject to the Rules of the Road, just like any other vessel.

The skipper of a sailboat underway under sail should have at least one member of the crew maintaining a proper lookout, particularly in relation to the actions of other boats astern and to leeward. The statistics show that improper lookout is five times more likely to cause a collision involving auxiliary sailboats than weather or water conditions, the second most frequent cause.

8. Operators of personal watercraft are reminded that according to Rule 14 - Head-on Situation, "When two power-driven vessels are meeting on reciprocal courses so as to involve risk of collision, each shall alter her course to starboard so that each shall pass on the port side of the other."

Many operators of personal watercraft who have filed accident reports following collisions reported that they didn't know which way to turn in the moments prior to the accident. Personal watercraft livery operators would be wise to ask customers who are about to rent their boats whether they are aware of this basic requirement under the Rules of the Road.

In **Boating Safety Circular 64** we described a collision between a 110-foot crewboat and a fishing party boat at anchor in a fog that had reduced visibility to less than a quarter of a mile. Neither vessel operator had observed requirements for sound signals prescribed in the Rules of the Road.

All operators of recreational boats are reminded that the Rules of the Road are intended to assure navigation safety for all vessels. During periods of limited visibility, the proper use of sound signals while underway or at anchor helps in the prevention of collisions.

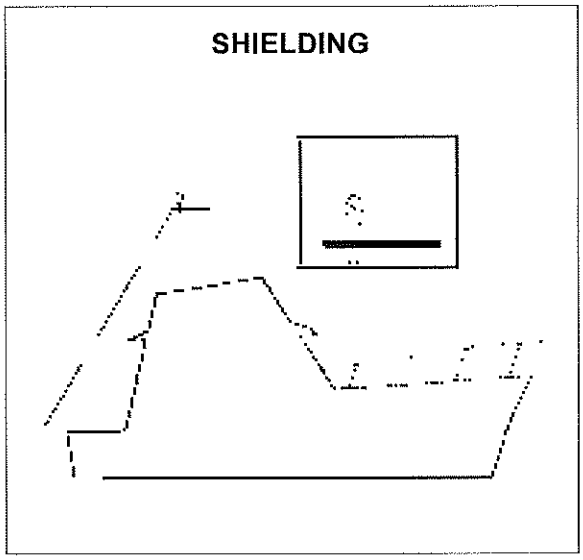
Glare from Masthead Light

In **Boating Safety Circular 65** we reported that manufacturers are clearly making an effort to comply with applicable portions of the Navigation Rules when installing navigation lights; however, many builders appear to have failed to determine whether there is a problem involving glare at the helm.

A properly installed navigation light complies with the Rules of the Road and does not produce glare. This means the light shines in the correct direction, is invisible to the operator of the boat on which it is installed, and does not shine on any parts of the boat. When navigation lights are on, a boat should sit in a shadow.

"Shielding" a navigation light points the light beam in the direction it is designed to shine and acts as an umbrella. Shielding shades the boat and eliminates glare in the eyes of the operator, as well as reflections off parts of the boat structure. If a light is high enough and is well-shielded, the entire boat will be bathed in shadow.

Control Station Design Concepts



The preceding discusses some of the ways in which boat design and the boating environment affect the boat operator's ability to maintain a proper lookout. The report, "Recreational Boating Safety Collision Research," upon which this article is based resulted in the publication of three final research reports:

Control Station Design Concepts for Bassboats, Bowriders, Runabouts, Skiboats and All Control Stations Designed For Sitdown Operation Only (AD-A055377 - Price: $15.00)

Control Station Design Concepts For Center Console Deck and Pontoon Boats (AD-A055726 - Price: $17.00)

Control Station Design Concepts For Cabin Cruisers and Flying Bridges (AD-A055406 - Price: $15.00)

The reports were developed under Coast Guard sponsored research to assist boat builders and designers in planning the control stations of various boat types. Use of the design concepts should provide adequate visibility, space and control locations for 90 percent of the user population while minimizing safety hazards within the control station area. The concepts cover the design of control stations that approximate the characteristics of the automobile control station for each of the titled groups of boat types.

Copies of the reports are available from:

The National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Telephone: (703) 487-4650

DOES YOUR PFD HAVE A SUNBURN?

A Personal Flotation Device (PFD), like any other item of equipment, eventually gets old and worn, and must be replaced. How do you know when a PFD must be replaced? Broken zippers and frayed webbings are frequent indicators of a worn-out device. Less obvious is the cover fabric of a PFD which has been weakened by extensive exposure to sunlight.

The most popular Personal FlotationDevices are fabric-covered Type II near-shore buoyant vests and Type III flotation aids. The fabric covering most often used is one of several types of nylon or polyester.

These synthetic fabrics have a number of advantages for use in PFD construction. They are economical, durable, and resistant to rot caused by microbes. They can be dyed in a wide range of colors. They are easy for PFD manufacturers to work with. They "drape" reasonably well, and therefore are good for constructing wearable articles. The nylon fabrics used are similar to those often used in constructing jackets and camping gear.

Nylon and polyester are plastics, however, and like many plastics they can start to break down after extended exposure to the ultraviolet (UV) light in sunlight. Fabric manufacturers can include UV inhibitors to slow the degradation process, and dyes used to color the devices may also provide some protection. Generally, darker dyes provide more protection than light or bright dyes, such as "neon" (fluorescent) shades. This is not always the case, however.

A PFD with a UV damaged fabric cover should be replaced. A weak cover could split open and allow the flotation material inside to be lost. How can you tell when a fabric PFD cover is worn out? A cover which has torn due to weakened fabric is obvious. Badly faded bright colors can also be a clue that deterioration has taken place. Compare fabric color where it's protected, under a body strap, for example, to where the fabric is exposed. Another simple test is to pinch the fabric between thumb and forefinger of each hand and try to tear it. If the fabric cover can be torn this way the PFD should definitely be destroyed and discarded.

Fabric covered PFDs should ordinarily last at least several boating seasons in normal use (vacations, weekends, and evenings, for example). PFDs used every day in direct sunlight will probably have to be replaced more often. When the boat is being operated, PFDs should be out and worn by everyone on board. If they are not being worn, they should at least be out and readily available. When the boat is not in use, PFDs should be allowed to dry out, then stowed under cover out of the sun.

Note: The stock of original copies of **Boating Safety Circular 72** is exhausted. This is a revised version of **Boating Safety Circular 72** . The original version contained a Defect Notification and Recall Campaign list; "Questions and Answers About the New Recreational Vessel Fee (RVF); Consumer Fact Sheets covering "Coast Guard Boarding Policy" and "U.S. Recreational Vessel Fee"; and questionnaires soliciting comments on the Coast Guard Recreational Boating Standards and Consumer Relations programs. Those articles have been removed because they are no longer considered current or are available from other sources.

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INDUSTRY STANDARDS ADOPTED IN SAFETY REGULATIONS

In the the Federal Register dated July 29, 1991 [56 FR 35817] the Coast Guard published a Final Rule adopting industry standards in place of detailed regulations in certain sections of Titles 33 and 46 of the Code of Federal Regulations (see affected CFR Titles and sections below). These amendments will eliminate the submission of technical information for affected components and reduce the overall cost and burden in staff hours and paperwork for both industry and the government, while providing a better method for ensuring that the affected components comply with Coast Guard regulations.

Since 1968 the Marine Safety Program has adopted over 250 standards and specifications to lessen the regulatory and administrative burden to both the Coast Guard and manufacturers. The rulemaking incorporates and updates both U.S. and international standards for numerous marine products including materials, backfire flame arresters, and hose assemblies for marine applications.

The Coast Guard has actively promoted use of industry standards in the spirit of the Office of Management and Budget Circular 119, "Federal Participation in the Development and Use of Voluntary Standards." This process has benefited both industry and government. Government costs are reduced for labor intensive tasks like plan review, equipment approval and verification of regulatory standards by field inspectors. Manufacturers no longer need to submit plans to the government for review when the product conforms to an incorporated standard. The amendments also adopt international standards, which will allow the United States to be more competitive in the world market.

The regulations in the rulemaking will have no effect on previously accepted installations as long as the equipment is maintained in good and serviceable condition. However, when a piece of equipment or system component is replaced, the regulations in the rulemaking apply to the replacement. The regulations are effective on August 28, 1991.

The following sections in Titles 33 and 46 of the Code of Federal regulations are affected by this rulemaking:

SUBCHAPTER L - WATERFRONT FACILITIES

33 CFR Part 127	Liquefied Natural Gas Waterfront Facilities

SUBCHAPTER O - POLLUTION

33 CFR Part 154	Oil Pollution Prevention Regulations for Marine Oil Transfer Facilities

SUBCHAPTER C - UNINSPECTED VESSELS

46 CFR Part 25	Requirements*

(*See related story at right)

SUBCHAPTER D - TANK VESSELS

46 CFR Part 32	Special Equipment, Machinery and Hull Requirements
46 CFR Part 34	Fire Fighting Equipment

SUBCHAPTER F - MARINE ENGINEERING

46 CFR Part 53	Heating Boilers
46 CFR Part 54	Pressure Vessels
46 CFR Part 55	Nuclear Powerplant Components
46 CFR Part 56	Piping Systems and Appurtenances
46 CFR Part 57	Welding and Brazing
46 CFR Part 58	Main and Auxiliary Machinery and related systems
46 CFR Part 59	Repairs to Boilers, Pressure Vessels and Appurtenances

SUBCHAPTER H - PASSENGER VESSELS

46 CFR Part 71	Inspection and Certification
46 CFR Part 76	Fire Protection Equipment

SUBCHAPTER I - CARGO AND MISCELLANEOUS VESSELS

46 CFR Part 91	Inspection and certification
46 CFR Part 92	Construction and arrangement
46 CFR Part 95	Fire protection equipment

SUBCHAPTER I-A - MOBILE OFFSHORE DRILLING UNITS

46 CFR PART 107	Inspection and certification
46 CFR Part 108	Design and equipment

SUBCHAPTER O - CERTAIN BULK DANGEROUS CARGOES

46 CFR Part 150	Compatibility of cargoes
46 CFR Part 153	Ships carrying bulk liquid, liquefied gas, or compressed gas hazardous materials

SUBCHAPTER Q - EQUIPMENT, CONSTRUCTION, AND MATERIALS: SPECIFICATIONS AND APPROVAL

46 CFR Part 162	Engineering equipment
46 CFR Part 163	Construction

SUBCHAPTER R - NAUTICAL SCHOOLS

46 CFR Part 169	Sailing School Vessels

SUBCHAPTER S - SUBDIVISION AND STABILITY

46 CFR Part 170	Stability requirements for all inspected vessels
46 CFR Part 174	Special rules pertaining to specific vessel types

SUBCHAPTER T - SMALL PASSENGER VESSELS (UNDER 100 GROSS TONS)

46 CFR Part 182	Machinery installation

SUBCHAPTER U - OCEANOGRAPHIC RESEARCH VESSELS

46 CFR Part 189	Inspection and certification
46 CFR Part 190	Construction and arrangement
46 CFR Part 193	Fire protection equipment

This rulemaking is of interest to readers of the **Boating Safety Circular**, because it includes the new requirements for backfire flame arresters in 46 CFR Parts 25 and 58.

"**Subpart 25.35 - Backfire Flame Control**

(a) Every gasoline engine installed in a motorboat or motor vessel after April 25, 1940, except outboard motors, shall be equipped with an acceptable means of backfire flame control.

(b) Installations made before November 19, 1952, need not meet the detailed requirements of this subpart and may be continued in use as long as they are serviceable and in good condition. Replacements shall meet the applicable conditions in this section.

(c) Installations consisting of backfire flame arresters bearing basic Approval Nos. 162.016 or 162.041 or engine air and fuel induction systems bearing basic Approval Nos. 162.015 or 162.042 may be continued in use as long as they are serviceable and in good condition. New installations or replacements must meet applicable requirements of subpart 58.10 of this chapter.

(d) [removed]

(e) [removed]

Subpart 58.10 - Internal Combustion Engine Installations

§ 58.10-5 **Gasoline engine installations**

* * * * *

(b) * * *

(2) All gasoline engines must be equipped with an acceptable means of backfire flame control. Installations consisting of backfire flame arresters bearing basic Approval Nos. 162.016 or 162.041 or engine air and fuel induction systems bearing basic Approval Nos. 162.015 or 162.042 may be continued in use as long as they are serviceable and in good condition. New installations or replacements must meet the applicable requirements of this section.

(3) The following are acceptable means of backfire flame control for gasoline engines:

(i) A backfire flame arrester complying with SAE J-1928 or UL 1111 and marked accordingly. The flame arrester must be suitably secured to the air intake with a flametight connection.

(ii) An engine air and fuel induction system which provides adequate protection from propagation of backfire flame to the atmosphere equivalent to that provided by an acceptable backfire flame arrester. A gasoline engine utilizing an air and fuel induction system, and operated without an approved backfire flame arrester, must either include a reed valve assembly or be installed in accordance with SAE J-1928.

(iii) An arrangement of the carburetor or engine air induction system that will disperse any flames caused by engine backfire. The flames must be dispersed to the atmosphere outside the vessel in such a manner that the flames will not endanger the vessel, persons on board, or nearby vessels and structures. Flame dispersion may be achieved by attachments to the carburetor or location of the engine air induction system. All attachments must be of metallic construction with flametight connections and firmly secured to withstand vibration, shock, and engine backfire. Such installations do not require formal approval and labelling but must comply with this subpart."

* * * * *

Editors Note: In reading the amendments to the backfire flame arrester regulations, it would appear that manufacturers of new boats and engines and owners of existing boats would be prohibited from installing flame arresters bearing USCG approval numbers, and would have to begin installing flame arresters labelled in accordance with SAE J-1928 or UL 1111. **This is not the intent of the new regulations.** The intent of the regulations is to remove the existing paperwork burdens associated with the present approval process for flame arresters, and instead, to adopt existing industry standards.

Therefore, a manufacturer with an existing certificate of approval for backfire flame arresters may continue to use those flame arresters until the certificate of approval expires. Manufacturers with existing inventories of Coast Guard approved flame arresters may continue to install them until such time as their inventories are exhausted. Owners replacing flame arresters may use either Coast Guard approved flame arresters or flame arresters labelled in accordance with SAE J-1928 or UL 1111 (whatever is available).

CONSUMER AFFAIRS

BOARDING HOTLINE/ BOARDING POLICY

As a part of Coast Guard initiatives to improve boarding policies and procedures, the Office of Navigation and Waterway Services recently expanded the services performed by the Boating Safety Hotline to include the collection of comments on Coast Guard boardings. Each boarding "feedback" call is transcribed on a report form which is sent to appropriate Coast Guard offices involved in boardings.

To date, the majority of the comments on Coast Guard boardings have been favorable. Complaints about boardings center on the following:

(1) Some boaters don't understand the purpose and the legal basis for boardings, i.e., they are unfamiliar with the Coast Guard's role as a law enforcement agency. They are often surprised or even resentful when the Coast Guard stops their vessels for "no apparent reason".

(2) Inspections are regarded as invasive and as deliberately looking for trouble. This is particularly true of the customs type inspections common in the Seventh Coast Guard District.

(3) Boaters are confused and concerned over what happens next if they are issued a Notice of Violation by the boarding officer.

A Consumer Fact Sheet was specifically developed to address these concerns. Copies of the Fact Sheet are available from the Coast Guard Consumer Affairs and Analysis Branch. Call the Boating Safety Hotline 1-800-368-5647.

Boaters who have given positive feedback are appreciative of a courteous attitude on the part of the boarding team, and appear to react favorably to the safety inspection, even when a violation is found, if the boarding officer explains the safety reasons for the various requirements.

BOATING SAFETY HOTLINE UPDATE

In 1986 the Coast Guard established a toll-free "800" number called the Boating Safety Hotline. The Hotline began on an experimental basis as a way to inform boat owners of safety recalls in progress, and to take complaints on problems that could be safety defects.

The Hotline also worked surprisingly well as a way to give the public fast and easy access to information on other boating safety topics. Hotline service reps are trained to answer questions on a variety of subjects ranging from equipment requirements on recreational boats, to the new MARPOL requirements and providing information on the new Recreational Vessel Fee requirements. The service reps usually send the caller additional information taken from an inventory of over 60 pamphlets, brochures, posters, fact sheets, articles, and video tapes.

Since its start, the Hotline has handled over 69,000 calls (more than 20,000 last year) and has proven itself as a valuable consumer relations tool. We are planning to upgrade Hotline telephone and computer equipment, invest more resources in service rep training, and expect to start a public awareness program through feature articles in newspapers and eventually a TV/radio Public Service Announcement campaign. The Hotline has worked well for the Recreational Boating Safety Program and could provide similar benefits for other Coast Guard programs.

WANTED!

ASSISTANCE IN THE FIGHT AGAINST BOAT THEFT

MARINE LAW ENFORCEMENT AGENCIES
ARE INCREASING THEIR EFFORTS
TOWARD THE RECOVERY OF STOLEN BOATS
AND PROSECUTION OF BOAT THIEVES

THE COAST GUARD ENCOURAGES
THE PUBLIC,
THE RECREATIONAL BOATING INDUSTRY,
LENDING INSTITUTIONS
AND
INSURANCE COMPANIES
TO PLACE A LARGER EMPHASIS ON USE OF

THE HULL IDENTIFICATION NUMBER (HIN)

TO IDENTIFY A BOAT
IN ANY PAPERWORK TRANSACTION
SUCH AS PURCHASE, SALE, TRANSFER,
INVENTORY, LOANS, INSURANCE, TITLING, ETC.

U.S. Department of Transportation
United States Coast Guard

JUNE 1992

Boating Safety Circular 74

CARBON MONOXIDE — THE INVISIBLE KILLER

The victims of carbon monoxide poisoning feel no particular pain except, perhaps, a severe headache which they usually attribute to some other cause. In fact, carbon monoxide will dull the senses to the point where the victims feel no fear or danger and have no will to save themselves. An hour after they drift into unconsciousness they are dead.

In **Boating Safety Circular 58** (June 84) we alerted readers to the carbon monoxide problem on recreational boats with permanently installed gasoline engines. In the article, *"A Good Way to Die"* we described some typical boating situations which result in fatalities when boat operators ignore the potential for carbon monoxide poisoning, or fail to conduct regular exhaust system inspection and maintenance.

The 1992 boating season is now underway and perhaps we can prevent a few accidents this year with an additional discussion of the carbon monoxide problem in recreational boating. Included with this article is a Technical Report, *"Educational Information About Carbon Monoxide"* , which is reprinted with the permission of the American Boat and Yacht Council, Edgewater, Maryland.

Carbon monoxide (CO) is a clear, odorless and poisonous gas that may be present even if the telltale smoke associated with exhaust emissions is not. Don't wait to feel the symptoms of carbon monoxide poisoning. If your boat has a permanently installed gasoline engine used for propulsion or as an auxiliary generator, get in the habit of inspecting the exhaust system frequently, particularly before you go for that first cruise of the season.

The "Station Wagon Effect"

Intrusion of carbon monoxide gas into the cabin and accommodation spaces on boats so equipped is another serious problem. Carbon monoxide can quickly reach dangerous levels due to aerodynamic principles which create substantial differences in the barometric pressures surrounding a boat in motion. Some boat speed and wind direction combinations can quickly raise CO concentrations to the hazardous level.

Boats moving forward generate areas of lower atmospheric pressure immediately aft of those parts of the boat which have large surfaces at right angles to a boat's direction of movement. This is sometimes called "back drafting" or the "station wagon effect". This is the same phenomenon which makes it possible for a race car to get a free ride by "drafting" close behind another car.

Back drafting worsens as the velocity of air movement from bow to stern increases relative to the velocity of the boat. The lower atmospheric areas are the result of the air streamlines being unable to flow in smooth lines around the hull and wheelhouse and further astern.

If the wheelhouse air volume is connected only to the air volume directly aft of the salon door, low pressure will develop within the wheelhouse and draw exhaust gases, including carbon monoxide into all areas having reduced air pressure.

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During tests conducted using U.S. Coast Guard Auxiliary vessels in 1985, the highest CO readings occurred when the test boats were cruising upwind with no forward ventilation sources, i.e., the forward hatch and windshield ports were closed. Reduced CO levels were achieved by opening the forward hatch and opening ports in the wheelhouse. Carbon monoxide concentrations on the flying bridges of test boats so equipped remained at acceptable levels, even when the flying bridges were enclosed.

Recent CO Research

Carbon monoxide related death and sickness cases occurring on inboard gasoline powered recreational boats were also the basis for a 1988 U. S. Coast Guard grant to the Volpe National Transportation Systems Center. A report, "The Intrusion of Engine Exhaust Into the Passenger Areas of Recreational Power Boats" was a product of the grant. The data presented in the report consists primarily of an analysis of CO sensor readings on board two cabin cruisers equipped with twin gasoline engines. The CO sensor readings were collected from many locations within the boats, with correlated relative wind direction and speed measurements. Cabin cruiser type boats were used because they are considered the most dangerous configuration for the intrusion of CO into living areas; however, cases involving other types of boats have also been reported.

The cabin cruisers used in the tests were both fitted with side mounted exhausts at the waterline. Even though the exhaust gases were mixed with seawater and a significant amount was discharged below the waterline, the testing showed that the CO was nearly insoluble in water. The test results would have been worse had the exhausts been located on the transom.

The tests demonstrated an alarming build up of carbon monoxide in living spaces on board the two cabin cruisers, especially when the relative and true wind were forward of the beam. During the tests, all forward openings were secured.

CO Concentrations and Symptoms

When carbon monoxide is inhaled, CO molecules attach to red blood cells in the same way oxygen molecules attach to red blood cells in a person breathing clean air. "Carboxyhemoglobin", the combination of carbon monoxide and hemoglobin (red blood cells), inhibits the blood's ability to combine with oxygen, resulting in oxygen deficiency.

There is no general agreement on a "safe" level of carbon monoxide exposure for humans. However, various published "acceptable concentration levels" indicate that an occupational day exposure average of 50 ppm (parts per million) would be acceptable for sea level conditions and exposures of 25 ppm for altitudes above 5,000 feet.

At an exposure level of 50 ppm for a day, a person's COHb level might reach 10 percent; victims may experience such physical effects as headaches, dizziness and diminished coordination. Levels between 10 and 15 percent CoHb cause nausea. Levels as high as 40 percent are associated with collapse and levels over 60 percent are usually fatal.

The importance of both (1) early detection, and (2) ventilation for prevention of carbon monoxide build up, are clearly evident.

Carbon Monoxide Detectors

There are several manufacturers of CO gas detectors intended for marine use, at least one of which is listed by Underwriters Laboratories. According to UL Standard 1524, "Carbon Monoxide Gas Detectors for Marine Use", a CO detector is an assembly of electrical components including a sensor and both a visual and an audible alarm.

The typical minimum COHb detection threshold is 20% (this figure is based upon military studies). Individuals with medical problems should consider using carbon monoxide detectors with lower COHb alarming capabilities.

Improvements in technology and reliability of carbon monoxide gas detectors have reached the point that their installation in accommodation spaces should be considered by all safety conscious recreational boaters. Detectors are available as single and multistation systems, fully integrated systems and self-contained units with internal batteries. The major drawback (continued with internal

(continued on page 10)

The following technical report, *"Educational Information About Carbon Monoxide"* is reprinted with the permission of the American Boat and Yacht Council, 3069 Solomons Island Road, Edgewater, Maryland 21037 (Tel: (410) 956-1050).

AMERICAN BOAT AND YACHT COUNCIL, INC.

EDUCATIONAL INFORMATION ABOUT CARBON MONOXIDE (T-22)

JANUARY 14, 1992

BACKGROUND

This Technical Information Report provides educational material about Carbon Monoxide relative to boats and boating. Carbon monoxide accumulation is affected by vessel geometry; hatch, window and door openings; ventilation openings; proximity to other structures; wind direction; vessel speed; and a multitude of other variables. This Technical Information Report attempts to discuss many of these and enable the reader to better understand some of the more predictable effects. However, this report is limited in that it cannot cover all conceivable variables and therefore, the reader is cautioned not to rely on it exclusively to prevent the accumulation of carbon monoxide.

INTENT: The information in this Technical Information Report concerns all vessels. An exception is vessels where diesel fuel is the only fuel source. The carbon monoxide component of diesel exhaust is extremely low relative to other exhaust products (e.g. nitrous oxide, aldehide, sulfur, etc.) and relative to the carbon monoxide produced in gasoline engine exhaust.

DEFINITIONS:

a. Carbon Monoxide - Carbon Monoxide is a gas formed by the combination of one molecule of carbon and one molecule of oxygen. Chemists refer to it as CO, its chemical formula, "C" for carbon and "O" for oxygen.
b. COHb - Carboxyhemoglobin is the molecule formed when CO combines with blood instead of oxygen.

PROPERTIES AND CHARACTERISTICS OF CARBON MONOXIDE

a. CO is a colorless, odorless and tasteless gas.
b. Its weight is about the same as air so it cannot be expected to rise or fall like some other gases but will distribute itself throughout the space.

Don't rely on the use of smell or sight of other gases to detect carbon monoxide as CO diffuses in the air much more rapidly than easily detectable (visible and smellable) gases.

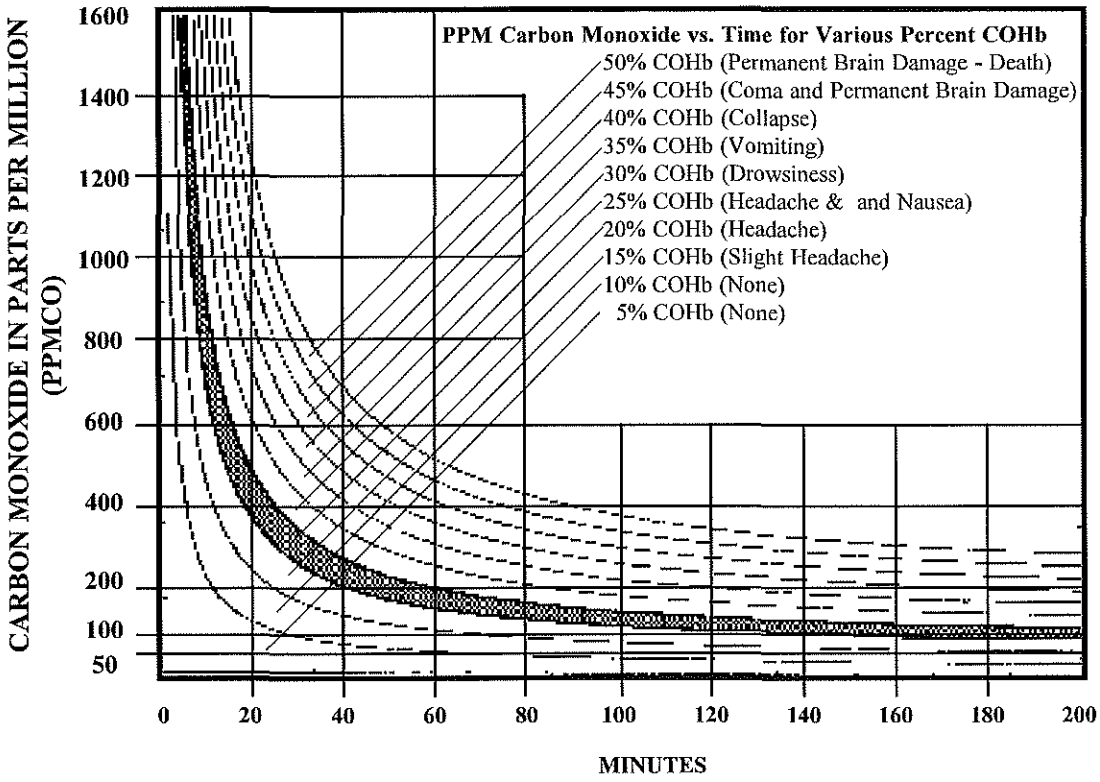
WHAT MAKES CARBON MONOXIDE: Anytime a material containing carbon burns, such as gasoline, natural gas, oil, propane, coal, or wood, CO is produced.

Common sources of CO are:

a. Internal combustion engines.

One should note that diesel engines produce substantially less carbon monoxide than gasoline engines.

Figure 1 - Carbon Monoxide Concentration vs. Time



Note: Figure 1 shows the generally accepted curves of a person's absorption rate of CO at various concentrations.

Example: At 180 PPM it would take over 1 hour (67.54 min.) for the blood to reach 15% COHb and a slight headache to occur.

This set of curves relates the PPM concentration of CO in the air to the percent of CO in blood hemoglobin, and gives the typical symptoms experienced at the various levels. It is based on data developed by the U.S. Army Human Engineering Laboratory, but makes certain assumptions necessary to condense a massive amount of scientific data into a single example. It assumes that the person has come aboard the boat from a clean air environment that is free of carbon monoxide.

b. Open flame devices such as:

(1) Cooking ranges,
(2) Central heating plants,
(3) Space heaters,
(4) Water heaters,
(5) Fireplaces, and
(6) Charcoal grills.

HOW A PERSON IS AFFECTED BY CARBON MONOXIDE - Carbon monoxide is absorbed by the lungs and reacts with blood hemoglobin to form carboxyhemoglobin, which reduces the oxygen carrying capacity of the blood. The result is a lack of oxygen for the tissues with the subsequent tissue death and, if prolonged, death of the individual.

Effects

Carbon monoxide in high concentrations can be fatal in a matter of minutes. Lower concentrations must not be ignored because the effects of exposure to CO are cumulative and can be just

as lethal. (See Figure 1).

Certain health related problems and age will increase the effects of CO. People who smoke or are exposed to high concentrations of cigarette smoke, consume alcohol or have lung disorders or heart problems, are particularly susceptible to an increase in the effects from CO. However, all occupants' health should be considered. Physical exertion accelerates the rate at which the blood absorbs CO.

Symptoms

One or more of the following symptoms can signal the adverse effect of CO accumulation:

a. Watering and itchy eyes
b. Flushed appearance
c. Throbbing temples
d. Inattentiveness
e. Inability to think coherently
f. Ringing in the ears
g. Tightness across the chest
h. Headache
i. Drowsiness
j. Incoherence
k. Nausea
l. Dizziness
m. Fatigue
n. Vomiting
o. Collapse
p. Convulsions

One should note that the order of the above list is generally the sequence of appearance of symptoms, however the order of appearance may change for different people.

Carbon monoxide poisoning may easily be mistaken for seasickness.

TREATMENT (Evacuate, Ventilate, Investigate, take Corrective Action)

a. Move the person to fresh air.
b. Administer oxygen if available.
c. Contact Medical help.
d. If victim is not breathing, perform artificial respiration per approved CPR procedures until medical help arrives and takes over.

Prompt action can make the difference between life and death.

e. Ventilate area.
f. Investigate source of CO and take corrective action.

INSPECTION: Look and listen for leaks in exhaust systems of both generator and propulsion engine(s) Look for discoloration around joints in the system (water leaks, carbon, stains, etc.).

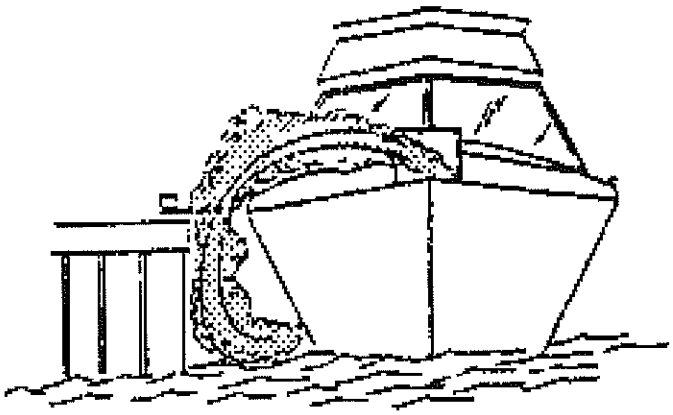
a. Make sure all exhaust clamps are in place and secured.
b. Make sure ventilation systems work and are not obstructed or restricted.
c. Make sure gaps around engine room plumbing and cableways and exhaust system doors, hatches, and access panels are minimized to reduce the opportunity for CO to enter the accommodation space(s).

OPERATION:

Cold Start vs. Warm Start - CO production is greater while combustion chamber surfaces and gas passages are cold versus when they are warm. A boat operator should:

a. pay attention to ventilating the boat,
b. orient the boat so it will allow the maximum dissipation of CO, and
c. minimize the time spent on getting underway.

Figure 2 - The Effect of Seawalls or Other Confined Spaces



Running engine or generator in confined areas

Boathouses, Sea Walls and Other Boats

A boat operator should be aware that dangerous concentrations of CO can accumulate when a boat, generator or other engine operated device is operated while the boat is moored in a confined area such as:

a. boathouses,
b. proximity to seawalls, or
c. proximity to other boats.

Orient the boat for maximum dissipation of exhaust or don,t run the boat or boat equipment for extended periods under these conditions. (See Figure 2).

A boat operator should be aware that CO is emitted from any boat's exhaust. The operation, mooring, and anchoring in an area containing other boats may be in an atmosphere containing CO not of the operator's making. An operator likewise needs to be aware of the effect of his actions on other boats. Of prime concern is the operation of an auxiliary generator with boats moored along side each other. Be aware of the effect your exhaust may have on other vessels and be aware that the operation of other vessel's equipment may affect the carbon monoxide concentration on your vessel. (See Figure 3.)

Figure 3 - How Boats Moored Close Together Can Affect Each Other

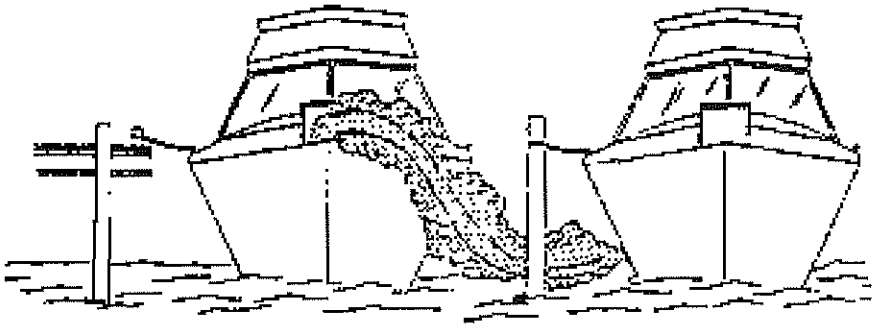
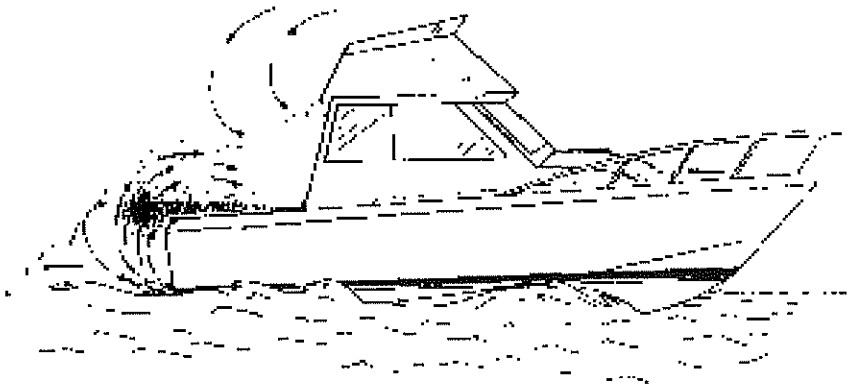


Figure 4 - Backdrafting (Station Wagon Effect)



Backdrafting (Station Wagon Effect) - Backdrafting or the "station wagon effect" is caused by air movement over or around a boat creating a low pressure area or suction area around the stern which can increase CO level on the boat. Backdrafting can be affected by relative wind direction, boat speed, and boat trim angle. See Figure 4 for "Airflow Over Boat and Behind Transom". Under certain speed and operating conditions the low pressure area may form in other regions and permit carbon monoxide to enter the hull through openings that are not on the back of the vessel. Boat factors which may affect carbon monoxide concentration:

a. Inefficient trim angle. (See Figure 6).
b. Excessive or unequally distributed weight.
c. Canvas Configurations - Under various conditions, adding or removing canvas may raise or lower CO levels. (See Figures 4, 5, 6)
d. Opening and closing ports, hatches, doors, and windows may raise or lower CO levels on board a boat.

Cabin Appliances - Boats having fuel burning appliances in accommodation areas should be provided with adequate ventilation and maintained to function properly.

Air Conditioning - It may be possible for CO to be brought into the air conditioned space by the air conditioner.

Ventilation of Accommodation Spaces - Accommodation spaces need to be ventilated to introduce fresh air into the spaces. Ventilation methods; e.g. windows, hatches, doors, and blowers; used to accomplish this may, under certain conditions, bring hazardous levels of CO into the accommodation spaces. Care should be taken to be aware of all prevailing conditions when using these ventilating methods.

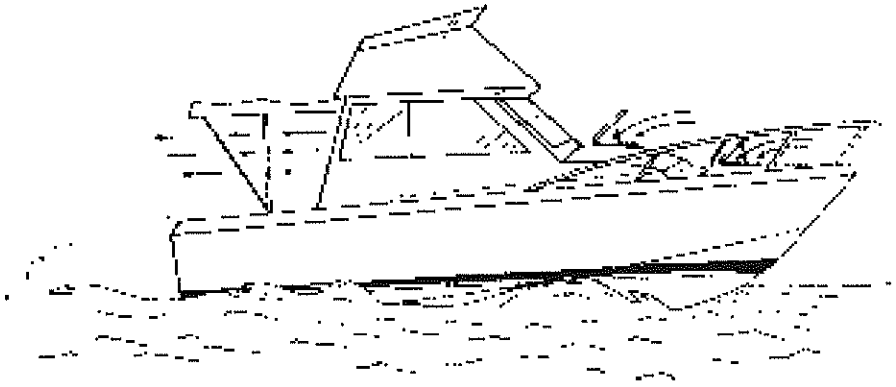
Altitude and Sea Conditions - Changes in altitude greater than 5,000 feet contribute to inefficient engine performance and may require adjustments to ignition systems, fuel systems, or changing the propeller's size.

a. Failure to make adjustments to ignition systems, fuel systems and propeller size may cause an increase in CO production.

b. Heavy sea conditions tend to load engines resulting in reduced performance and thereby increasing their CO production.

Portable Generator Sets - Gasoline powered portable generator sets produce CO. These sets discharge their exhaust products in locations which can lead to an increase in the accumulation of carbon monoxide in the accommodation space. This equipment is not recommended for use on recreational vessels.

Figure 5 - The Effects of Canvas Configurations



Desired Air Flow Through The Boat

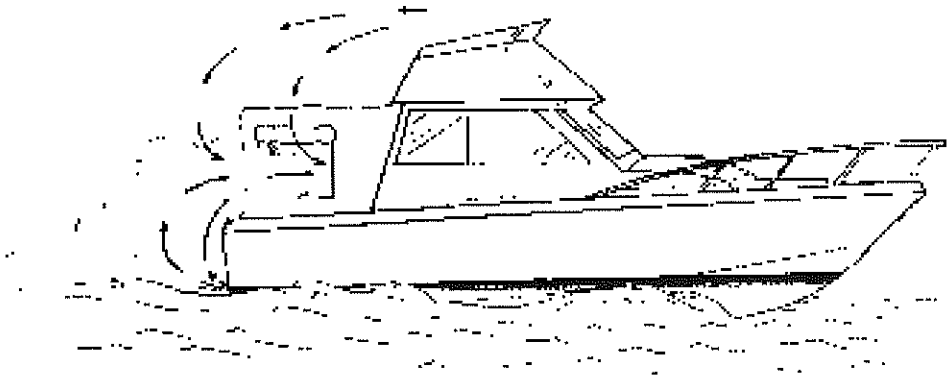
MAINTENANCE

Engine Performance - Efficient engine performance is vital to minimizing CO production. The following items are those considered to have the greatest effect on increased CO production:

a. Fuel system - Fuel that is contaminated, stale or incorrect octane number.

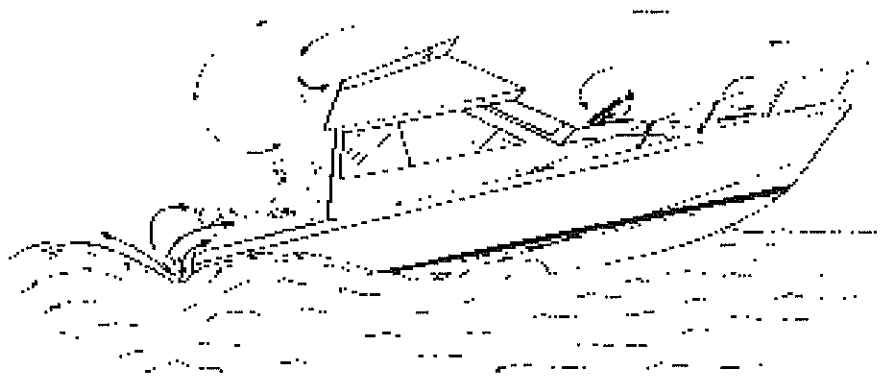
b. Carburetors/Injectors
   (1) Dirty or clogged flame arrester.
   (2) Malfunctioning automatic choke plate or faulty adjustment of manual choke plate.
   (3) Worn float needle valve and seat.
   (4) High float level.
   (5) Incorrect idle mixture adjustment.
   (6) Dirty or worn injectors.

c. Ignition System
   (1) Fouled or worn spark plugs.
   (2) Worn points or incorrect gap on points.
   (3) Shorted or opened circuit high tension spark plug cables.
   (4) Incorrect ignition timing.



Certain Canvas Configurations Can Increase Back Drafting

Figure 6 - Inefficient Trim Angles



Excessive Bow Attitude Can Increase Back Drafting

d. General

(1) Worn piston rings and valves.

(2) Engine temperature - Cold running engines increase CO production. Engine cooling water system design and selection of thermostat(s) are primary considerations affecting engine operating temperature. Generally, an engine produces less CO if it operates at a relatively high temperature within manufacturer's specifications.

(3) Exhaust back-pressure - Certain alterations to the exhaust system may increase engine exhaust back pressure and CO production.

(4) Restricted engine room or compartment ventilation.

External Conditions - External conditions that contribute to inefficient engine performance are:

a. Fouled hull bottom.
b. Damaged and fouled running gear (shaft, strut, propeller, rudder and trim tabs).
c. Incorrect selection of propeller size.

CO DETECTION SYSTEMS (See ABYC A-24, "Carbon Monoxide Detectors")

General - Even with the best of boat design and construction plus utmost care in inspection, operation, and maintenance, hazardous levels of CO may still be present in accommodation spaces under certain conditions. Continuing observation of passengers for symptoms of CO intoxication can be supplemented by an alarm type CO detection device in the accommodation space.

Detectors - Current CO detector technology can be broken down into three major categories - single-point, multi-point, and fully-integrated - the difference being the degree to which each type of unit considers exposure time.

a. Single-Point Detection - The single-point detector will sound the alarm whenever the detector senses that a single pre-set PPM level of CO has been exceeded.

b. Multi-Point Detection - The multi-point detector alarm will sound at a number of selected CO levels. The multi-point detector may include several different measuring time periods with their corresponding different PPM CO level alarm settings.

c. Fully-integrated detection - The fully-integrated detector will sound an alarm to any combination of PPM CO level and exposure time that would cause a health hazard.

Detection devices should meet the requirements of ABYC A-24 "Carbon Monoxide Detection Systems on Boats".

battery is, should the battery go dead, the detector would be incapable of indicating the presence of carbon monoxide.

A draft American Boat and Yacht Council (ABYC) Standard A-24 due to be published in one to two years, will recommend CO detectors on any boat with accommodation spaces and gasoline engines or gasoline generators.

Prevention

The best way to prevent carbon monoxide problems associated with leaks from the exhaust system is with regular inspections and maintenance.

Inspect the engine and generator exhaust systems for cracks in the hot, unjacketed sections of the exhaust manifolds. Check the tightness of the bolts holding the exhaust manifolds to the engine blocks.

Be sure engineroom bulkheads are completely sealed against leaks into accommodation areas. All holes in the engineroom bulkhead for plumbing, wiring and controls should be sealed by whatever means is most convenient. Seal larger holes with pieces of plywood. Fill spaces around wiring and plumbing with caulking, electrician's putty or the nondrying putty material used by heating and ventilating contractors to seal pipes in the sides of air conditioning equipment. Sealing the holes in engineroom bulkheads will also make the cabin much quieter while the boat is underway.

Be sure that all rubber hose connections in the exhaust system are fitted with two clamps at each end. Double clamping will go a long way toward preventing the exhaust hose from coming loose due to vibration.

Make sure exhaust hoses aren't burned through or beginning to show signs of advanced age. If you replace them, be absolutely certain that they are labeled by the manufacturer for use in a marine exhaust system.

If you own a double cabin cruiser or motor yacht, the exhaust lines probably pass through the aft stateroom on their way to the transom. There may be a rubber hose connection at the transom, at the engineroom bulkhead and at each end of any muffler installed in that exhaust line. All of these joints should be accessible for a complete inspection. If you find that the exhaust lines run behind cabinetry, as they do on many boats, now is the time to provide access. Cut holes or install removable panels so that inspection is relatively easy. You will want to inspect these connections at least twice every season. A crack or leak in the exhaust line is easy to detect while the engine is running. These are wet exhaust lines. A leak or crack will cause a steady drip of water.

The best measures to take in order to prevent CO from migrating into passenger carrying areas and accommodation spaces is to provide alternate sources of air for the cockpit and cabin areas. Leave a port in the windshield open and open a deck hatch. If you can feel a flow of air coming aft through the cabin and cockpit areas, you probably won't have much of a problem with carbon monoxide being pulled forward and into the boat. Exhaust deflectors can help, but they won't totally eliminate the problem.

Other CO Sources

Don't install a portable generator below decks. No portable generators meet the Coast Guard Electrical and Fuel System Standards. The fuel tank is usually on the top of the generator directly above electrical components that are not ignition-protected, a potentially serious fire hazard on a boat. The exhaust system on a portable generator is usually constructed of nonmarine alloys that can rust through after brief exposure to a salt water environment. The carburetors on most portable generators are not intended for marine use.

Do not use any flame producing device in an unventilated area. Any heater, stove or lantern that produces an open flame uses oxygen. The argument that these devices do not produce carbon monoxide does not apply when they are used in enclosed spaces. Alcohol heaters and stoves, propane heaters and stoves, catalytic heaters, oil lamps, gasoline lanterns, even charcoal stoves consume oxygen. When the amount of oxygen in the air gets below a certain level, these devices produce carbon monoxide because of incomplete combustion of their fuel. Ventilation must be provided whenever any device producing an open flame is used in a boat cabin.

U.S. Department of Transportation
United States Coast Guard

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16751
April 2, 1992

Editor's Note: A copy of the following letter was sent to each State Boating Law Administrator alerting marine law enforcement authorities to recent changes in the Federal regulations governing acceptable backfire flame arresters. We reported on the change in the regulations in Boating Safety Circular 72.

Mrs. Elizabeth Raymond
Boating Law Administrator
Dept. of Wildlife, Fisheries
and Parks
P.O. Box 451
Jackson, MS 39205

Dear Mrs. Raymond:

In the Federal Register dated July 29, 1991, the Coast Guard Office of Marine Safety, Security and Environmental Protection published a final rule adopting industry standards in place of detailed regulations in certain sections of Titles 33 and 46 of the Code of Federal Regulations. We are bringing the publication of these particular regulations to your attention because they may affect law enforcement policies covering backfire flame arresters in your State.

Since 1968 the Coast Guard Marine Safety Program has adopted over 250 industry standards and specifications to lessen the regulatory and administrative burdens on both the Coast Guard and manufacturers. Prior to the publication of the regulations, manufacturers of backfire flame arresters had their products tested by independent test laboratories and then submitted the test results to the Coast Guard. The Coast Guard then accepted the test results as a basis for issuing a Coast Guard approval number. We included a reprint of the regulations in Boating Safety Circular 72 (September 1991). A copy of the pertinent pages is enclosed for your reference.

Under the new regulations effective August 28, 1991, an acceptable means of backfire flame control is a flame arrester complying with either Society of Automotive Engineers Standard SAE J-1928 or Underwriters Laboratories Standard UL 1111 and labelled accordingly. The possible implications of this change for State law enforcement policies were discussed at the 48th meeting of the National Boating Safety Advisory Council on November 11, 1991, and in the December/ January 1992 issue of the "Small Craft Advisory" (copy of page 5 enclosed).

After August 28, 1991, an acceptable backfire flame arrester may bear:

1. A U.S. Coast Guard approval number; or

2. The words, "complies with UL 1111 per tests by (name of testing facility)"; or

3. The words, "evidence of compliance with the standard shall be indicated by the marking SAE J-1928 with the word MARINE arranged in a suitable manner."

We hope this explains the situation sufficiently for your State to make appropriate changes to law enforcement policies, and if necessary, to State laws and/or regulations. Please let us know if you need further clarification.

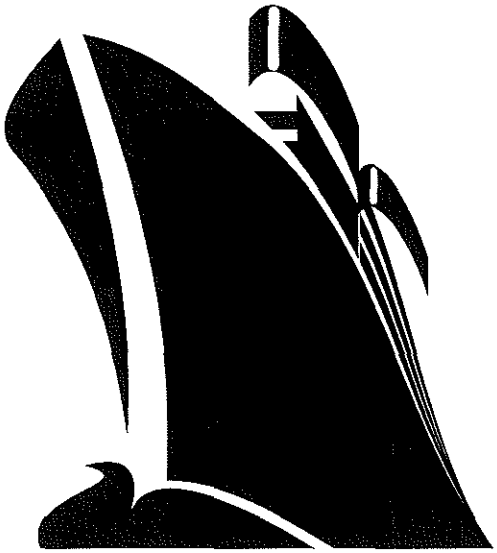
A. J. MARMO
Acting Chief, Auxiliary, Boating,
and Consumer Affairs Division
By direction of the Commandant

SMALL BOATERS -- BE WARY

In recent years the number of large commercial vessels serving the Port of Baltimore and the number of small boats sailing on the Chesapeake Bay have both increased. Every day, large ships bearing tons of cargo pass through the major shipping channel that runs the length of the bay.

Small boats should be aware of the constraints under which large commercial ships operate.

Rule 9 of the "Rules of the Road" specifically states that small craft "shall not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway." Unlike most small boats, large vessels must often keep to a narrow channel. Operators of small craft should avoid ship channels where possible. When unavoidable, these channels should be crossed quickly at right angles.



Speed

On open waters, large ships may travel faster than the usual "maneuvering speed" of 10 to 13 knots. In poor visibility or in congested areas, ships often travel faster than you would expect. In low visibility, ships navigate by radar. However, small boat operators must not assume they will always be detected.

Lightly loaded ships or loaded vessels that are unevenly trimmed must keep up a fair speed to stay under control when in a channel. If they slow down too much or stop, they risk being driven aground by wind, tide or current.

It doesn't take a whole lot of time for a large ship to reach you. At 10 knots, a ship goes one nautical mile in six minutes. At 15 knots, this takes four minutes. Large, difficult to maneuver ships cannot always successfully avoid small craft in narrow channels, so it's up to the smaller boats to stay clear of these vessels.

A ship that is slowing down does not steer very well. It needs the propeller action on the rudder to respond. A pilot may sometimes choose to turn instead of slowing down to serve a particular situation.

Once a ship's engines are put "full astern," there is nothing more one can do to slow a ship. Reversing action will in most cases swing the bow to starboard, therefore, if small boats have a choice, they should try to maneuver to the port side of the larger vessel to avoid a collision. It should be kept in mind that it takes four to six minutes and 2,000 to 4,000 feet for a large ship to stop after its engines are reversed.

Vigilance

Small commercial vessels that operate on waterways should also be watched carefully. Tugs pushing barges, especially at night when the barges may be poorly lit, have to be looked out for. A partially submerged towing cable can cut a boat in two. Commercial fishing vessels, though more maneuverable, may pose a problem when hauling in large nets which can be deceptively long. Learn to recognize the mast lights of a tug towing one or more barges, and of commercial fishing vessels towing nets.

Keep a constant lookout, especially astern.

The safe sailor has a roving eye on the water. He or she uses binoculars, which can help determine ships' lights and directions with greater accuracy, especially at night.

Small boaters should keep out of the way of large ships. This doesn't mean that open waters "belong" to the big ships. What it does mean is that big ships must stay in deep channels, whereas small boats don't have to. Therefore, sailing or traveling in ship channels should be avoided whenever possible, especially in fog, rain or darkness.

Always maintain a watch, especially at night.

Even on a clear night, you will have difficulty

seeing a big ship approach. You might see it first as a black shadow against a background of shore light, or as a shadow moving rapidly across still water. At that point, you are not far apart.

Remember that your lights will not be easily spotted from a larger ship. Focus attention on the ship's light. To determine whether you are in the path of a ship, note the vessel's sidelights, as well as the masthead lights. If you see only one sidelight, or if one is much brighter than the other, you can be fairly sure you are not in the direct path of the ship. This also lets you know which way to move in order to get clear altogether. If you see both sidelights, you're dead ahead - MOVE OUT FAST.

Visibility

Don't underestimate the speed of a large ship. A slow boat might not be able to take effective evasive action on a collision course with a large ship. In visibility of a quarter of a mile or less, the speed differential is simply too great.

At night, make sure that your navigation lights are bright, and not obscured by sails, flags or dinghies in davits. If you see the running lights of a ship, and you're not sure whether you've been spotted, begin to get out of the way immediately. Use flashlights on sails, a spotlight, flash bulbs or a white flare to indicate your position. (Strobe lights should be reserved for distress.) Carry a radar reflector as high on the boat as you can — a must in restricted visibility.

Whistle Signals

Know whistle signals and use them only when vessels are in sight of one another. The master or pilot of a large ship will frequently not use the port or starboard whistle signals when passing small boats, lest the signals be misunderstood and cause the smaller vessel to change course erratically.

Five or more short blasts on a whistle is a danger signal. If you should hear this, check right away and see if it is for you. If so, make way fast.

Radios

Use your radio. If you have a VHF radio aboard, remember that channel 16 is the calling and distress frequency, and channel 13 is the working frequency used to arrange safe meeting and passing between ships and other watercraft. Use channel 13 for bridge-to-bridge communication and monitor channel 16.

- **Be alert - maintain watch at all times.**
- **Don't take the helm if you have been drinking.**
- **Be seen, especially at night.**
- **Carry a radar reflector.**
- **Know whistle signals.**
- **Use binoculars.**
- **Use your radio.**
- **Observe all speed limits.**

Anchorages and Piers

Choose safe anchorages. Each year commercial ships and fishing vessels ram and sink a few boats anchored in navigation channels or tied to marker buoys. Coast Guard buoys tell ships, "here is where you must pass." It is illegal, as well as unsafe, to tie up to them.

When navigating small craft in harbors, be particularly cautious around piers. Ships may be maneuvering in the vicinity. Sudden propeller wash or wakes generated by large ships can be extremely dangerous to small boats.

Don't pass close to ships leaving piers. You don't know what is on the other side of them, and their turbulence can cause you problems.

Remember harbor speed limits — you are responsible for your own wake.

Conclusion

Whether you are a small boat operator or the master of a large container ship, it is wise to visualize any possible situation which can result when vessels of all shapes and sizes compete for the same space. Plan for it well ahead of time.

Keep in mind that few people survive collisions with ships.

Always keep clear.

Editor's Note: The previous article by Mr. Thomas J. Pettin originally appeared in the March/April 1992 issue of *Proceedings of the Marine Safety Council* .

U.S. Department of Transportation

United States Coast Guard

JUNE 1993

Boating Safety Circular 75

What navigation lights must the operator of a 19-foot powerboat display on inland waters at night?

What navigation lights must the operator of a 40-foot cabin cruiser display on international waters during periods of reduced visibility, such as in fog or heavy rain?

What navigation lights must the operator of a 36-foot sailboat display in international waters at night when underway under both a mainsail and an auxiliary engine?

What type of vessel may carry two all-round lights in a vertical line at the top of the mast, the upper one red and the lower one green, in addition to sidelights and a sternlight?

We'd be surprised if many of our readers knew all the correct answers and didn't have to consult a copy of the Navigation Rules or some other source of boating safety information. There are many boat operators who, for various reasons, choose to ignore the significance of navigation lights to maritime safety. Our examinations at the boat shows also indicate that there are builders of boats who do not make things any easier for those who go boating at night and have to be able to determine whether they are the "Stand-on" or the "Give-way" vessel in crossing or passing situations.

We are therefore beginning this issue with an article about the Rules as they apply to navigation lights required for vessels less than 20 meters* (65.6 feet) in length. Included are discussions of the various operator or manufacturer noncompliances we have observed, and a review of articles covered in previous issues of the **Boating Safety Circular**.

* Those sections in the Navigation Rules involving larger vessels, vessels being pushed or towed, fishing vessels, etc. are marked with an asterisk and were omitted from this article for the sake of brevity.

Federal law requires the display of navigation lights on all vessels operating between sunset and sunrise or during periods of reduced visibility. Under ordinary conditions they tell boat operators something about each other's size, speed, course, kind of boat (sail, power, etc.) and mode of operation. Navigation lights also enable vessel operators to properly apply the Navigation Rules.

Although it is the boat operator's responsibility to carry and use navigation lights, most manufacturers choose to install them or offer them as optional equipment. However, during factory and boat show inspections Coast Guard standards personnel frequently observe that many manufacturers of recreational boats do not have a good understanding of the Rules governing proper installation of navigation lights. Some manufacturers are installing navigation lights which do not meet the requirements of the International or the Inland Rules.

Boat buyers and boat owners assume that the equipment installed on their boats at the time of purchase complies with all legal requirements. Deficient, shoddy and improperly installed equipment seriously endangers their lives as well as the lives of others who operate their boats at night.

In order to reduce the dangers to which the members of the boating public are exposed, under Coast Guard Recreational Boating Standards policy, both the boat manufacturer and the dealer are responsible

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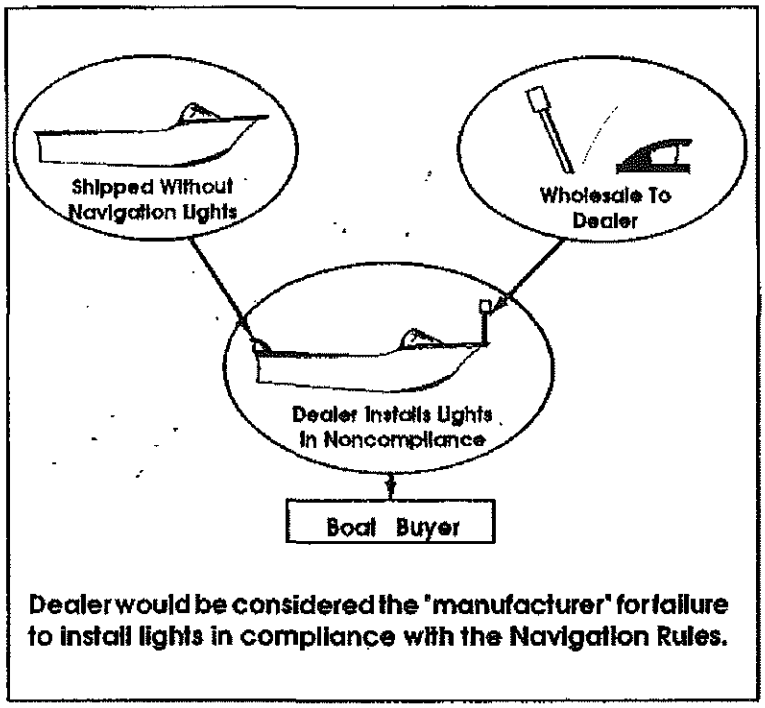
for the adequacy of navigation lights that the manufacturer installs at the factory or the dealer installs. Any manufacturer or dealer who installs navigation lights prior to offering a boat for sale must:

(a) Install lights that satisfy the requirements of the International Rules; or

(b) Install lights that satisfy the Federal requirements of the Inland Rules; or

(c) Be able to prove that failure to install lights in a legal configuration was the result of a specific order to the contrary from the buyer.

Under this policy, boats that are manufactured with installed navigation lights that do not meet either Federal or international requirements, contain a defect that creates a substantial risk of personal injury to the public. Thus, such boats are subject to the defect notification requirements in 46 U.S.C. 4310. This policy is in the best interests of both the boat manufacturers, dealers and the boating public.



Dealer would be considered the "manufacturer" for failure to install lights in compliance with the Navigation Rules.

THE NAVIGATION RULES

The International Regulations for Preventing Collisions at Sea (72 COLREGS) became effective on July 15, 1977. The 72 COLREGS apply to all vessels upon the high seas and in all connecting waters navigable by seagoing vessels. They are published as regulations in Appendix A to Part 81 of Title 33 of the Code of Federal Regulations.

The Inland Navigation Rules were enacted by law on December 24, 1980, and became effective for all inland waters except the Great Lakes on December 24, 1981. The Inland Rules became effective on the Great Lakes on March 1, 1983. Rules 1 through 38 apply to all vessels used upon the inland waters of the United States, and to vessels of the United States on the Canadian waters of the Great Lakes, to the extent that there is no conflict with Canadian law. Three Annexes to the Rules which cover navigation lights were published as regulations in Parts 81, 84 and 89 of Title 33 of the Code of Federal Regulations.

A vessel operating on the waters of the United States may carry the lights prescribed by the International Rules (72 COLREGS) or the Inland Rules. It is important to note that with the exception of Annex V to the Inland Rules (Pilot Rules), the International and Inland Rules and Annexes are very similar in both content and format.

The Coast Guard publishes a manual, "Navigation Rules, International - Inland" (COMDTINST M16672.2B) which contains both the International and the Inland Rules. The manual contains requirements for navigation lights, shapes, sound signals, and maneuvering rules that must be followed by U.S. vessels navigating the high seas and U.S. inland waters.

A copy of the Navigation Rules must be carried on vessels (both commercial and recreational) 12 meters (39.4') or more in length.

See Changes to the Rules on Page 31.

See order form on Page 35

THE NAVIGATION RULES - INTERNATIONAL

RULE 1 - Application

(a) These Rules shall apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.
(b) Nothing in these Rules shall interfere with the operation of special rules made by an appropriate authority for roadsteads, harbors, rivers, lakes or inland waterways connected with the high seas and navigable by seagoing vessels. Such special rules shall conform as closely as possible to these Rules.
*(c) **

THE NAVIGATION RULES - INLAND

RULE 1 - Application

(a) These Rules apply to all vessels upon the inland waters of the United States, and to vessels of the United States on the Canadian waters of the Great Lakes to the extent that there is no conflict with Canadian law.
(b)(i) These Rules constitute special rules made by an appropriate authority within the meaning of Rule 1(b) of the International Regulations.
(b)(ii) All vessels complying with the construction and equipment requirements of the International Regulations are considered to be in compliance with these Rules.
*(c) **

Since a vessel complying with the International Rules is considered to be in compliance with the Inland Rules, the remaining references in the italic type face in the material in the this article, are taken from the International Rules.

THE NAVIGATION RULES

RULE 20-Application:

(a) Rules in this Part shall be complied with in all weathers.
(b) The Rules concerning lights shall be complied with from sunset to sunrise, and during such times no other lights shall be exhibited, except such lights as cannot be mistaken for the lights specified in these Rules or do not impair their visibility or distinctive character, or interfere with the keeping of a proper look-out.
(c) The lights prescribed by these Rules shall, if carried, also be exhibited from sunrise to sunset in restricted visibility and may be exhibited in all other circumstances when it is deemed necessary.
(d) The Rules concerning shapes shall be complied with by day.

The excerpts of the Navigation Rules as they relate to navigation lights for various size vessels are stated in metric terms, i.e. meters vs. feet. The following conversion table may be helpful in understanding the Rules:

Metric Measure	U.S. Measure
20 meters	65.6 ft
12 meters	39.4 ft
7 meters	23.0 ft

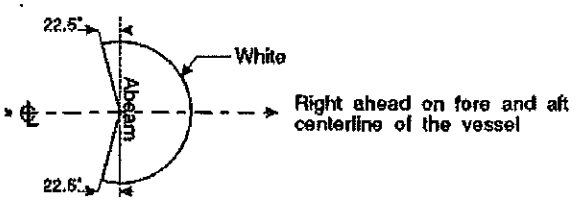
(e) The lights and shapes specified in these Rules shall comply with the provisions of Annex I to these Regulations.

THE NAVIGATION RULES

RULE 21 - Definitions:

(a) "Masthead light" means a white light placed over the fore and aft centerline of the vessel showing an unbroken light over an arc of the horizon of 225 degrees and so affixed as to show the light from right ahead to 22.5 degrees abaft the beam on either side of the vessel.

MASTHEAD LIGHT



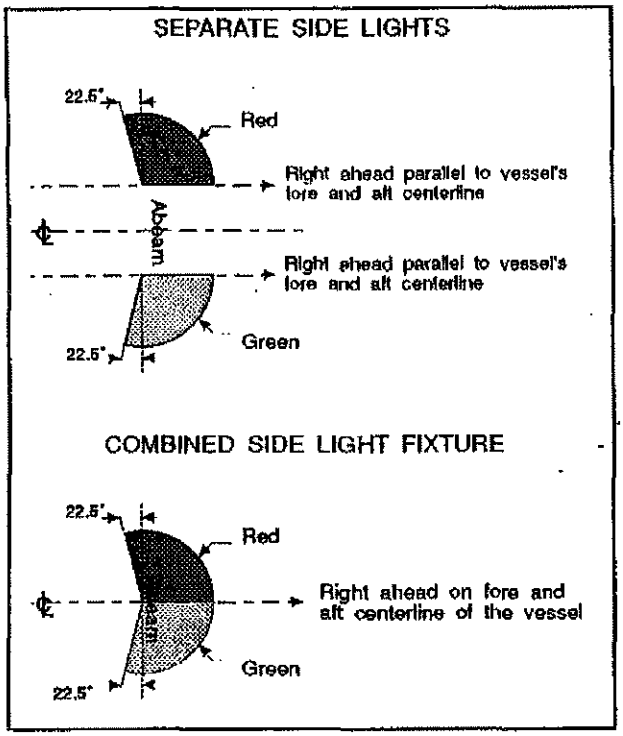
Note: Under the Inland Rules, on a vessel of less than 12 meters in length, the masthead light shall be placed "as nearly as practicable to the fore and aft centerline of the vessel."

THE NAVIGATION RULES

RULE 21 - Definitions:

(b) "Sidelights" means a green light on the starboard side and a red light on the port side each showing an unbroken light over an arc of the horizon of 112.5 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on its respective side. In a vessel of less than 20 meters in length, the sidelights may be combined in one lantern carried on the fore and aft centerline of the vessel.

Note: Same for the Inland Rules, except that on a vessel of less than 12 meters in length, the sidelights when combined in one lantern, shall be placed as nearly as practicable to the fore and aft centerline of the vessel.

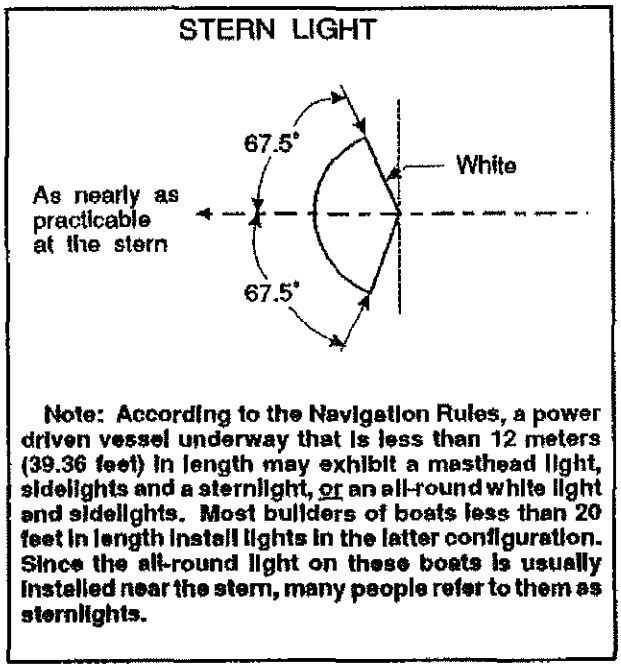


THE NAVIGATION RULES

RULE 21 - Definitions:

(c) "Sternlight" means a white light placed as nearly as practicable at the stern showing an unbroken light over an arc of the horizon of 135 degrees and so fixed as to show the light 67.5 degrees from right aft on each side of the vessel.

(d) "Towing light" means a yellow light having the same characteristics as the "sternlight" defined in paragraph (c) of this Rule.

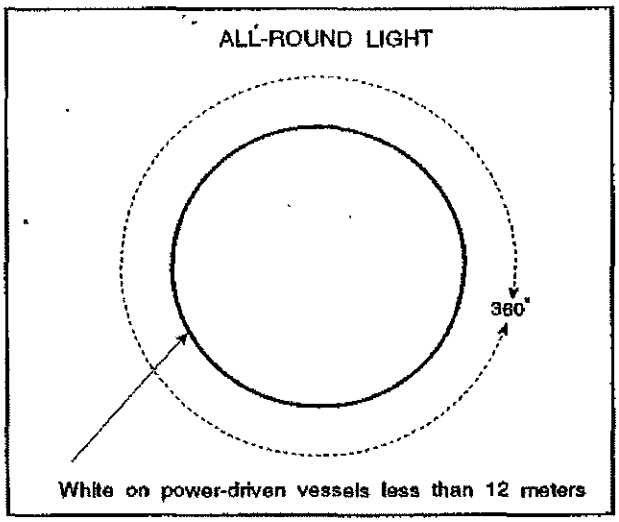


Note: According to the Navigation Rules, a power driven vessel underway that is less than 12 meters (39.36 feet) in length may exhibit a masthead light, sidelights and a sternlight, or an all-round white light and sidelights. Most builders of boats less than 20 feet in length install lights in the latter configuration. Since the all-round light on these boats is usually installed near the stern, many people refer to them as sternlights.

THE NAVIGATION RULES

RULE 21 - Definitions:

(e) "All-round light" means a light showing an unbroken light over an arc of the horizon of 360 degrees."

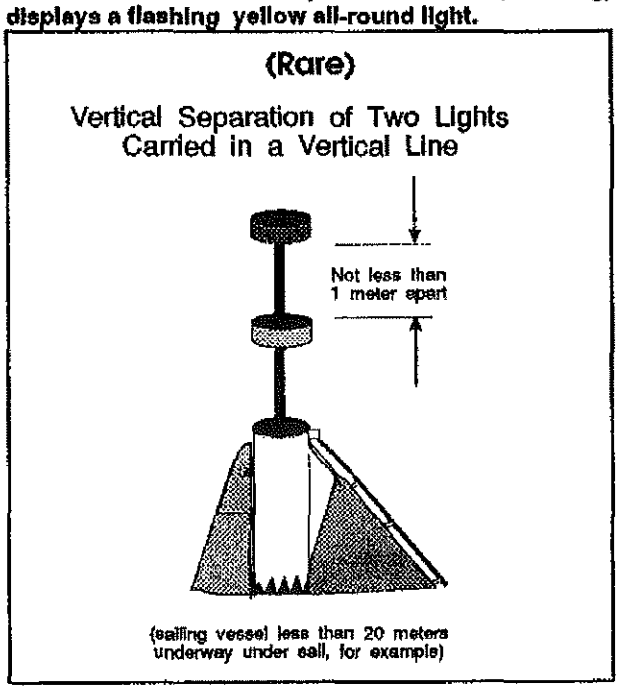


Notes:

The Rules allow for a maximum of six degrees of blockage by masts, topmasts or structures.

A sailing vessel less than 20 meters in length underway under sail may display a red and a green all-round light carried in a vertical line (Rule 25(c)). Such displays are rare because of the additional power drain and the required minimum one meter separation above the uppermost sail.

A hovercraft in the non-displacement mode (hovering) displays a flashing yellow all-round light.



THE NAVIGATION RULES

RULE 22 - Visibility of Lights

The lights prescribed in these Rules shall have an intensity as specified in Section 8 of Annex I to these Regulations so as to be visible at the following minimum ranges:
*(a) * [applies to a vessel 50 meters or more in length]*
(b) In vessels of 12 meters or more in length, but less than 50 meters in length:
a masthead light, 5 miles; except that where the length of the vessel is less than 20 meters, 3 miles
a sidelight, 2 miles;
a sternlight, 2 miles;
a towing light, 2 miles;
a white, red, green or yellow all-round light, 2 miles
(c) In vessels of less than 12 meters in length:
a masthead light, 2 miles;
a sidelight, 1 mile;
a sternlight, 2 miles;
a towing light, 2 miles;
a white, red, green or yellow all-round light, 2 miles
(d) In inconspicuous, partly submerged vessels or objects being towed:
a white all-round light, 3 miles.

THE BIGGER THE BETTER

During a recent trip to a powerboat show we were surprised by the minimal size navigation light fixtures many manufacturers are using, particularly on large, high performance boats capable of speeds well in excess of 40 miles per hour. Several of the high performance boats were equipped with the same minimum size combination sidelight fixtures as were used on much smaller, non-planing boats.

On a dark night with a clear atmosphere navigation lights tell boat operators something about each other's size, speed, relative course and kind of boat. More importantly, using their knowledge of navigation light displays, other vessel operators can properly apply the Rules of the Road. The Navigation Rules do not specify standards governing visibility based upon sizes of navigation light fixtures. Rather, visibility is expressed in terms of luminous intensity, i.e., range of visibility in nautical miles.

A power driven vessel less than 12 meters in length may display:

(a) A white masthead light visible two nautical miles, separate or combined sidelights visible one nautical mile, and a white sternlight visible 2 nautical miles; or

(b) A white all-round light visible two nautical miles and separate or combined sidelights visible one nautical mile.

In many situations which require vessel operators to properly apply the Rules of the Road, navigation lights compete with the lights on other vessels, and with shore lights which have much greater ranges of visibility. A boat moving at 60 miles per hour is covering a mile in one minute. If the brightest navigation light such a boat displays is visible for as little as two nautical miles, there will be many situations where boat operators have less than two minutes to determine the size and speed of an approaching vessel and to take whatever steps might be necessary to avoid a collision. Allowable reaction time would be even shorter in confined waterways, heavy traffic, poor visibility and confusing shore lights. Instant maneuvering decisions must be made in these situations, and navigation lights must indicate relative course and vessel type at a glance.

We remind all boat manufacturers about the increasing numbers of high speed boats in use on our nation's waters. We urge all boat builders, particularly any builder of a boat that is faster than 40 miles per hour, to use at least the next higher minimum luminous intensity when selecting navigation light fixtures. We urge any owners replacing navigation lights, particularly those in congested areas and waters frequented by operators of high performance boats, to use larger and brighter navigation lights.

The main reasons why boat manufacturers use only the minimum size navigation light fixtures are probably because of esthetics or to reduce glare. Some manufacturers have begun offering retractable cleats. No violation exists between sunrise and sunset if a vessel has no lights or does not exhibit them. We believe it is also possible to design retractable navigation light fixtures. A large retractable fixture would be invisible during the day and could be fitted with screens that prevent glare when a vessel is operated at night.

As the average speeds at which recreational boats are operated increases, there's no question. When selecting navigation lights, the bigger -- the better.

VESSELS UNDER POWER

THE NAVIGATION RULES

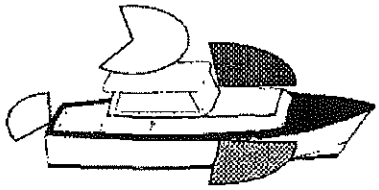
RULE 23 - Power-driven Vessels Underway

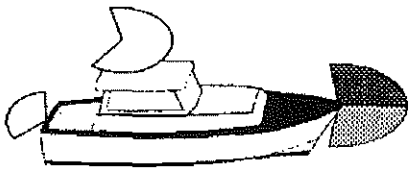
(a) A power-driven vessel underway shall exhibit:
(i) a masthead light forward;
(ii) a second masthead light abaft of and higher than the forward one; except that a vessel of less than 50 meters in length shall not be obliged to exhibit such light but may do so;
(iii) sidelights;
(iv) a sternlight.
(b) An air cushion vessel when operating in the non-displacement mode [i.e., hovering] *shall, in addition to the lights prescribed in paragraph (a) of this Rule, exhibit an all-round flashing yellow light.*
(c)(i) A power-driven vessel of less than 12 meters in length may in lieu of the lights prescribed in paragraph (a) of this Rule exhibit an all-round white light and sidelights;

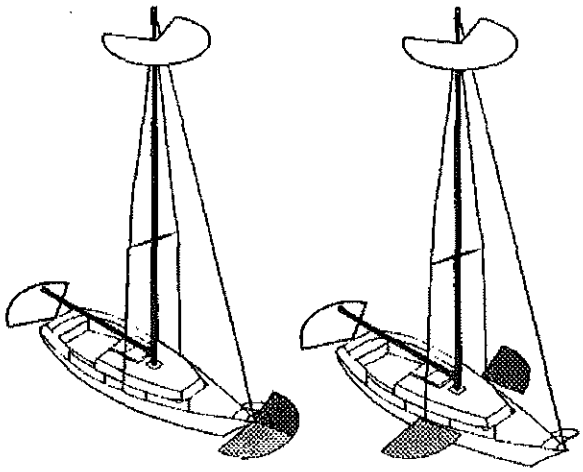
Vessels Less Than 20 Meters in Length Underway Under Power[1]

[1] Note: A sailing vessel underway under both sail and under power is considered a powered vessel.

Inland or International





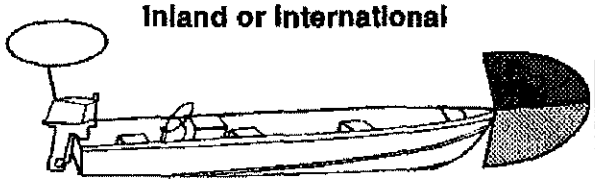


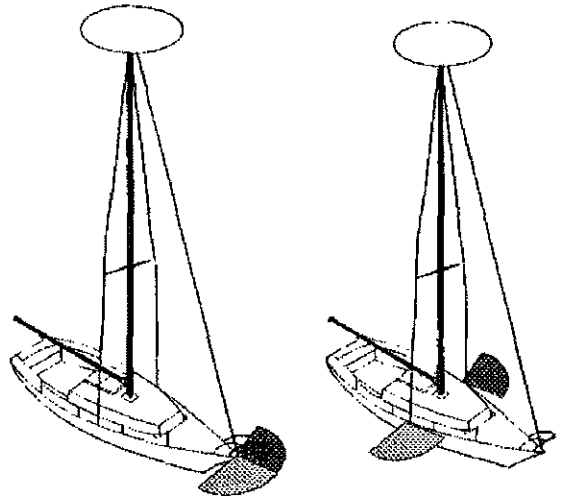
Sailboat under power

Vessels Less Than 12 Meters in Length Underway Under Power[1]

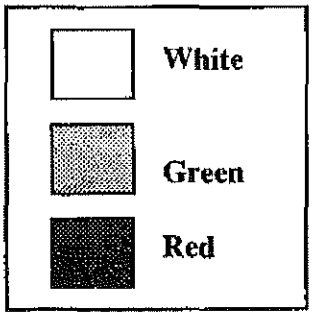
[1] Note: Powered vessels less than 12 meters in length may display any of the arrays illustrated on this page.

Inland or International

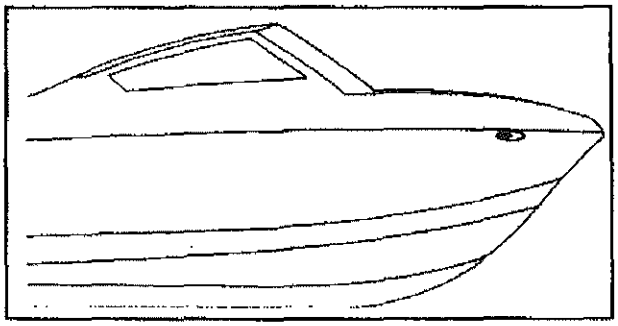


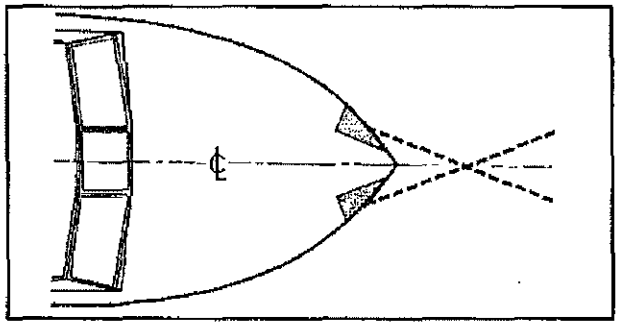


Sailboat under power



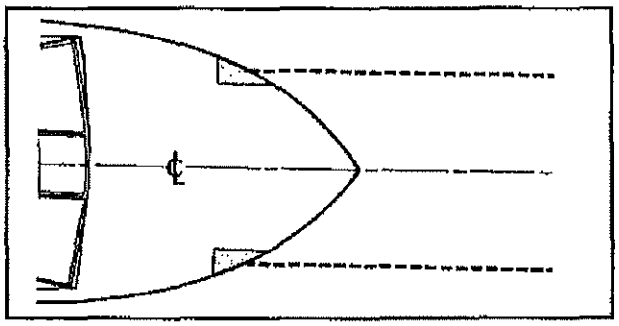
VESSELS UNDER POWER - PROBLEMS IN THE FIELD





Sidelights: One navigation light installation error which Coast Guard inspectors frequently find is the installation of flush mounted sidelights in the forward part of the hull of a boat, usually below the rub rail. As a result, the lights are installed "cross-eyed" and the operator of an approaching vessel may be confused about the relative direction in which these boats are travelling causing maneuvering errors.

Positioning: Sidelight fixtures must be installed parallel with the fore and aft centerline of the vessel and arranged to show an unbroken light from right ahead to 22.5 degrees abaft the beam, a total sector arc of 112.5 degrees. Sidelights that are installed in the contour of the bow without providing a mounting surface tooled to be parallel with the fore and aft centerline of the vessel are not in compliance with the Inland or International Navi-



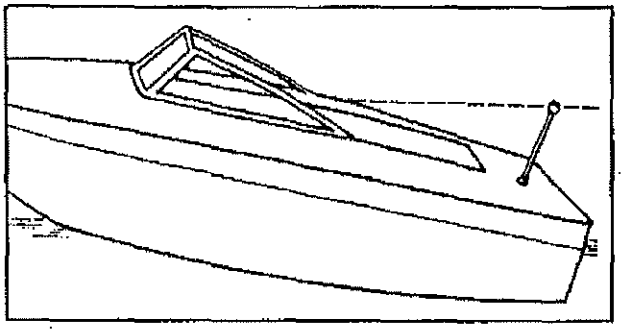
gation Rules. Depending on the breadth of the vessel near the bow and how far aft from the vessel's stem the lights are mounted, this shift can be more than 20 degrees in some cases. Either fit wedge-shaped blocks between the fixture and the hull so as to make them parallel to the centerline of the vessel, or move the fixtures further aft where the curvature of the hull isn't so pronounced. However, installing the fixtures too far aft of the vessel's stem may result in the sidelights not being visible from a position dead ahead. Also, most of these flush mounted sidelights are installed below the vessel's rub rail. International Navigation Rules require that sidelights be installed above the uppermost continuous deck. Therefore this configuration is not in compliance with International Navigation Rules.

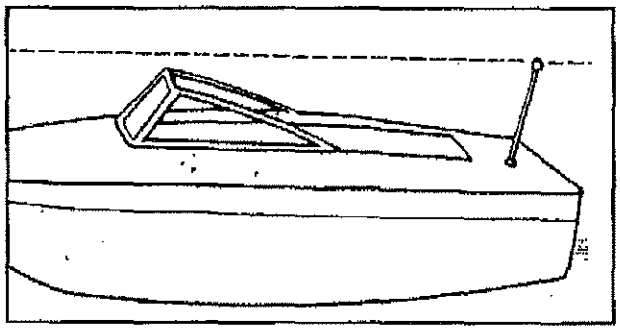
Intensity: Another factor in proper installation of sidelights on a power-driven vessel is that they must maintain their required minimum intensity in a vertical sector from 5 degrees above to 5 degrees below the horizontal. They must also maintain at least 60 percent of their minimum required intensity from 7.5 degrees above to 7.5 degrees below the horizontal. For vessels under sail, sidelights must maintain their required minimum intensity in a vertical sector from 5 degrees above to 5 degrees below the horizontal and at least 50 percent of their minimum required intensity from 25 degrees above to 25 degrees below the horizontal to allow for heel. Installing flush mounted sidelights, designed to be mounted to a vertical surface in the hull contour, without providing a mounting surface tooled to be vertical, shifts the vertical coverage sector. This also results in a noncompliance with the Navigation Rules.

The illustrations show examples of this type of installation. Many manufacturers use similar sidelight installations. This is a dangerous trend which is likely to end up costing somebody a pile of money when a plaintiff's attorneys go after everyone who might be liable for a serious collision.

Visibility of sternlight: Some owners install davits on the stern of their boats to allow them to raise and carry a dinghy. Others rest the dinghy on its side on a swim platform. While these owners no longer have to tow the dinghy, many such installations fail to account for the fact that when the dinghy is aboard, it blocks visibility of the sternlight by an overtaking vessel.

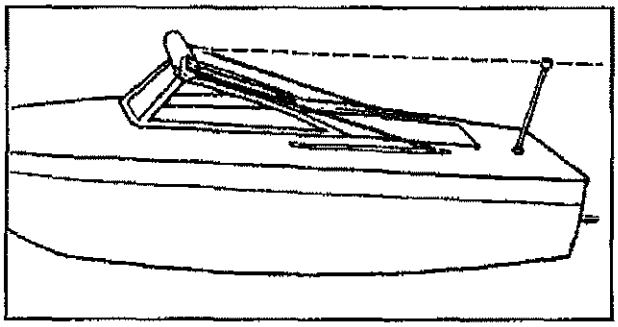
VESSELS UNDER POWER - PROBLEMS IN THE FIELD





All-round lights: A boat's all-round (32 point, 360 degree) white running light is the most important of a small boat's navigation lights because it can be seen from any direction. The most common problem associated with this light is that it is frequently mounted on a staff that is too short. As a result, the light is obscured when the vessel is underway because of the tendency of the bow to rise when the boat is moving, or the light is obscured by canvas tops or other equipment owners add after purchasing a boat.

The most common type of all-round white light fixture features a telescopic staff attached near the stern of the boat. During the day the boat operator can lower the light fixture to where it is flush with the deck or gunwale and out of the way. The telescopic staff is a practical feature for the boat operator who wants the light fixture out of the way while trolling, docking or performing other

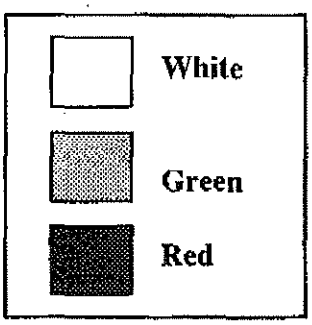


maneuvers. At dusk the boat operator loosens a threaded sleeve, pulls up the rod and tightens the sleeve again. Unfortunately, the actual height to which the staff can be extended is usually dictated by the distance from the top of the gunwale to the deck beneath it.

If the all-round light is obscured from any direction, while at rest or underway, or by any part of the boat structure or its equipment, owners are urged to buy a longer staff, even if it will require the use of a removable staff, rather than one which telescopes. Owners are also urged to remember to fully extend the staff when turning on their boats' running lights.

Combination masthead light and anchor light: Some navigation light fixtures consist of a combination masthead light and anchor light. The fixture can be carried on any vessel less than 50 meters in length. When underway, the masthead light sector (225°) in the fixture is switched on and displayed with sidelights and a sternlight (135°) in a separate fixture. When at anchor, the 135 degree aft sector of the combination masthead light and anchor light is switched on creating an anchor light and the sidelights and sternlight are turned off. The combination masthead light and anchor light is being improperly used because both sectors are being turned on in addition to a sternlight when the vessel is underway. Consequently, two white lights are seen when the vessel is viewed from astern, instead of the single required sternlight.

Combination sidelight fixtures on bass boats: Many bass boats are equipped with a combination sidelight fixture mounted on the stem. Dealers and owners who later add electric trolling motors must make sure the combination sidelight fixture is still visible.



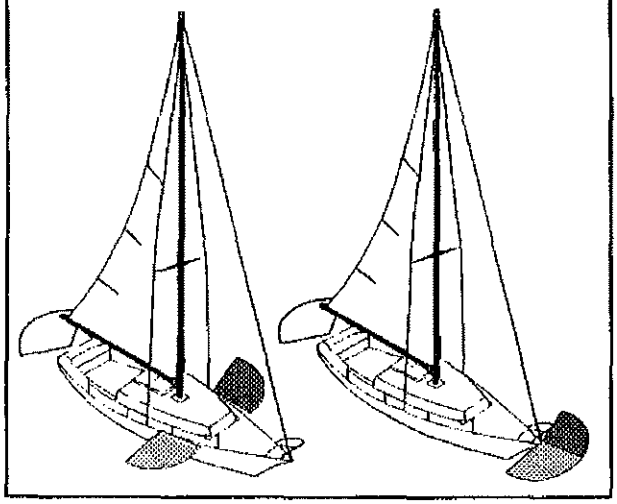
VESSELS UNDER SAIL

THE NAVIGATION RULES

RULE 25 - Sailing Vessels Underway and Vessels Under Oars

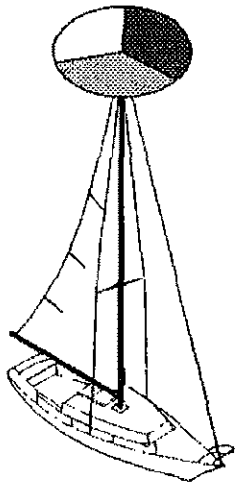
(a) A sailing vessel underway shall exhibit:
(i) sidelights;
(ii) a sternlight
(b) In a sailing vessel of less than 20 meters in length the lights prescribed in paragraph (a) of this Rule may be combined in one lantern carried at or near the top of the mast where it can best be seen.
(c) A sailing vessel underway may, in addition to the lights prescribed in paragraph (a) of this Rule, exhibit at or near the top of the mast, where they can best be seen, two all-round lights in a vertical line, the upper being red and the lower green, but these lights shall not be exhibited in conjunction with the combined lantern permitted by paragraph (b) of this Rule.
(d)(i) A sailing vessel of less than 7 meters in length shall, if practicable, exhibit the lights prescribed in paragraph (a) or (b) of this Rule, but if she does not, she shall have ready at hand an electric torch or lighted lantern showing a white light which shall be exhibited in sufficient time to prevent collision.

Sailing Vessels Less Than 20 Meters In Length Underway Under Sail Inland or International

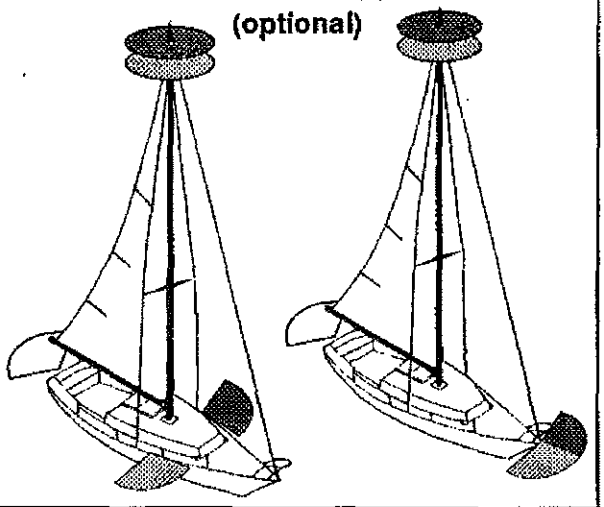


Tricolor light vs. sidelights and stern light: Because the tricolor light allowed on sailing vessels less than 20 meters under sail is displayed higher than sidelights and a sternlight, it is more visible from long distances. Thus the tricolor light is recommended for offshore sailors because large vessels can see it better. Although their lower display makes sidelights and a sternlight less visible, they give other vessel operators a better perception of vessel size and relative distance in crowded waterways.

Sailing Vessels Less Than 20 Meters In Length Underway Under Sail Inland or International

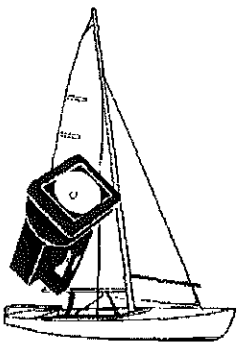


Sailing Vessels Less Than 20 Meters In Length Underway Under Sail Inland or International (optional)



Sailing Vessels Less Than 7 Meters In Length

Note: The operator of a sailing vessel less than 7 meters in length should shine the light on the vessel's sails when an approaching vessel is sighted.



U.S. Department
of Transportation
**United States
Coast Guard**

JUNE 1994

Boating Safety Circular 76

PREVENTING PROPELLER AND BOAT STRIKE ACCIDENTS

There are nearly 12 million registered boats in the United States, 95 percent of which are less than 26 feet in length. These same boats account for as many as 80 percent of the underwater impact injuries in which people in the water are struck by a boat or its propeller. The majority of these accidents are the result of operator error, making them one of the most preventable of all types of boating accidents. While boat or propeller strike accidents are relatively few in number, as compared to other types of boating accidents, some of them are severe and have tragic consequences . . .

Operator inexperience, incompetence, negligence and intoxication are significant contributing factors in reported boat and propeller strikes, as well as in all other types of boating accidents. In almost all cases, the victim is in the water -- a swimmer, scuba diver, fallen water skier or the operator or a passenger.

Passengers moving about a boat, or who are improperly seated on the bow, a gunwale or a seatback, are ejected from the boat or fall overboard when boat operators are wake jumping, are in sharp turns, or are performing other maneuvers at speeds which are dangerously fast for prevailing conditions. Some victims are ejected from boats by collisions with another boat or a submerged or fixed object. Ejections from a boat are also caused by sudden acceleration or deceleration. While some victims have been struck by the propeller when a boat was airborne, such as when one vessel collides with and passes over another, such incidents are rare.

Negligent or Grossly Negligent Operation of a Vessel which endangers lives and/or property is prohibited by law. The Coast Guard may impose a civil penalty for negligent operation; violations involving boating while intoxicated could result in criminal penalties. State and Federal marine law enforcement officers are trained to define negligent operation as failure to exercise that degree of care which a reasonable person under like circumstances would demonstrate in order to prevent the endangering of life, limb or property of any person. Grossly negligent operation involves situations in which the boat operator knows a certain act can create an unreasonable risk of harm. Some examples of actions that may constitute negligent or grossly negligent boat operation are:

- Operating a boat in a swimming area;
- Operating a boat while under the influence of alcohol or drugs;
- Excessive speed in the vicinity of other boats or in dangerous waters;
- Hazardous water skiing practices; or
- Bowriding or riding on the seatback, gunwale or transom.

Most boat or propeller impact accidents can be prevented by boat operators who follow basic safe boating practices:

- Always maintain a proper lookout. The greatest single cause of accidents in which people in the water are struck by a boat or its propeller is operator inattention or carelessness.

- Make sure the engine is off so the propeller is not rotating when passengers are boarding or disembarking a boat.

- Never start a boat with the engine in gear.

Inside:
Natural Ventilation Openings and Ducts 2

• Slow down when approaching congested areas and anchorages. In congested areas, always be alert for swimmers and divers.

• Become familiar with the warning buoys signifying swimming areas and other hazardous areas.

• Keep the boat well clear of marked swimming and diving areas. Become familar with the red and white or blue and white diagonally striped flags signalling that divers are down.

• Before getting underway, make sure passengers are properly seated. Some operators of larger boats with several passengers have started their boats and put the engine in gear while their friends were still swimming or diving from the boat.

• Never ride on a seatback, a gunwale, the transom or on the bow.

• When someone falls overboard:

(1) turn the bow of the boat towards the person in the water. For example, if a person falls overboard on the starboard (right) side, turn the boat to starboard so as to move the propeller away from the person in the water.
(2) Slow down.
(3) Circle around, keeping the individual in sight.
(4) Take the engine out of gear or turn off the engine at least a boat length from the victim.
(5) Throw the individual a line or something which floats with a line attached to it and pull the person to the boat.

• When water skiing, designate a passenger who will keep the skier(s) in sight at all times. Communicate with a skier using standard water skiing hand signals.

The best approach to preventing boat and propeller strikes is to educate boaters, especially boat operators. They must learn the abilities and limitations of their equipment. They must learn and understand the hazards their boats can cause to people in the water. Above all, they must understand the consequences of careless or negligent operation, and how they, as boat operators, can act to prevent accidents.

OPENINGS AND DUCTS IN NATURAL VENTILATION SYSTEMS

According to a letter from the Commanding Officer, U.S. Coast Guard Martine Safety Office Puget Sound:

"Over the past year or two several boat builders in this District have begun to build larger boats. These larger boats naturally have larger engine compartments. I have noted that on some of these boats the builder continues to use the same size and number of ventilation ducts for the larger compartments (i.e., one three inch exhaust and intake duct for a 100 cubic foot net compartment volume).
I don't believe builders are purposely thwarting the regulations in order to save a few dollars; they just don't realize that with increased engine compartment volume they need to increase the ventilation capacity."

According to Sections 183.630(d) and (e) of the Ventilation System Standard:

"(d) Except as provided in paragraph (e) of this section, supply openings or supply ducts and exhaust openings and exhaust ducts must each have a minimum aggregate internal cross-sectional area calculated as follows:

A= 5 ln (V/5)

Where:
(1) **A** is the minimum aggregate internal cross-sectional area of the openings or ducts in square inches;
(2) **V** is the net compartment volume in cubic feet, including the net volume of other compartments connected by openings that exceed 2 percent of the area between the compartments; and
(3) **ln** is the natural logarithm of the quantity (V/5).
(e) The minimum internal cross-sectional area of each supply opening or duct and each exhaust opening or duct must exceed 3.0 square inches."

For example, let's assume that we are trying to determine the minimum size openings and ducts which would be required for a 19-foot fiberglass inboard powered by a six cylinder, in-line engine. The engine compartment measures five feet by three feet by four feet. This means the total engine

compartment volume is 60 cubic feet.

Net compartment volume is determined by subtracting the volume of permanently installed items of equipment and accessories from the total compartment volume.

Examples of items which would probably be permanently installed in the engine compartment of a 19-foot inboard are:

- the engine
- the fuel tank
- the battery

Examples of items which would not be considered permanently installed are:

- stowed fenders
- coolers
- tool boxes
- other items that may or may not be in a compartment requiring ventilation at any given time.

For the sake of this example, let's assume the engine and the battery are the only permanently installed items of equipment installed in the engine room of the 19-foot inboard. The typical volume of a six cylinder, in-line engine is 3.5 cubic feet. The volume of a battery is .5 cubic feet.

60.0 ft^3	(engine compartment volume)
- 3.5 ft^3	(volume of 6 cyl engine)
56.50 ft^3	
-.50 ft^3	(volume of 1 battery)
56.00 ft^3	**net compartment volume**

Using the table at right, the 19-foot inboard would require supply ducts and openings with a minimum total cross-sectional area of 12.07 square inches. Any opening used to achieve the minimum 12.07 square inch total cross-sectional area cannot be smaller than three square inches.

The minimum total cross-sectional area of all the exhaust ducts and openings in our example is also a minimum of 12.07 square inches with a minimum of three square inches per opening.

Construction of a boat with a larger net compartment volume would require progressively larger supply openings and ducts and exhaust openings and ducts.

Net compartment volume in cu.ft. V	ln (V/5)	Aggregate internal cross-sectional area in sq. in. 5 ln(V/5)*
6	.1823	.91
7	.3365	1.68
8	.4700	2.35
9	.5878	2.93
10	.6931	3.46
11	.7885	3.94
12	.8755	4.37
13	.9555	4.77
14	1.0296	5.14
15	1.0986	5.49
16	1.1632	5.81
17	1.2238	6.11
18	1.2809	6.40
19	1.3350	6.67
20	1.3863	6.93
21	1.4351	7.17
22	1.4816	7.40
23	1.5261	7.63
24	1.5686	7.84
25	1.6094	8.04
26	1.6487	8.24
27	1.6864	8.43
28	1.7228	8.61
29	1.7579	8.78
30	1.7918	8.95
31	1.8245	9.12
32	1.8563	9.28
33	1.8871	9.43
34	1.9169	9.58
35	1.9459	9.72
36	1.9741	9.87
37	2.0015	10.00
38	2.0281	10.14
39	2.0541	10.27
40	2.0794	10.39
41	2.1041	10.52
42	2.1282	10.64
43	2.1518	10.75
44	2.1748	10.87
45	2.1972	10.98
46	2.2192	11.09
47	2.2407	11.20
48	2.2618	11.30
49	2.2824	11.41
50	2.3026	11.51
51	2.3223	11.61
52	2.3418	11.70
53	2.3608	11.80
54	2.3795	11.89
55	2.3978	11.98
56	**2.4159**	**12.07**
57	2.4336	12.16
58	2.4510	12.25
59	2.4680	12.34
60	2.4849	12.42

*The minimum internal cross-sectional area of each supply opening or duct and each exhaust opening or duct must exceed 3.0 square inches. The shaded area in the table indicates values of "A" which do not meet the minimum size requirements specified in 183.630(e).

HULL IDENTIFICATION NUMBERS AND SALES OF REPLACEMENT HULLS FOR PERSONAL WATERCRAFT

The largest number of vessels reported stolen annually are Personal Watercraft (PWC). In addition, both PWC manufacturers and independent aftermarket manufacturers routinely sell replacement hulls for PWC.

The sale of replacement PWC hulls without Hull Identification Number (HINs) represents a serious problem for State vessel registration, numbering and titling authorities and marine theft investigators, because thieves can "launder" the engine and other components from a stolen PWC. The sale of replacement PWC hulls with an HIN which differs from the HIN originally assigned to the vessel may also mislead retail purchasers about the age of a used PWC and might be considered evidence of fraud.

Because of these problems involving HINs and the sale of replacement hulls for personal watercraft, the Coast Guard urges manufacturers to require any purchaser seeking a replacement hull to:

(1) return the damaged hull to your company or the dealer for destruction and disposal; and
(2) affix the same HIN originally assigned to the PWC, preferably with OEM rivets and epoxy.

Both PWC manufacturers and manufacturers of aftermarket PWC hulls are reminded to be very careful to ensure that the methods used for affixing HINs to PWC hulls make the HINs difficult to remove, without leaving obvious evidence of tampering. If the HIN is on a separate label which is riveted to the hull, the label should also be bonded with epoxy or some other adhesive.

These procedures will ensure that PWC with replacement hulls are traceable through manufacturer warranty and State vessel registration and numbering systems, and makes it virtually impossible for a "damaged" PWC hull to be recycled as a usable vessel.

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U.S. Department of Transportation

United States Coast Guard

AUGUST 1996

Boating Safety Circular 78

LIFEJACKETS - THEY FLOAT, YOU DON'T

About 8:30 a.m. three men, ages 31, 37, and 38, left for a day of fishing on a lake aboard a 1988 18-foot, four inch bass boat. The weather was clear, the water was choppy (1.5 to 2 foot waves), the wind was seven to 14 miles per hour from the northwest, the air temperature was about 65 - 70 degrees Fahrenheit. A county employee who had been fishing on the lake at about 8:00 a.m. on the same day, reported whitecaps on the water and winds of 16 to 17 miles per hour.

About 10:30 a.m., two people also boating on the lake noticed the unoccupied open fiberglass bass boat circling at slow speed. The boat was retrieved and the identity of the owner was determined from State vessel registration records. No witnesses had seen the men in the boat after it got underway, or witnessed the accident.

Shortly thereafter, a Civil Air Patrol aerial search and a county sheriff department water search commenced and continued for four days, with no results. About 8:00 a.m. five days after the accident, a boater found the body of one victim. A water search located the two other victims about three and one-half hours later. None of the victims was wearing a Personal Flotation Device (PFD)[a Coast Guard approved lifejacket], and all were fully clothed. The autopsy did not indicate that alcohol or drugs were involved, nor was trauma indicated. All three men drowned.

A decal on the outboard engine cover read "150 HP," but the engine markings indicated a 200 horsepower outboard motor. The U.S. Coast Guard Maximum Capacities label, permanently attached to the port console, showed a rating for six persons or 810 pounds and a 175 horsepower motor. Fishing gear and five PFDs were found in seat lockers forward of the starboard console; one PFD had a cord with an engine kill switch clip attached to it.

According to a brother of one of the victims, who had been on the boat when it was being operated on a river about four weeks prior to the accident, the boat tended to wobble or rock from side to side, at a speed of 65 miles per hour. The boat builder's customer service manager stated that the boat was rated at 70 miles per hour with a 175 horsepower outboard motor.

"Contributing to the loss of life were the occupants' failure to wear Personal Flotation Devices (PFDs) . . . Had [they] worn PFDs, they might have survived."

The National Transportation Safety Board (NTSB) was unable to determine the probable cause of the accident; however, the NTSB stated that the accident was likely the result of: (a) the boat striking a wave while chine-walking, (b) a sudden turn by the operator at high speed, or (c) a sudden pitch or roll in response to striking a wave at high speed, or a combination of the three, throwing the occupants overboard. Contributing to the accident, according to the NTSB, was the operator's powering of the boat beyond the manufacturer's recommendation and the Coast Guard maximum guidelines. Contributing to the loss of life were the occupants' failure to wear PFDs, the operator's failure to

Inside:

Fuel Tank Fill and Vent Systems 6
Explosion danger with recharging of 7
SVR gel cell batteries

use the boat's installed engine kill switch, and a sticking accelerator pedal, which allowed the boat to continue to operate. The operator and his two passengers may not have recovered from the impact of entering the water in time to prevent their drowning or, if they did recover, they may not have been able to board the boat. Had the occupants worn PFDs, they might have survived.

In its report, the National Transportation Safety Board recommended "that the U.S. Coast Guard publish a **Boating Safety Circular** that describes the circumstances of this accident, stressing the dangers of operating a boat at high speed and the phenomenon known as "chine-walking," the need to wear PFDs, and the use of engine kill switches.

This accident demonstrates that all persons may be unexpectedly ejected from a boat, leaving no one to stop it, and also the need to wear Coast Guard approved lifejackets. Today, the typical high performance boat may be a bass boat, a skiboat, a speedboat, or one of several combinations, and may be able to attain speeds as high as 70 to 100 miles per hour. Many high performance boats also have accommodation areas for sleeping and a galley for cooking.

With the innovations in boat and engine design and the greatly increased boat speeds, recreational boat operators have had to learn a whole new terminology, previously used only by raceboat drivers:

Chine-walking is a phenomenon associated primarily with V-bottom hulls, which are operated at high speed with only a minimum amount of hull area in the water. When chine-walking, the hull may have a tendency to roll or fall off to one side then the other. This rolling action must be stopped or controlled if the oscillation appears to be intensifying. Unchecked, the boat may go out of control and flip over or eject the occupants. Chine-walking is controlled by small, properly timed, and continuous steering corrections, by trim correction, or both. It also helps to have a very tight steering system with minimal backlash.

The chine of a boat refers to the edge on each side of the hull where the bottom meets the hull sides. **When you hook a chine**, the chine dips down far enough to dig into the water, usually in a turn. This can cause the boat to suddenly turn more sharply than anticipated and/or roll up on its outside edge. In severe cases, the boat can roll over and the operator and any passengers might be ejected.

YEAR	CAUSE	VESSELS INVOLVED	FATALITIES
1994	High Speed Maneuver	71	18
	Speeding	733	46
1993	High Speed Maneuver	69	9
	Speeding	536	27
1992	High Speed Maneuver	110	17
	Speeding	429	27
1991	High Speed Maneuver	73	32
	Speeding	206	35

Porpoising is a continual rhythmic up and down motion of the boat's bow, not caused by wave action. Porpoising is usually associated with over trimming the engine (too far out), weight distribution (center of gravity too far aft) or hull bottom design.

When a boat which is on plane suddenly turns sharply, it **spins-out**, often reversing direction. This is usually caused by a forward

See related story on pages 4 and 5

area of the hull digging into the water and veering to one side allowing the aft end of the boat to rapidly pivot around the bow. Spinning out can be associated with starting an intended turn, then compounded by a bow steer situation, running bow down, hooking a chine, or even hooking an inside sponson of a true tunnel hull boat.

When a high speed boat is **squirrelly,** it has unpredictable running characteristics which may give the operator an uneasy feeling as to the handling and control at a specific speed, balance and trim setting. This condition requires the boat operator's undivided attention at all times.

When there is **steering backlash** there is play or lost motion in the steering system between the engine steering arm and the steering wheel. Minimization of steering backlash is always desirable, but particularly with high performance boats. Dual steering cables, correctly adjusted, used with outboards and single sterndrives, or hydraulic steering systems are excellent installations for minimizing backlash.

High performance V-bottom hulls often have a tendency to chine walk or rock from side to side at high speeds. As speeds increase there is less boat hull in the water, and with V-bottom hulls, the supporting surface becomes narrower. Depending upon the design of the boat and the load it is carrying, at some point the hull falls off to one side, the port side for example, and the aft end of the boat's chine on the port side strikes the water surface. Then, with a small steering correction by the boat operator, the boat will fall off to the chine on the opposite (starboard) side. This oscillating motion (chine-walking) will continue until the operator either slows down, or makes some other change to the trim of the boat, like lowering the outboard motor back in the water a small amount with the power trim switch or hydraulic jack plate. Several other factors can cause chine-walking, such as motor setup, propeller design, play in the steering system and soft or loose motor mounts.

While many slower runabouts can be equipped with single cable steering systems, high-speed bass boats and other performance craft must use a more precise dual-cable system. Dual-cable steering reduces the slop or "play" inherent in a single helm and cable merely by adding a second cable which is in tension against the other. Most engine manufacturers offer solid motor mounts through their high performance divisions.

Passengers usually have a disadvantage the operator doesn't have -- the operator knows when he or she is going to make a sharp turn -- passengers usually do not. Passengers who are moving about a boat, or who are improperly seated on the bow, a gunwale or a seatback, are ejected from the boat or fall overboard when boat operators are wake jumping, are in sharp turns or are performing other maneuvers at speeds which are dangerously fast for the prevailing conditions. Some victims are ejected from boats by collisions with another boat or a submerged or fixed object. Ejections from a boat are also caused by sudden acceleration or deceleration.

DROWNINGS AS COMPARED TO OTHERFATALITY TYPES IN RECREATIONAL BOATING ACCIDENTS 1989 - 1994

YEAR	DROWNINGS	OTHER DEATHS	TOTAL
1994	613	171	784
1993	667	133	800
1992	673	143	816
1991	739	185	924
1990	707	178	865
1989	753	143	896

(continued on page 6)

While preparing this article for the **Boating Safety Circular**, we contacted Mercury Marine engineer, Mr. Richard Snyder, a recognized expert on hydrodynamics, boat testing, and high performance boating and racing, and asked him a number of questions about the operational phenomenon called chine-walking. What follows are Mr. Snyder's answers to our questions:

What is chine walking?

Chine walking is a rhythmical roll from side to side (chine to chine) encountered usually at higher on-plane speeds on some V-bottom boats, more often when powered by a single outboard motor. It might be thought of as the lateral version of "porpoising" which is longitudinal, on-plane pitching or rhythmical bouncing (up and down bow motion) that can be encountered with many boat bottom designs.

What causes chine walking?

As any planing boat, but in particular a V-bottom boat, is powered to higher speeds, the boat is supported increasingly by the velocity pressure of the water touching the hull, and decreasingly by the static pressure of displacement. With a V-bottom boat, that means that the center portion of the bottom touching the water is becoming narrower. There will finally come a point where the boat will roll or fall to the side, away from its former balanced position. This imbalance can be initiated by a simple slight movement of the steering wheel when putting the boat, intentionally or not, into a slight turn.

Now comes the part not well known. Because the center of gravity of the outboard (or sterndrive) lies behind the steering (swivel or rudder) axis, the outboard will want to fall in the direction of the roll. This fall, due to gravity, will accentuate or magnify the roll since in a small way it's trying to make the boat turn slightly in that roll direction.

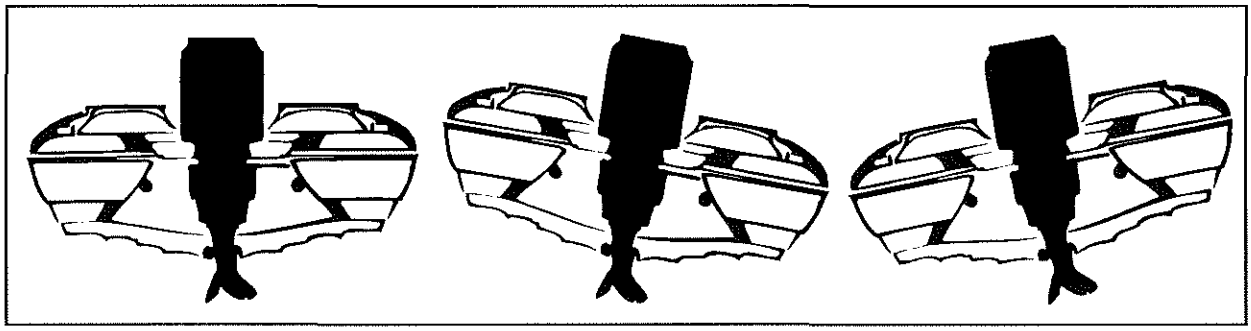
Because of the spring in the steering system and often some counter input to the steering wheel by the operator, the hull will bounce back over center to roll in the opposite direction. Then the outboard, due to gravity, flops back over center to the opposite side, thus accentuating the opposite roll. This action can continue to cycle and grow to a greater and greater magnitude if nothing different is done.

What does the operator feel when a boat is about to start chine-walking?

What the operator originally feels, usually, is a very mild, rather stable level of this cyclic roll if the operator does not increase speed, change boat trim, or put incorrect input into the steering wheel.

What can the operator do?

Plenty. The novice operator can reduce speed a little or trim the bow down a little. But what just about all faster V-bottom drivers quickly learn is how to make little rhythmical corrections to the steering wheel which can level the boat out immediately and permit the operator to safety continue to increase speed. This proper steering technique coupled with a simple search for the optimum engine trim, and thus boat trim, will allow the boat to be safely operated at its maximum speed, given the existing engine height, propeller and boat load.



But of course there is one major adjustment that can greatly help the chine walking situation. And that is taking all practical steps to remove the free play from the steering system. The usual first step, if it isn't present, is to install dual cable steering and correctly adjust out as much of the free play as possible. There are also relatively new hydraulic steering systems (both manual and power) that have addressed the free play problem very well.

On the lighter, faster boats the outboard motor (or sterndrive) installation height can be raised a little to reduce the amount of rudder in the water. As boat speed increases the most desirable size of rudder decreases and excessive rudder definitely adds to the

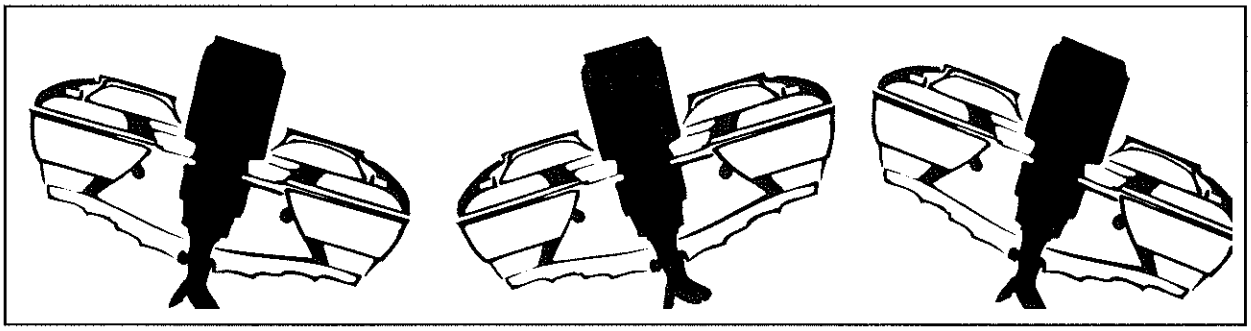
likelihood or severity of chine walking.

Are certain types of boats or boats with various types of propulsion more susceptible to chine walking than others?

As discussed earlier, V-bottom boats possess the only bottom design where the boat can ultimately fall off a narrowing center strip of water contact. Although single outboards are the most common propulsor where chine walking is present, multiple outboards and single or multiple propulsors of other types are not exempt, if sufficient speed and steering free play is present.

Will power trim equipment or after-market equipment such as hydrofoils or trim tabs make a boat more susceptible to chine walking?

Power trim has long been an essential to achieving the most efficient, comfortable, even safest ride as the many recreational boating variables change. However, as an operator reaches for higher speeds, this is achieved by both throttle and hull attitude adjustments.



Basic hull physics dictates that a boat bottom will run most efficiently (achieve the greatest lift to drag ratio) when the bottom is operating at a four to five degree angle to the water. Faster boats tend to run flatter than that. Thus power trim plays a major role in giving the operator a tool to trim the propulsor out thus lifting the bow.

Generally, add on "hydrofoils" are not considered to be much of a chine walking factor. However, at some trim settings, "hydrofoils" can cause some V-bottom boats to roll sharply over on one side creating a hazardous condition.

While the Coast Guard does not have sufficient accident statistics to justify a regulation requiring the use of kill switches, many engine manufacturers, including your company, offer them as optional equipment. Does Mercury Marine have any specific recommendations about the use or maintenance of kill switches or dead man throttles, e.g., foot throttles?

Kill switches ("lanyard operated ignition interruption switches" or more simply "lanyard stop switches") are contained in most manufacturers' control boxes and as a dash mounted accessory. We think that they are generally a good safety device to use. Although Mercury has made them a part of our control boxes for 17 years, operator usage is not very high.

Foot throttles are generally thought of as a plus for boat control in that, obviously, both hands are then available for steering control. However, foot throttles do create the possibility of shifting into gear with too much throttle (RPM), and have thus been involved in serious gearcase damage. Also, occasionally when coming down hard off of a wave, an operator's foot may inadvertently, though briefly, depress the foot throttle, giving the boat an unexpected burst of speed.

Among the materials in the appendices to the National Boating Safety Advisory Council (NBSAC) Report of the Propeller Guard Subcommittee is a pamphlet published by Mercury Marine titled "Hi-Performance Boat Operation," which contains a variety of important information which might be of intertest to our readers. Is the pamphlet still published, and how might interested individuals obtain a copy?

The Mercury pamphlet entitled "Hi-Performance Boat Operation" now in its 4th edition is, I believe, a useful teaching tool. I wrote this booklet originally in 1977 and have updated it on several occasions. It is included with every engine sold (outboard and sterndrive) by Mercury's High Performance Division. A copy can be purchased through Mercury, Mariner, Force and MerCruiser dealers. A copy can also be purchased from Mercury Marine in Fond du Lac, Wisconsin by writing to: Mercury Marine, Publications Department, P.O. Box 1939, Fond du Lac, Wisconsin 54936-1939. The current price is $0.40.

Coast Guard Approved Lifejackets:

In 1994, the Coast Guard received reports of 6,906 recreational boating accidents which resulted in 784 fatalities, 613 of which were drownings. Coast Guard Approved lifejackets could have saved the lives of at least 550 boaters who drowned in 1994, including approximately 30 children who were 12 years of age or younger. The primary causes of the accidents were operator inattention or carelessness and speeding.

During this year's National Safe Boating Campaign, the Coast Guard and other recreational boating safety organizations are urging all recreational boaters to wear their lifejackets, instead of simply storing them on board for the purposes of meeting minimum equipment carriage requirements.

Historically, the major obstacle to encouraging the recreational boating public to wear lifejackets while boating, was the fact that the currently Coast Guard approved, inherently buoyant lifejackets were too bulky and therefore uncomfortable. On March 28, 1996, the Coast Guard published a final rule in the Federal Register establishing structural and performance standards for inflatable lifejackets for recreational boaters, as well as the procedures for Coast Guard approval of inflatable lifejackets. The regulations in the final rule are intended to allow approval of lifejackets which may be more appealing to boaters, than currently approved, inherently buoyant lifejackets, thereby increasing the percentage of lifejackets actually used by the boating public and saving lives. Several manufacturers will have Coast Guard approved inflatable lifejackets on the market this summer.

Kill Switches

Emergency shut off switches otherwise known as kill switches have been in use on racing boats for many years. Several companies offer kill switches for sale to the public or as optional equipment. Kill switches can be attached or wired into most engine control systems which are equipped with remote electric starting.

Most kill switches have a lanyard with a snap or hook which is intended to be fastened to some part of the operator's clothing or lifejacket. If the operator falls overboard, or leaves the helm station without disconnecting the lanyard, it will turn off the ignition or open a special switch in the ignition circuit, thereby stopping the engine.

In general, it can be expected that a boat will come to a stop within 50 to 75 feet of an operator who goes overboard with the kill switch operating properly. In such a situation, some persons would still drown due to the lack of swimming ability (failure to wear a lifejacket) or injuries received while being ejected from the boat.

Although accident data does not support the need for a Federal regulation requiring the installation or use of kill switches, the Coast Guard recommends the use of such devices.

NEW FUEL TANK FILL AND VENT SYSTEMS REDUCE WATER POLLUTION

Several boat manufacturers are now using a single fitting which incorporates both the fuel fill and the fuel tank vent. If fuel comes out of the vent, it simply flows back down the fuel fill. Some boat owners have complained about overfilling tanks on boats equipped with new fuel fill fittings.

Because gasoline spilled into a boat can lead to a significant fire or explosion hazard, the Coast Guard Fuel System Standard in Subpart J of Part 183 requires manufacturers of boats with permanently installed gasoline engines (except outboards) to design fuel tank fill and vent systems so that if there is an overflow from the fill or the vent, gasoline doesn't go into the boat. The American Boat and Yacht Council's voluntary industry standard, H-24, has the same requirements, and they also apply to many outboard powered boats.

For many years the typical fuel tank fill and vent system has consisted of a fuel fill located somewhere on the deck or gunwale, and a vent fitting located on the topsides. When the tank is full, liquid fuel squirts out of the vent. Many boat owners look for overflow from the vent as an indication that the tank is full. However, some States have recently passed laws making fuel spills as small as these illegal, and the Environmental Protection Agency (EPA) is considering similar regulations.

Boat owners who have been using overeflow from the vent to determine when their tanks are full are contributing to water pollution and risk creating an explosive condition. Low cost after-market devices are available (such as an in-line whistle) which will indicate when a fuel tank is almost full.

There are obvious advantages for boat manufacturers who use the new fittings:

(1) one fitting, instead of two, reduces inventory and costs; and

(2) repairs are cheaper, because only one part needs to be replaced.

Owners and operators of boats equipped with the new combination fuel tank fill and vent fittings are reminded to be careful and to avoid overfilling the tank when they are refueling.

CONSUMER ADVISORY - DANGER OF EXPLOSION IF SEALED VALVE REGULATED (SVR) GEL CELL BATTERIES IMPROPERLY RECHARGED

The American Boat and Yacht Council (ABYC) Project Technical Committee for DC Electrical Systems recently informed the Coast Guard that an explosion can occur when gel cell batteries are recharged with battery chargers which are not **automatic temperature-sensing voltage-regulated chargers**.

According to East Penn, a manufacturer of gel cell batteries, SVR (Sealed Valve Regulated) batteries work on the "recombination principle." This means that the hydrogen that is normally produced on the negative plate in all lead-acid batteries, recombines with the oxygen produced on the positive plate to form H_20 or water. This water replaces the moisture in the gel.

The oxygen is trapped in the cell by special pressurized sealing vents. If an SVR gel cell battery is overcharged, the hydrogen and oxygen will be produced faster than they can recombine, and will be driven out of the sealing vents and lost to the atmosphere.

Hydrogen gas released by a battery is extremely flammable and requires only a source of igniton to set it off. Some explosions have occurred.

SVR gel cell batteries are advertised as "maintenance free" and as "sealed," which may lead boat owners to believe that gel cell batteries do not emit hydrogen gas during charging and are completely safe to put anywhere on a boat. These claims are true as long as the manufacturer's instructions for charging are carefully followed.

Automatic, temperature-sensing, voltage-regulating battery chargers must be used. Charge voltage must be limited to 13.8 to 14.1 volts maximum. Constant voltage chargers must never be used.

In addition to the explosion dangers associated with recharging with the wrong equipment, overcharging or undercharging an SVR gel cell battery also reduces performance and battery life. Before using and recharging gel cell batteries boat owners should read the instructions, or contact the manufacturer, to be sure they have the correct type of battery charger, and are recharging it in accordance with the manufacturer's specifications.

U.S. Department of Transportation

United States Coast Guard

April 1997

Boating Safety Circular 79

THERE ARE NO "MAINTENANCE-FREE" METALLIC FUEL TANKS

With today's recreational boat building technology most boats are constructed of very durable materials with the potential for a long service life. As a result, the typical purchaser probably expects that any permanent appurtenance provided with the boat, such as a fuel tank, will provide as long a service life as the hull itself. Unfortunately, many Coast Guard defect investigations have found that aluminum fuel tanks, which were not installed in accordance with the Coast Guard Fuel System Standard or the voluntary standards published by the American Boat and Yacht Council or the National Fire Protection Association, are badly corroded after only a few years.

Each year funds are available through the Boat Safety Account of the Aquatic Resources Trust Fund (revenue from motorboat fuel taxes) for award to national nonprofit public service organizations to fund boating safety projects. In fiscal year 1992, the Coast Guard awarded a grant to Underwriters Laboratories (UL) for the purposes of studying problems associated with the use of aluminum fuel tanks.

UL conducted a limited survey of boat owners to determine how many had problems with leaking fuel tanks and to obtain as many details as possible about each particular tank. These details included:

1. the age of the tank,
2. the particular aluminum alloy,
3. the method of construction, and
4. the method and location of the installation of the tank in the boat.

UL located owners of boats fitted with badly corroded aluminum fuel tanks by publicizing details of the research effort in monthly newsletters and magazines published by the Boat Owners Association of the United States (Boat/US), the U.S. Power Squadrons, and the United States Coast Guard Auxiliary.

The goal of the UL survey was to answer the following questions:

1. What was the extent of problems with aluminum fuel tanks?
2. Did the responses from survey participants indicate a common factor such as geographical location, boat manufacturer, or method of tank installation or was there a common factor associated with the use, storage, or maintenance habits practiced by vessel owners?
3. If a common factor was not apparent, could UL identify fuel tank installations which seemed to be experiencing reliability problems? What were the parameters affecting these particular situations?
4. Would the collected data allow the prediction of the average "life span" of an aluminum tank?
5. Could UL identify a root cause of aluminum fuel tank problems? Was there a feasible remedy which could be implemented in new boats as well as boats already in the field?

Underwriters Laboratories mailed 250 survey forms to respondents to its calls for information; 160 completed forms (64%) were returned. Although the survey was not a statistically valid representation of the entire boating population, the limited data gathered during this research effort showed that aluminum fuel tanks failed in many different makes,

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types and models of recreational boats.

One of the most significant issues facing designers and manufacturers of recreational boats is the challenge of integrating all the necessary equipment into a boat while maximizing space, efficiency and serviceability. In addition to the engine(s), other equipment such as generators, water tanks, and, for many boats, accommodation spaces often compete for the precious space afforded by the bilge. As a result, items which are considered maintenance-free, like the fuel tank, are relegated to the less accessible areas in the bilge. Therefore, when a fuel tank develops a problem, the problem source is not only difficult to detect, but any necessary repairs are usually complex.

While 92 percent of the aluminum fuel tank failure cases examined during the UL study were reportedly caused by corrosion, discussions with repair yards and examinations of various fuel tank samples showed that failures due to fatigue cracking at baffle welds may also be a significant cause of failures. The fatigue failures were primarily confined to fuel tanks constructed from 0.090 in. thick aluminum sheet; however, fatigue failures at baffle welds are not easy to see, and the presence of any corrosion in the vicinity of the failure may have led to misdiagnosis of the problem.

Several owners of one brand of boats reportedly had to replace fuel tanks which failed due to abrasion. The boats had been constructed with the fuel tanks permanently mounted beneath the rear deck. The platforms on which the tanks rested were covered with rubber, presumably for the purposes of either cushioning the tank, or isolating the tank from contact with the plywood platform which may eventually have become waterlogged. The rubber material was attached to the base plywood platform with metal staples, which were not recessed into the rubber. Over time, there was abrasion and perforation of contact areas on the bottom surface of the fuel tank because of contact with the staples.

Field Inspections

One aspect of this research effort was a fact-finding trip to the Southeast in order to find some evidence of the extent of fuel tank failures in the field. Boat repair yards, and both custom and OEM aluminum fuel tank manufacturers were visited for the purposes of examining various perspectives. Visits to both a boat repair yard and a metal fabrication shop yielded several discarded aluminum fuel tanks.

Discarded tanks had been foamed-in place, secured by straps, and retained by brackets. There was evidence of the contact of the bottom of the tank with water in the bilge, incomplete encapsulation of the tank with flotation foam, and collection of water underneath the foam adjacent to the tank. Tank labels were peeling or illegible, coatings were incomplete, rubber strips were haphazardly glued to the tank surface, and brass fittings were screwed directly into the aluminum tanks. Several of the fittings were found to have been covered by putty or foam, evidence that boat owners may have resorted to a quick fix before inevitably having to remove the tank.

There were signs of corrosion underneath the foams on tanks which had been foamed-in-place; where the tank was in contact with water in the bilge; underneath the rubber strips glued to the tank; at weld seams; and even on and around tank fittings. In fact, all of the tanks examined showed corrosion of various types and to different extents over all surfaces. The common result of all of these examples, was clear evidence that they had not been installed in accordance with the Coast Guard Fuel System Standard in Subpart J of 33 CFR Part 183, or the voluntary standards published by the American Boat and Yacht Council (ABYC H-24 and H-33) or the National Fire Protection Association (NFPA-302).

Replacing damaged tanks

According to the responses from boat owners who participated in the UL survey, a great amount of confusion exists in the boating world as to what constitutes an acceptable and reliable fix for a leaking aluminum fuel tank. Some owners settled for temporary repairs, while some owners and manufacturers replaced failed tanks with OEM specification tanks using original installation methods. Some boat owners also went to great expense to try to modify the original installation, although the effectiveness of the fixes was also questionable.

According to the UL report, one of the most convenient courses of action for both new vessel

Eighty-one percent (123 of 152) of the boats used as the basis for the UL study were fueled by gasoline, while the remaining 19 percent (29) were diesel powered. One of UL's most startling findings was the fact that 23 percent of the owners of gasoline-powered boats continued to operate their boats after a fuel tank problem was detected, i.e., almost one-quarter of the owners of gasoline-powered boats responding to the survey do not fully comprehend the hazard of leaking fuel in the bilge of a boat. Since the majority of the respondents to this survey were members of the major boating organizations which promote boating safety, the UL study concluded that the proportion of uninformed boaters was probably higher in the general boating population.

construction and for repair/replacement of damaged aluminum fuel tanks is to use thicker aluminum sheets for tank construction. The report states that pitting for aluminum has been shown to be proportional to the cube root of time. Therefore, while it can be shown that by merely doubling the thickness of the material, the time required for perforation due to pitting is theoretically increased by a factor of eight. However, in the absence of more practical experience with tanks constructed of thicker aluminum sheeting subjected to the conditions in the bilge of a boat, the UL report notes that there is no way to determine a suitable thickness, which would guarantee an acceptable service life in relation to the service life of the boat itself.

Some of the people who were interviewed during the course of the UL study stated that the "industry fix" for corrosion problems with 0.090" wall thickness aluminum fuel tanks was to switch to a thicker 0.125" sheet aluminum for any replacement products. The 0.125" sheet aluminum not only reduced the susceptibility of the tanks to corrosion, but also reduced the number of fuel tank failures due to fatigue at the baffle welds. However, some of the failed tanks which were examined were constructed of 0.125" thick aluminum, meaning they had service lives which were similar to the thinner 0.090" material. Other considerations for assessing the limitations of a thicker aluminum sheeting are the extra cost, the weight penalty, and the increased difficulty in manufacturing the tank.

Stainless Steel

The UL report indicates that some boat owners chose stainless steel as the material for replacement fuel tanks, since this material is obviously "stronger" than aluminum; however, it is also susceptible to pitting and crevice corrosion in the marine environment, although at a different rate than aluminum. Stainless steel is also susceptible to stress-corrosion cracking and is even more prone to that type of failure at weld areas.

Only the 316L stainless steel alloy with a specified minimum wall thickness of 0.031 inches is considered suitable for use in the construction of marine fuel tanks. American Boat and Yacht Council standards ANSI/ABYC H-24, ABYC H-33, and ANSI/NFPA 302 all require stainless steel fuel tanks to be less than 20 gallons in capacity and cylindrical with domed heads to limit the wall stresses experienced in service.

While the uninformed boat owner who happens to construct a small capacity rectangular tank may be lucky enough to avoid a failure due to stress corrosion cracking; some boat owners who participated in the UL study spent considerable amounts of money to have replacement tanks constructed to capacities as high as 150 gallons. Many other boat owners who were surveyed mentioned that, on a cost independent basis, they would have preferred to have used stainless steel for their replacement tanks.

Coatings

The UL report also indicates that some boat owners have tried various coatings such as zinc chromate primers and paints, and epoxy-based coatings, while others covered their old leaking aluminum tank with fiberglass to form a new tank. The problem with these methods for repairing a damaged tank is the difficulty in achieving sufficient adhesion of the film to the base metal, and in applying a uniform and sufficiently thick protective layer free of pores, or "holidays" through which water may penetrate. Any water penetration will eventually lead to destruction of the film and renewed, or accelerated, corrosion attack of the base metal.

The UL report notes that the effectiveness of any coating highly depends on the conditions of the

surface to which it is applied, the ability of the type of coating to withstand the environment to which it is exposed, the durability of the coating, and both the extent and manner in which it is applied. If properly applied to the tank, chromate treatments and epoxy paints may well be effective in delaying or preventing corrosion.

Fiber-Reinforced Plastic (FRP) or Polyethylene (PE) Tanks

Fiber-reinforced plastic fuel tanks (commonly known as fiberglass tanks), which are constructed in the same manner as boat hulls, but with the use of fire-retardant resins, have been in existence for many years. While FRP fuel tanks have proven their effectiveness, they are very labor-intensive to produce, making this option time- and cost-prohibitive to many of the high volume manufacturers of low and medium priced boats.

The polyethylene fuel tanks probably most widely known to recreational boaters are the red portable plastic tanks which have been produced for many years and are commonly used in smaller outboard powered boats. Today the use of PE for the construction of permanently installed fuel tanks may represent as much as 75 percent of the market.

FRP and PE tanks which are installed in a boat which is subject to the Fuel Systems Standard in Subpart J of Part 183, are still subject to the same requirements as metallic fuel tanks, as well as some additional requirements concerning the integrity of the material after aging and exposure to solvents. The critical test is the 2.5 minute fire test as specified in 33 CFR 183.580, which may be conducted in a fire chamber or in an actual or simulated hull section. Experience has shown that PE tanks, depending on the construction details and the particular installation conditions, have the capability of withstanding this test with acceptable results.

The UL report notes that PE fuel tanks have some drawbacks in that they tend to swell upon initial exposure to fuel and certain PE resins may be susceptible to environmental stress cracking. The biggest advantage with the use of nonmetallic fuel tanks is that they do not corrode, and, if they are properly manufactured and installed, they should last for the expected service life of the boat. As a result, any owner of a boat with a metallic tank which has failed, should consider a replacement tank constructed of PE.

Installing an aluminum fuel tank

The most important consideration with the use of a permanently installed aluminum fuel tank is being careful to make a good installation:

Aluminum as a fuel tank material can be very good if special care is taken to choose the proper aluminum alloy, the proper welding rod, and the method of installation. Aluminum is a very anodic material, and the basic fuel system in a boat consists of copper and bronze.

Aluminum and copper, in the presence of moisture, always create a very bad galvanic cell and special efforts must be made to avoid any direct contact. This can be done by inserting a 300 Series stainless steel fitting between the aluminum tank and any copper or brass fittings.

Aluminum tanks must be carefully installed so as to avoid any condition that will entrap moisture against the tank because aluminum in direct contact with salt water will corrode. A tank should be installed so that water will drain off quickly.

The aluminum alloy must be a salt water resistant alloy such as 5052, 5083 and 5086, which have very low copper content.

The aluminum surfaces must be prepared carefully and thoroughly (degreased and primed or etched) to assure a bond of the foam to the tank, prevent attack of the aluminum by the substances in the foam and to preclude moisture.

The foam must meet certain requirements concerning cell structure, moisture resistance, and density such that the foam will bond without voids, there will not be damaging water absorption and

Several years ago a marine engineer reported removing an aluminum fuel tank which had a hole in it. The hole in the tank was almost directly below the fill pipe and it was theorized that a chip of brass from a brass fitting (thread chip) dropped into the tank and then corroded its way through. The rest of the four year old tank was in excellent condition. If problems such as this are to be avoided, aluminum fuel tanks must be thoroughly cleaned and great care must be exercised to avoid coupling aluminum to copper alloys (even the small thread chip left in a tank).

there will be a certain inherent strength to preserve the bond to the tank.

H-24, Gasoline Fuel Systems, is available from the American Boat and Yacht Council, 3069 Solomons Island Road, Edgewater, MD 21037-1416. The price is $35.00 per copy plus $1.00 postage and handling.

A Study on Problems With Aluminum Fuel Tanks in Recreational Boats is available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 (Tel: (703) 487-4650). The price is $21.50 and the document accession number is PB95191664.

Conclusion

Examination of the data received from participants in the UL survey, as well as research into marine aluminum alloys has confirmed the existence of certain problems with aluminum fuel tanks in recreational boats, primarily due to failure to install them in accordance with recognized safety standards. The increased growth in the availability of polyethylene fuel tanks shows that they are realistic and effective alternatives to the use of aluminum. The use of thicker aluminum sheet for the tank construction, combined with a protective coating may be a temporary solution to the problem for both existing and newly constructed boats. The shortcomings of aluminum fuel tanks in recreational boats are mainly controlled by the environmental parameters in the bilge.

The crucial point is that permanently installed metallic tanks are assumed by the general boating population to be safe and reliable throughout the entire service life of the boat. The UL report indicates that the general boating public needs to become more educated about a product which many take for granted. Boat owners need to take an increased initiative in the inspection, care and maintenance of their boat's fuel system.

PERSONAL WATERCRAFT CONSPICUITY

Accidents involving Personal Watercraft (PWC) have been attributed to a wide variety of factors including the fact that due to their relatively small size and unusual patterns of maneuvering relative to other vessels, PWC are not easily recognized visually.

The most prevalent type of accident involving PWC is a collision with another vessel -- 80 percent in 1994; 83 percent in 1993; 82 percent in 1992; and 80 percent in 1991. A little more than half of the collisions involve PWC operators who intentionally operate in close proximity to other boats -- either riding in formation with other PWCs, or deliberately wake jumping behind another vessel.

In 1995 the Marine Technology Society was awarded a grant to study ways to improve the conspicuity of Personal Watercraft (PWC). Highlights of the report are described in this article.

The enhancement of conspicuity, according to the report, requires improving how the human eye is first alerted to the presence of a PWC and how the mind processes this information to determine the identity, position, and motion of the object relative to the observer. Several general enhancement methods were considered based upon earlier research regarding the conspicuity of motorcycles and other motor vehicles.

Six conspicuity enhancement methods were chosen for evaluation:

1. A flashing amber light;
2. A flashing automotive headlamp;
3. The operator's use of an international orange colored lifejacket;
4. The use of international orange material to cover the bow and stern surfaces of the PWC;
5. The operator's use of an international orange colored lifejacket and covering the bow and stern surfaces of the PWC with an international orange material; and
6. A vertical water spray, which is featured on one PWC manufacturer's models.

A group of evaluators observed each of the conspicuity methods (except the vertical water jet which had been observed in actual use earlier in the study) from various angles and distances when PWC were operated at various speeds. The composite average evaluation results are printed below. All of the observers commented on the effectiveness of the bright international orange color as a most significant factor in attracting their eyes to the vessel.

The use of the strobe light was not effective in improving conspicuity because the energy produced by the light was lost in the brighter background of the marine environment on a reasonably bright day. The strobe light would have been more effective in a low light condition.

The use of the automotive headlight was not effective in improving conspicuity, unless the observer was in direct alignment with the beam of light.

The vertical waterjet only operated at planing speed, when the PWC was already leaving a significant wake. As a result, the added effect of the roostertail was nearly insignificant.

The international orange surfaces were very noticeable and the color is in common use where conspicuity is critical. When both the rider's lifejacket and the front and rear surfaces of the PWC were international orange in color all observers reported a very significant degree of improvement in conspicuity.

EVALUATION RESULTS

PWC Modification	Head On	From Rear	From Side
Amber Strobe	3.0	2.1	2.7
Flashing Headlamp	2.4	1.0	1.1
International orange lifejacket	3.0	3.6	3.0
International orange bow and stern	3.3	3.1	2.0
Int'l orange bow and stern and lifejacket	4.4	4.6	3.4
Roostertail (vertical waterjet)	1.8	2.0	1.8

No Change	Slight Improvement	Noticeable Improvement	Significant Improvement	Very Significant Improvement
1	2	3	4	5

COAST GUARD ISSUES WARNING ABOUT UNAPPROVED LIFE JACKETS

On December 16, 1996 the U.S. Coast Guard issued a news release warning the public about a potential problem with certain unapproved inflatable life jackets. The problem does not exist with inflatable life jackets approved by the Coast Guard. Life jackets are also known as personal flotation devices or PFDs.

Halkey-Roberts, a manufacturer of inflator mechanisms for the PFD industry, has reported that its manual-automatic mechanisms, Mark II (product number V80000) and Mark III, (product number V83000), when used in combination with carbon dioxide cylinders with a half- inch threaded neck produced by Nippon Tansan Gas Company (NTG) and distributed by either NTG or Leland Limited, sometimes fail to pierce the cylinder when activated automatically by water. The same potential condition holds for United Moulders, Ltd., (UML) Mark III manual- semiautomatic mechanisms when used in combination with the NTG/Leland C02 cylinder.

According to the news release, the Halkey-Roberts inflators are not marked with an identifying product number and come in black only. Likewise, Leland/ NTG cylinders are marked Leland or NTG but may be coated, making the marking invisible.

The news release emphasized that the products named are not faulty in themselves, but that they may not work well together. No problems have been reported to the Coast Guard in the manual operation of these devices, nor have any problems been reported with these parts when used in combination with other inflators or cylinders.

The Coast Guard urged owners of Techvests and Techfloats to check their model number against those listed because Survival Technologies coats its cylinders and NTG is not visible on the cylinders.

The list includes only information that has been provided by manufacturers. As a result, the Coast

Guard noted that manufacturers not listed may have inflatable PFDs with this inflator-cylinder combination and urged owners of inflatable PFDs to check their equipment for this combination of inflator and cylinder.

Because the products involved are not Coast Guard-approved, the Coast Guard cannot give authoritative instructions on how they should be handled. Owners of affected PFDs should be aware that unless the manufacturer is contacted and corrective action is taken, these devices might not provide any flotation unless they are inflated manually.

Coast Guard-approved inflatable PFDs are expected to be available to the public before the 1997 boating season begins, and they will be marked with a U.S. Coast Guard approval number starting with 160.076.

Consumers who want more information should contact the manufacturers of their inflatable PFDs. The following manufacturers have informed the Coast Guard of affected models and would like owners of these models to call:

MANUFACTURER	PFD NAME	PFD MODEL NOS.
LIFESAVING SYSTEMS (813) 645-2748	PRO-LITE	481-AO, 481-AN
MUSTANG (800) 526-0532	CREWFIT	C10171, C11601, C10173, C11603 (WITH HARNESS), C10014, C10019 (RECHARGE KITS)
SPORTING LIVES (800) 858-5876	SOSPENDERS	120A, 120AH, 123A
STEARNS (800) 783-2767	SECUMAR	1140, 1150
SURVIVAL TECHNOLOGIES (800) 525-2747	TECHFLOAT	TECHVEST B01322, B01325, B01615

COUNTRY CODES AND HINS FOR BOATS INTENDED FOR EXPORT

At the back of this issue of the **Boating Safety Circular** is a **Federal Register** document containing Supplementary Notice of Proposed Rulemaking (SNPRM) concerning Hull Identification Numbers (HINs) for boats. In the SNPRM, the Coast Guard proposes adopting the International Organization for Standardization (ISO) HIN format, which consists of a two character country code followed by a hyphen, followed by the existing 12 character HIN format. Use of the ISO HIN standard was mandated for use on all craft to be used in the European Common Market after June 16, 1996, as specified in the European Union and Directive for Recreational Craft.

As a result, several U.S. manufacturers have sought the Coast Guard's opinion on how to go about complying with the ISO HIN standard, without affixing two separate HINs.

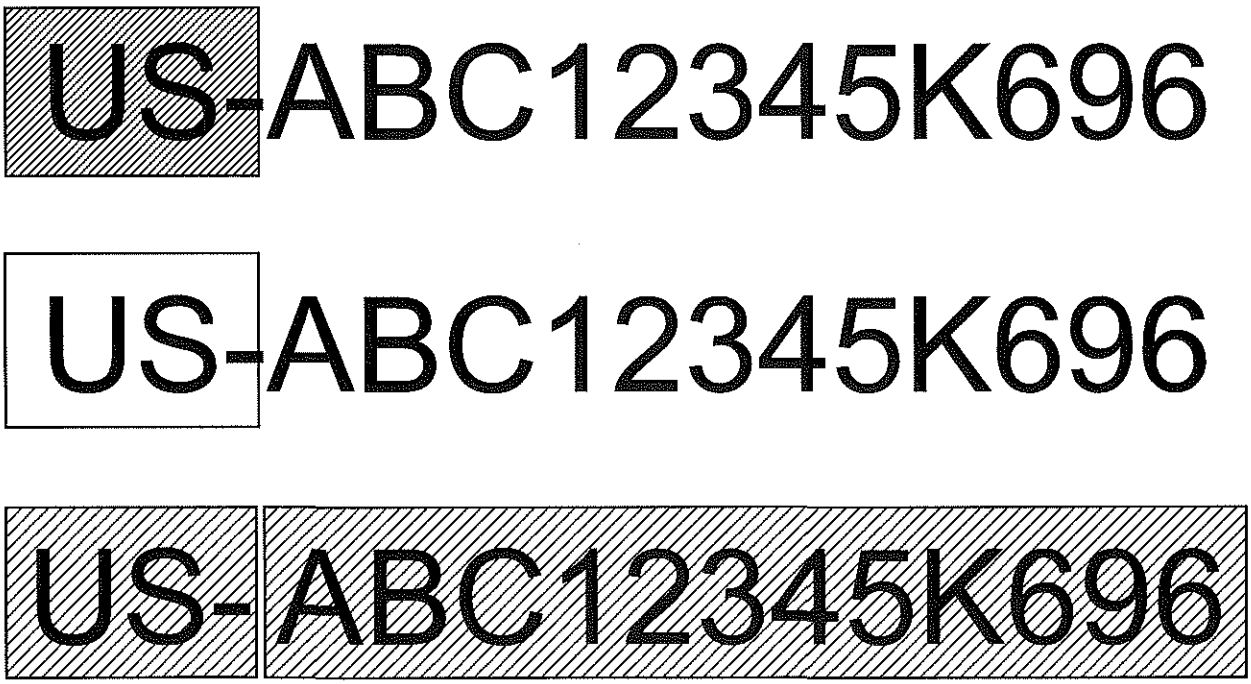
According to 181.27 of Title 33, Code of Federal Regulations, "If additional information is displayed on the boat within two inches of the hull identification number, that information must be separated from the hull identification number by means of borders or must be on a separate label so that it will not be interpreted as part of the hull identification number.

As a result, there are several different methods manufacturers who export their boats for the purposes of sale overseas can use when affixing HINs to their boats and meet both the Coast Guard and ISO HIN format requirements:

1. Display two different HINs, one beneath the other.

ABC12345K696 (existing USCG format)
US-ABC12345K696 (ISO format)

2. Surround the country code and hyphen to the left of the existing HIN format with a border or display the country code and hyphen on a separate label.



U.S. Department of Transportation

United States Coast Guard

December 1998

Boating Safety Circular 80

DON'T INSTALL GENERATOR SETS ON THE CHEAP

With the proliferation of accessories requiring 110 volt AC electrical power, most people with boats having sleeping and cooking accommodations would like to have a source of such energy. Given that the boat has AC circuit wiring and a distribution panel board installed, the simplest sources are a shore power connection while at the dock and an inverter while at sea. An inverter converts low voltage DC to high voltage AC with reasonable efficiency. This is limited to battery capacity; or, if the engine is running, to the alternator output. This will handle modest accessory loads for a while, but any heavy AC load will deplete the battery in short order. An extra battery held in reserve for cranking the engine and a battery disconnect/selector switch is almost a necessity.

For heavier loads such as electric stoves, air conditioning, or water heaters, shore power or a separate source of AC power on board such as a generator set is the only way to go. Some larger boats can be obtained with a generator set already permanently installed, using the main engine fuel source. These are comparatively expensive installations running to several thousand dollars or considerably more, depending on output capacity. Even if not so equipped originally, these larger boats may have a space set aside for their installation, usually in the engine compartment. But not just any generator set should be installed in the boat interior. It must be a "marine" generator set: liquid cooled with provisions for exterior discharge of exhaust gasses. If installed in a boat using gasoline as fuel, it must be "ignition-protected": creating no sparks or other sources of ignition that can set off a gasoline vapor explosion. A gasoline generator set, even if installed in a compartment separate from the main engines or fuel tanks, needs to be an ignition-protected type. The carburetor also needs a backfire flame arrester.

Such generators are inherently expensive. Liquid cooling usually means a heat exchanger to separate the engine cooling liquid from the sea water. Water jacketed manifolds and high rise elbows with water discharge into the exhaust hose are standard. When looking in the many catalogs that come through the mail or passing through a large hardware store, boat owners will see generator sets with outputs of 2 to 5 kilowatts for prices from $300 to $600, a far cry from a $3,000 built-in generator set. What a temptation: cheap AC power for the boat! Such generators are not intended for installation in enclosed spaces, on land, or on the water, and come equipped with warnings to that effect. Their specifications are: air-cooled, gasoline fuel in an integral tank on the generator set, direct exhaust discharge, and no ignition-protection or backfire flame arrester.

Does this mean they should never be used or installed on a boat? Not necessarily. The key word here is "on" not "in." Such generator sets are all right when running in the open air above deck. They may be noisy, but they will do the job. A three sided enclosure with a top will shield some of the noise and still allow for adequate air cooling. These would be basically short usage installations, certainly not to be left running for extended periods. The limited fuel tank size would take care of that. They can be

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one source for restoring a dead battery to life so the main engine can be started - always a secure feeling when you sit around at anchor most of the night using up battery power for anchor and cabin lights, alarms and stereo music.

All generator sets need to be used with caution, whether liquid cooled permanently installed in the engine compartment or sitting out on the open deck. Internal combustion engines, particularly gasoline engines, are a source of carbon monoxide (CO). This can have an insidious way of getting back into the boat, even if discharged to the exterior. Wind direction, being tied up next to a dock or sea wall or next to another boat may let CO into the boat through an open port or cabin ventilator. One of the riskiest but common procedures on boats equipped with a generator set and air conditioning is to close the cabin up on a hot night and go to sleep with the generator set and air conditioning on. If doing that, a working carbon monoxide alarm is essential. Even though the engine compartment is separated from the cabin space by a bulkhead, this may not be absolutely vapor tight. If an exhaust leak is present and the cabin is at a slightly lower pressure than the engine space, it can become a serious situation. It's not a bad idea to keep the engine compartment ventilation blower running whenever the built-in generator set is running. It brings in fresh air and purges any fumes in the space.

INSPECT FLAME ARRESTERS TO SAVE LIVES

Most boaters driving gasoline powered inboard boats know that there is something on top of the carburetor. They probably think it's to keep bugs, loose clothing and other airborne objects from being sucked into the engine. Those who are more knowledgeable may know it is a backfire flame arrester, but don't know how important it is. Some might even think about taking it off to "let the engine breathe" better and increase speed, even one-tenth of a mile per hour.

On one boat some years back, with a V-6 stern drive, the arrester had been replaced with an automotive paper element air cleaner. The owner still had the sack from the auto parts store with the sales slip. There was an engine compartment explosion and ensuing fire. A little girl, who was asleep on cushions under the fore deck, never made it out. They sued the boat manufacturer, the stern drive manufacturer and even GM [General Motors], which made the basic engine. They didn't get a dime.

Backfire flame arresters serve a very important safety function. All gasoline engines with carburetors tend to vent fuel vapor after shutdown. If shut down from high speed, they are hot and will boil off some of the fuel in the float bowl. This vapor goes into the engine compartment and will linger for a while unless taken out by the ventilation blower. The vapor itself does no harm , as long as there is no source of ignition present. Sources of ignition can be electrical or from a backfire in the engine intake system when it is restarted. Most of us have heard a backfire. On a boat, flames spouting out of the carburetor can ignite that fuel vapor in the engine compartment.

The operating principle of the flame arrester is to cool and quench the flame front by forcing it to pass between some closely spaced metal elements that act as a heat sink. Since the engine must take in air without too much restriction, many elements are required with many small spaces between, hence the typical arrester design of a circular shape that is six or more inches in diameter and an inch or more in height. Some form of delayed or late ignition takes place in one of the cylinders at a time when the intake valve is open and the resulting flame ignites the fuel and air vapor in the intake manifold. The pressure created has to go somewhere, and that's back out through the carburetor or intake system. With a working flame arrester, only the pressure is released and none of the flame gets out.

A damaged flame arrester is little, if any, better than none at all. The slip of a tool that spreads the metal elements apart, even in one spot, can let that flame pass through. Damaged arresters should be replaced, and inspection of the arrester should be a part of every commissioning. Occasional careful cleaning with oil and grease dissolvers will keep the engine breathing normally. A tight metal-to-metal

Editors Note: The two preceding articles, *"Don't Install Generator Sets on the Cheap"* and *"Inspect Flame Arresters to Save Lives"* originally appeared in Boat and Motor Dealer Magazine, and are reprinted with the permission of the magazine and their author, Mr. Ralph Lambrecht.

joint is probably the best, with an elastic stop nut used on the hold down stud to make sure it stays tight.

Most two-cycle gasoline engines don't need flame arresters. Such inboard engines are found on personal watercraft and jet boats, basically outboard powerheads coupled to water jet pumps. Backfire flame arresters and the power heads of such engines are required to pass similar tests to be certified (as an acceptable means of backfire flame control). This consists of being subjected to a 50-cycle test procedure in which the carburetor, with the arrester installed, is mounted on top of a cylindrical chamber simulating the volume of an intake manifold. The outside of the carburetor is in another chamber of several cubic feet in volume with a spring-loaded lid. Both chambers are filled with an explosive mixture of propane and air. The mixture in the chamber below the carburetor is ignited by a spark plug. The resulting explosion and flame front must not ignite the mixture in the upper chamber. To complete the test cycle, the mixture in the upper chamber may also be ignited by another spark plug to prove that it was in the explosive range. There must never be an incident where the upper chamber mixture is ignited as a result of the mixture in the lower chamber.

Federal law requires that inboard gasoline engines be equipped with an acceptable means of backfire flame control (a Coast Guard approved device or one which meets UL 1111 or SAE 1928). It's a good safety precaution and one that has prevented a lot of boat fires and saved more than a few lives over the years.

VOLUNTARY COMPLIANCE TESTING PROGRAM

The Coast Guard has implemented a free program to test recreational boats voluntarily supplied by manufacturers for compliance with the Safe Loading, Safe Powering and Flotation Standards. Under the program, manufacturers may request compliance testing early in a production run. Early testing can minimize the financial risk associated with Coast Guard imposed recalls and reduce the numbers of noncomplying boats reaching the public. Points to consider for this voluntary program are:

1. Testing is free, but is limited to boats subject to standards, e.g., boats less than 20 feet in length.
2. Boats which fail testing will be re-tested after the manufacturer's corrections are made.
3. If the boat fails compliance testing and the numbers of noncomplying boats is significant, the Coast Guard could require defect notification, recall and repair of all affected units. Therefore, manufacturers are encouraged to have a boat tested early in the production run to minimize the risks associated with a recall.
4. Manufacturers can bring their boats to the test facility in Solomons, Maryland for testing, or the Coast Guard will make arrangements to pick up and return boats which are provided voluntarily.
5. Manufacturers may witness compliance testing and ask questions about testing methods, techniques and procedures.
6. Boats provided for testing will incur some damage:
   a. Holes are drilled at selected locations on the topsides and in the cockpit sole to allow the escape of entrapped air.
   b. Boats are submerged in a tank for 18 hours prior to testing; flotation foam may absorb water during this process and may retain it after testing.

We encourage all manufacturers of boats which are subject to the Display of Capacity Information, Safe Loading, Safe Powering, and Flotation Standards to consider voluntary compliance testing as part of their business strategies. The testing is free, it helps ensure that a manufacturer's products meet minimum safety standards, and it reduces the risk of a costly recall campaign in the future.

The Coast Guard laboratory tested about 50 boats during 1998 and expects to test more next year. Manufacturers who would like to learn more about the voluntary compliance testing program should contact:

Mr. Gary Larimer
(E-mail GLarimer@comdt.uscg.mil)
1-800-368-5647 or (202) 267-0986

SMALL BUSINESS REGULATORY ENFORCEMENT FAIRNESS ACT (SBREFA)

Is your company a small business entity? The Coast Guard has established a program for responding to small entity inquiries concerning information on and advice about compliance with statutes and regulations under our jurisdiction.

Small entity means a small business, small organization, or small governmental organization. (It does not apply to individual persons.)

Small business or small business concern means an enterprise that is independently owned and operated and which is not dominant in its field of operation. (15 U.S.C. 632)

Small organization means any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. (5 U.S.C. 601(4))

Small governmental jurisdiction means governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than 50,000. (5 U.S.C. 601(5))

Small Business Administration Size Standards. If you have any questions concerning size standards, please contact the U.S. Small Business Administration, Office of Size Standards at 202-205-6618. The Small Business Administration also provides assistance to small businesses.

The Small Business Administration Web site can be accessed at http://www.sbaonline.sba.gov

Coast Guard contacts. Small businesses may contact the following individuals for assistance in complying with and applying Recreational Boating Safety regulations:

General Recreational Boating Safety Inquiries:

Senior Chief Petty Officer Al Johnson
[tel: 617-223-8463; fax: 617-223-8471]
Commander (osr),
First Coast Guard District,
Boston, MA. [CT, MA, ME, NH, NJ, NY, PA, RI, VT]

Mr. Steve Phillips
[tel: 757-398-6204; fax: 757-391-8107]
Commander (Aoax)
U. S. Coast Guard Atlantic Area
Portsmouth, VA
[DC, DE, MD, NC, NJ, NY, PA, VA]

Lieutenant Junior Grade Keirsten Current
[tel: 305-536-4498; fax: 305-536-4498]
Commander (osr)
Seventh Coast Guard District
Miami, FL
[FL, GA, PR, SC, VI]

Mr. Kevin Kelly
[tel: 504-589-6770; fax: 504-589-5653]
Commander (osr)
Eighth Coast Guard District
New Orleans, LA
[AL, AR, CO, FL, GA, IL, IN, IO, KS, LA, MI, MN MS, ND, NE, NM, OH, OK, SD, TN, TX, WI, WV, WY]

Mr. Frank Jennings
[tel: 216-902-6094; fax: 216-902-6018]
Commander (o)
Ninth Coast Guard District
Cleveland, OH
[IL, IN, MI, MN, OH, PA, WI]

Lieutenant Commander Dennis Otoshi
[tel: 510-437-3831; fax: 510-437-3223]
Commander (Poo)
U. S. Coast Guard Pacific Area
Long Beach, CA
[AZ, CA, NV, UT]

Mr. Dolph Diemont
[tel: 206-220-7257; fax: 206-220-7265]
Commander (osr)
Thirteenth Coast Guard District
Seattle, WA
[ID, MT, OR, WA]

Mr. Kent Richards
[tel: 800-541-2161; fax: 808-541-2161]
Commander (oax)
Fourteenth Coast Guard District
Honolulu, HI
[AMSAM, CNMI, GU, HI]

Ms. Sue Hargis
[tel: 907-463-2297; fax: 907-463-2299]
Commander (moc)
Seventeenth Coast Guard District
Juneau, AK
[AK]

Interpretation of Federal Requirements on Recreational Boating Safety Inquiries:

Boat and associated equipment manufacturer requirements.
Mr. Peter Eikenberry
[tel: 202-267-6894; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Boat and associated equipment defect notification and recall requirements.
Mr. Alston Colihan
[tel: 202-267-0981; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Recreational Boat Compliance Testing
Mr. Gary Larimer
[tel: 202-267-0986; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Boat operator and equipment carriage requirements.
Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Boating Accident Report Database (BARD) statistics.
Mr. Bruce Schmidt
[tel: 202-267-0955; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Federal Marine Event Permitting Procedure Regulations.
Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Further Information on Specific Regulatory Projects Inquiries:

Federal Requirements for Wearing Personal Flotation Devices.
Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Federal Requirements for Education in Recreational Boating Safety.
[tel: 202-267-0577; fax: 202-267-4285]
Commandant (G-OPB-2)
U. S. Coast Guard Headquarters
Washington, DC

Vessel Identification System.
Ms. Jeanne Timmons
[tel: 202-267-0857; fax: 202-267-4423]
Commandant (G-OPB-2)
U. S. Coast Guard Headquarters
Washington, DC

Standards for Navigation Lights Used on Recreational Boats.
[tel: 202-267-0984; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

National Boating Safety Activities: Funding for National Nonprofit Public Service Organizations.

[tel: 202-267-1077; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

Propeller Injury Prevention Involving Rented Boats.
[tel: 202-267-0984; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Amendments to Hull Identification Number Regulations. Mr. Alston Colihan
[tel: 202-267-0981; fax: 202-267-4285]
Commandant (G-OPB-3)
U. S. Coast Guard Headquarters
Washington, DC

Regattas and Marine Parades Permitting Procedures.
Mr. Carl Perry
[tel: 202-267-0979; fax: 202-267-4285]
Commandant (G-OPB-1)
U. S. Coast Guard Headquarters
Washington, DC

The Small Business and Agriculture Regulatory Enforcement Ombudsman and 10 Regional Fairness Boards were established to receive comments from small businesses about Federal agency enforcement actions. The Ombudsman will annually evaluate the enforcement activities and rate each agency's responsiveness to small business. If you wish to comment on the enforcement actions of the U.S. Coast Guard call 1-888-REG-FAIR (1-888-734-3247).

100 MPH LIFEVESTS DO NOT PROTECT WEARERS FROM TRAUMATIC INJURY IN A HIGH SPEED CRASH

Several life preserver (PFD) manufacturers have advertised their products as "100 mile per hour lifevests." This has led many readers of the advertisements to the false conclusion that such products will protect riders of Personal Watercraft (PWCs) from injuries in high speed crashes. The impact rating of a life preserver has nothing to do with protecting the operator or passengers on a PWC from impact trauma. In fact, Underwriters Laboratories (UL) Standard 1123, "Marine Buoyant Devices," was revised recently to change the name of the "Impact Test" to the "Dynamic Strength Test" in order to better reflect the intent of the evaluation.

If a life preserver is strength tested at 100 miles per hour (mph), the statement means only that the fasteners, e.g., snaps, buckles, etc., have supposedly been tested at 100 mph. In one such test, the lifevest is attached to a wooden frame and dropped from a helicopter at the rated speed to see if the buckles remain fastened.

The use of a "100 mph lifevest" does not mean that a wearer would be less susceptible to traumatic injuries. As one boating safety specialist has pointed out -- following a 100 mph accident, hopefully, the 100 mph lifevest will still be fastened around the victim's battered, bruised and possibly dead body.

COMPLIANCE GUIDELINES AVAILABLE

If you are a recreational boat manufacturer and have difficulty navigating the Code of Federal Regulations for compliance with applicable U.S. Coast Guard safety standards, the American Boat and Yacht Council (ABYC) might have just the product for you. ABYC publishes four "Compliance Guidelines" that explain, interpret and clarify the regulations. The Guidelines complement the regulations by explaining various means a manufacturer may use to achieve compliance, and diagrams and tables are also provided.

The available titles are:

Flotation Compliance Guideline
Electrical System Compliance Guideline
Fuel System Compliance Guideline
Ventilation Compliance Guideline

As of today, the guidelines cost $23.00 each, which includes $3.00 shipping and handling. Reduced prices are available for orders in larger quantities. The full set of four is $72.00. For complete ordering instructions, call ABYC in Edgewater, Maryland at (410) 956-1050.

GEL CELL BATTERIES UPDATE

In **Boating Safety Circular 78** (August 1996) the Coast Guard published an advisory concerning the installation and charging of gel cell batteries. Some people misconstrued this advisory to mean that gel cell batteries are inherently dangerous.

Gel cell batteries are not inherently dangerous. They are much safer than non-sealed wet cell storage batteries. When installed and maintained in accordance with the manufacturer's instructions gel cell batteries will provide safe service. Any battery, whether wet cell, gel cell, a sealed battery, or other type has the potential to be dangerous if not properly installed or maintained, especially if it is not properly charged. Overcharging and overheating are the two main culprits that damage batteries.

The Coast Guard's concern is not with gel cell batteries, but with the proper installation and maintenance of all batteries. In the cases reported to us the batteries were installed in closed compartments and overcharged, causing excessive heat and production of hydrogen gas.

Hydrogen gas is produced in the charging process and is extremely flammable. In unsealed batteries this gas is vented to the atmosphere. In sealed batteries it is recombined into the electrolyte and it is only vented to the atmosphere if there is excessive pressure from overcharging. Any battery if overcharged, will overheat and cause a build up of pressure inside the battery which may result in a hazardous situation. The Coast Guard's intent is to warn all boat operators/owners that all batteries have to be installed and maintained properly.

All batteries must be installed and maintained in accordance with the manufacturer's instructions to be used safely. On boats with permanently installed gasoline engines, except outboard engines, batteries must also be installed in accordance with Federal regulations in 33 CFR 183.420.

U.S. Department of Transportation

United States Coast Guard

December 1999

Boating Safety Circular 81

THE FAR SIDE OF THE LAW

Cartoonist, Gary Larson, famous for his "The Far Side," once drew a cartoon in which the survivor of a shipwreck is floating in an inflatable liferaft with the logo, "A1," and watching a portable TV. Suddenly the announcer says:

" ... last month the A-1 Life Raft Co. issued a statement announcing that it was recalling 50,000 of its small rubber boats due to defective glue used in their manufacture, causing the boats to lose air and gradually sink over a matter of a few days ..."

Over the years a number of joke writers and cartoonists have lampooned the public's tendency to ignore recall notices they receive from manufacturers of various consumer products, particularly automobiles. Perhaps one reason why is the fact that many manufacturers attempt to minimize potentially adverse impacts on company sales by being deliberately vague about defects in the company's products.

However, the U.S. laws which require boat and engine manufacturers to notify owners and recall products which contain "defects which create a substantial risk of personal injury to the public," are actually very specific about the information a defect notice must contain. Let's take a moment and review the wording of the statute.

First of all, according to 46 U.S.C. 4310(d):

"The notification ... shall contain a clear description of the defect . . ."

Notice the use of the word, "shall;" it doesn't mean a clear description of the defect is optional. Yet we've received copies of notices to consumers in which a permanently installed gasoline fuel tank which leaks is described as "a fuel tank problem." Another manufacturer described a defective steering system as "potentially involving the steering operation of your boat."

Second, the notification shall contain:

"an evaluation of the hazard reasonably related to the defect or failure [to comply]."

Often we receive copies of defect notices to where no mention is made about the degree of danger to the consumer with continued use of the defective product. There is no mention, for example, about the fact that continued use of a boat with a leaking fuel tank may lead to a fire or explosion, or the fact that continued use of a boat with a "faulty steering system" actually means the steering system could suddenly lock making it impossible for the boat operator to turn to avoid a high speed collision.

The whole point of defect notification is to alert purchasers about substantial risk defects in boats and engines, which may cause fatalities or serious injuries. There are serious adverse impacts on safety when the public is deliberately misled about the degree of danger associated with the continued use of defective products.

USE CAUTION WITH AC (ALTERNATING CURRENT) ON BOARD

Having a source of alternating current (a.c.) on board a boat is really satisfying. It lets the boater operate all kinds of things he or she can't do with 12 volt direct current (d.c.) electricity, particularly large appliances like air conditioning, electric stoves and house size television sets. On a yacht with its

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own generator, a.c. can be had anywhere when the vessel is underway, or at rest. For most boaters with boats that have overnight accommodations, however, there are only two choices: an inverter to make a.c. from 12 volt d.c., or a shore power connection by a plug-in cable. The inverter output is limited by its design and the battery capacity available; the shore power cable only by the rating of the cable itself and the design of the shore power system on board.

The shore power cables available from the marine supply houses carry one of three common ratings for most boats under 40 feet:

(1) 20 ampere, 125 volt;
(2) 30 ampere, 125 volt; and
(3) 50 ampere, 125 volt.

All three are for single phase, two pole, three wire systems: a live conductor, a neutral conductor (usually white) and a green grounding (protective) wire. All three have their own distinctive plug terminal configurations to prevent the casual user from plugging the 20 amp plug into a 30 amp receptacle on the dock, or either the 20 amp or 30 amp into the 50 amp receptacle on the dock.

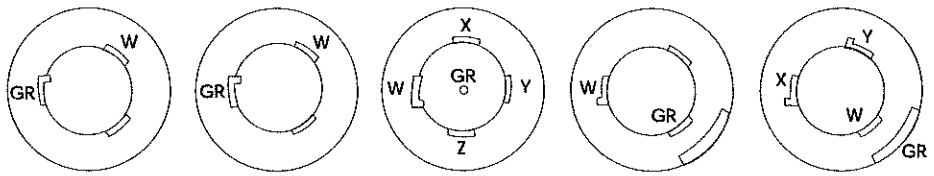
The 20 amp and 30 amp plug terminal arrangements are very similar, differing only in the radius on which they are arranged, the positioning on the plug being the same (see accompanying diagram from ABYC Standard E-8). With a worn socket on the dock and a little muscle, it is possible to force the 20 amp plug terminals onto a 30 amp socket and vice versa. Since most marinas are equipped with 30 amp receptacles, there is generally no problem for boats equipped with 30 amp cables. For the boat with only a 20 amp system and cable, frustration may cause an attempt at forcing the plug into the 30 amp socket. In most cases this does not create a problem, since the usage of power on board smaller boats is usually within the 20 amp range. There's no chance of getting mixed up with the 50 amp receptacle, *as long as the plug terminals have not been altered.* If there has been some alteration of the terminal with the "L" shape, all kinds of things become possible, some with fatal consequences.

If the 30 amp plug with an altered green wire (GR) terminal can be forced into the 50 amp receptacle, it is possible that the "GR" terminal could be inserted into the "W" terminal of the 50 amp, 2 pole, 3-wire receptacle on the dock. This would immediately electrify the metallic frame of every appliance on board to which the green "protective" wire is attached. The same could be true of the 50 amp 125/250 volt, 3-pole, 4-wire receptacle (3-phase a.c.) on which the "GR" terminal is on the outer rim of the receptacle, two of the three inside terminals being live.

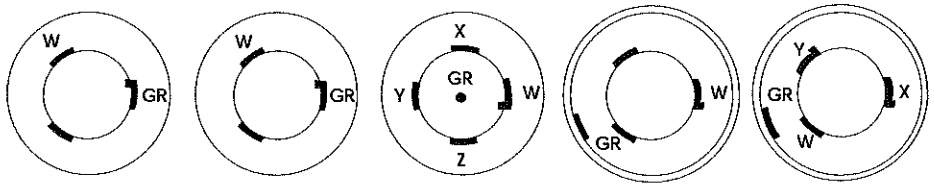
Editor's Note: The article, *"Use Caution with AC On Board"* originally appeared in Boat and Motor Dealer Magazine, and is reprinted with the permission of the author, Mr. Ralph Lambrecht, a member of the American Boat and Yacht Council (ABYC) Electrical Project Technical Committee.

SHORE POWER CABLE CONFIGURATIONS

RECEPTACLE AND CONNECTOR -- LOCKING AND GROUNDING



20 A 125V 2-POLE, 3-WIRE NEMA L5-20 | 30 A 125V 2-POLE, 3-WIRE NEMA L5-30 | 30 A 120/208V 30Y 4-POLE, 5-WIRE NEMA L21-30 | 50 A 125V 2-POLE, 3-WIRE NEMA SS-1 | 50 A 125/250V 3-POLE, 4-WIRE NEMA SS-2



PLUG AND INLET -- LOCKING AND GROUNDING

Wiring: GR = green; W = white; Unmarked, X, Y, Z, = other colors, including black

Why would anyone be foolish enough to alter the "L" shaped "GR" terminal on the 20 or 30-amp, 2-pole, 3-wire plug? Only to be able to insert it into a 50 amp, 2-pole, 3-wire receptacle, which he or she may have wanted to do because all of the 20 amp or 30 amp receptacles on the dock are already occupied. If he or she gets the "GR" terminal of the plug into the "GR" terminal of the receptacle, there's no problem, except for having 67 percent too much amperage capacity on the line. If he or she does it wrong, someone could get a shock or worse.

On board, the green protective wire of the a.c. system is probably also connected to the d.c. negative terminal on or near the engine, in line with ABYC standard E-8. The purpose of this is to allow any leakage of a.c. current that may get into the d.c. ground by some minor fault, to get back to the shore "GR" terminal, rather than go into the water. Leakage of a.c. current into the water, even a very small amount not enough to open any circuit breakers, can create an electrical field around the boat which can be fatal to swimmers and divers. So, a.c. current into the green wire of the a.c. system due to an improperly inserted plug, can create big time problems on board the boat, and in the water. The a.c. receptacles in the head, galley and engine room should be equipped with ground fault circuit interrupters (GFCI) which will monitor the current flowing in the live and neutral conductors at the receptacle. If the current flow on the live and neutral conductor is not virtually the same (within 5 milliamps), the GFCI will interrupt the circuit. If the green wire is live or acting as a neutral conductor, the GFCI will open the circuit in both live and neutral conductors, *but not the green wire*, to which it is not connected.

A small percentage of patched up electrical connections may be seen during a stroll around the docks at some marinas: household extension cords, Y-connector cables to split a 50 amp receptacle into two 30 amp receptacles and various other "Rube Goldberg" adapters. Making the right connection to shore power for the boat is the responsibility of the skipper, not the dock operator. The yacht club in a major mid-west city thought so, but still found themselves as defendants in a lawsuit when a swimmer was electrocuted in the water behind a boat. The only thing that could be confirmed was that the 30 amp plug on the shore power cable from the boat had an altered "GR" terminal. Was it plugged into one of the 50 amp outlets in the dock box? It could be made to go in. No one knows, because the first thing they did when the electrical field in the water was detected, was to pull out the plug, and no one paid any attention.

SHORE POWER CORDS – PROPER USE AND MAINTENANCE

- All shore power cords should be rated suitable for Marine Use, or better still, "UL-Marine" listed for marine shore power applications.
- CAUTION -- Never use ordinary "outdoor use" extension cords to provide electrical shore power to the boat or any equipment, such as a battery charger on board the boat. These cords are not rated for and are not suitable for the severity of a marine environment. They can deteriorate and/or overheat causing electrical shock, a short circuit or a fire.
- All shore power cords should have male (plug) and female (connector) ends of the locking type. Make sure that plugs and connector are turned to the full locked position by pulling on them. If they are properly locked, they will not pull out. A plug or connector not properly locked will become loose, causing arcing (sparks) on the contacts, resulting in a failure, and possibly a fire.
- All male (plug) ends must be molded on or have weather-proof boots in order to provide a weatherproof seal when plugged into a receptacle.
- All female connector ends must have a locking ring to secure the power cord to the inlet on the boat and provide a weatherproof seal.
- Adapters should always be used at the shore end of a power cord.
- Always make sure that the "Main" circuit breaker on the boat is turned "OFF" before connecting or disconnecting the shore power cord,
- Always connect the female end of the cord to the boat before plugging the male end into shore power receptacle. Always disconnect the male end from the shore power receptacle before disconnecting the female end from the boat.
- Never leave a shore power cord on the dock with only the plug end connected. A live cord end is dangerous, especially if it accidentally falls into the water.
- Periodically check shore power cords for the following:

  • Cuts, cracks or severe abrasions on the yellow cord covering.

  • Bent, broken or loose plug blades.

• Plug blades or connector slots that show signs of overheating or arcing, such as:

☐ Brown or black discoloration on insulation around blades or slots.

☐ Discoloration and/or erosion of blade material

• Faulty locking rings due to cracking or damaged threads.

■ Do not allow cords to be pinched by a closed door or hatch. Pinch points create resistance and generate heat that can result in a fire.

■ Never coil a cord tightly on the dock. Such a coil acts as a heat generator and can cause a fire. Hang the cord loosely on a hook or support or lay it out in a loose coil of only a few turns.

■ Spray all contacts monthly with an electrical contact cleaner, corrosion inhibitor and lubricant, such as LPS-1 made by Holt Lloyd Corp. Please note that "WD-40" or silicone sprays are not appropriate because the film they leave increases contact resistance. The proper spray types can be found at electrical supply houses or stores such as Radio Shack.

■ If a shore power cord should become immersed in water, it should be immediately sprayed with fresh water, THOROUGHLY dried, and blades and contact slots sprayed with a moisture displacement before re-using.

Editor's Note: The preceding article, *"Shore Power Cords - - Proper Use and Maintenance"* is reprinted with the permission of the author, Mr. Bob Carlson, also a member of the American Boat and Yacht Council (ABYC) Electrical Project Technical Committee.

PROPELLER INJURY PROTECTION

In 1996, as part of an ongoing effort to reduce the incidence of propeller-related injuries and fatalities involving recreational boats, the Coast Guard awarded a boating safety grant to the Marine Technology Society to ascertain the "state-of-the-art" in propeller injury prevention devices. The findings of the earlier study revealed a number of devices being offered for sale ranging in sophistication from a simple ring surrounding the propeller to hydrodynamically advanced water jet propulsion systems. Essentially, no reliable information on the performance of these devices was available. Some of the significant concerns associated with the use of the devices were initial costs, possible losses in fuel economy, vessel maneuverability and human protection.

Therefore, in 1997, the Coast Guard awarded a second boating safety grant to quantify by field testing, the performance of a number of the devices identified in the earlier study. There were three primary areas of investigation:

(1) propulsion performance as exhibited by top speed, fuel economy, stopping time, acceleration time, and turning times;

(2) human protection improvement; and

(3) methods for safety enhancement other than propulsion system modifications.

Four different vessels using three propeller driven propulsion units and eight different guards or systems were evaluated in the field. Propeller guards, water jet propulsion, new propeller designs and the substitution of an axial jet for the propeller were all evaluated.

Note: While each of the devices/systems tested are available on the open market, each system type was not available for a wide range of engine horsepower ratings or for all brands of engines. All of the devices tested were "off the shelf" and no effort had been made by the manufacturers to optimize the device for the specific vessel and application.

All shielding devices and pump jet devices demonstrated a decrease in speed and economy performance when applied to planing vessels. Also, all of the devices, except the ring propeller and one of the ring guards demonstrated a decrease in stopping, turning and acceleration performance. All of the devices give some improvement in low speed human protection, but most of the devices offer a decrease in high-speed human protection.

None of the devices has the high degree of practicality in a wide range of operating environments (trash, weeds, shallow water, damage tolerance, etc.) as that established by an unguarded propeller. For planing vessels, the study concluded that some improvement in low-speed human protection can be achieved at the expense of decreased performance, decreased high speed protection and some decrease in practicality. The cost benefit ratio for using the tested devices on planing vessels is sensitive to both vessel type and operational environment.

When using shielding devices and pump jet devices on displacement vessels there is a small decrease in fuel economy, top speed, turning, stopping and acceleration performance. The decreased performance is small and not nearly as significant as the decrease for planing vessels. Since only low speeds are of interest for displacement vessels, the study concluded that all of the devices provide significant improvement in human protection. The practicality considerations are similar to those of planing vessels. For displacement

vessels, there are devices which offer significant improvement in human protection at small cost in performance, i.e., cages on rental houseboats. The device practicality is dependent on the operating environment.

Several methods other than propeller shielding have some potential for reducing the number of propeller injuries. The report concluded that the use of interlock devices and warning signs should enhance safety and possibly prevent some propeller injuries, but have a limited potential due to the difficulty of ensuring their use. Boating laws are effective only if compliance with the law can be measured easily. Since some, if not most, houseboat renters are inexperienced boaters, educational requirements for such operators emphasizing safety including propeller hazards should prevent some propeller injuries. The required use of a "person in the water" flag would raise awareness and help to develop a safety pattern that would prevent some propeller injuries. Since compliance with both of these requirements is easily observed even under casual observation, the report concludes that such requirements are enforceable. Additionally, if the penalty for noncompliance were significant, then their implementation could result in a completely new level of public awareness and concern. Therefore, the report concluded that boating laws requiring houseboat renter education and appropriate display of a "person in the water" flag should be developed and implemented.

Some ring guard designs had little or no cavitation/ ventilation problems, while others had major problems, particularly in high speed turns and during low speed accelerations. The report concluded that the detailed design/fabrication of ring guards is very important since attention to the details determines the performance of the device.

The centrifugal pumpjet has no effective rudder since there are no steerable components in the water. As a result, there is no off-throttle steering with this type of drive. The report concluded that there are serious operational hazards associated with centrifugal jet pump drives when being operated by untrained individuals (even if they have extensive experience with propeller drives).

The report also concluded that the ring propeller is effective only in relatively clean water conditions and the repair costs for propeller damage will be significantly higher than for conventional propellers.

The report, *"Propeller Injury Protection – An Evaluation of Commercially Available Protection Devices,"* is the result of a boating safety grant awarded to the Marine Technology Society. Copies are available from Commandant (G-OPB-3), U.S. Coast Guard, Washington, DC 20593-0001.

SALE OF FOREIGN-BUILT BOATS BY IMPORTERS

All recreational boats sold or offered for sale in the United States must bear two identical Hull Identification Numbers consisting of a U.S. Coast Guard assigned Manufacturer Iderntification Code (MIC). Personnel from the Recreational Boating Product Assurance Division recently visited several boat shows where they encountered a number of foreign-built recreational boats which had Hull Identification Numbers in the newly required International Organization for Standardization (ISO) format. While use of the ISO HIN standard is mandatory for use on all craft to be used in the European Common Market, and is optional for U.S. manufacturers who export, **foreign-built boats imported into the United States must bear Hull Identification Numbers consisting of a U.S. Coast Guard assigned MIC.**

According to 46 U.S.C. 4307(a)(1)(A)(i),

"A person may not . . . sell or offer for sale, introduce or deliver for introduction into interstate commerce, or import into the United States, a recreational vessel . . . unless -- it conforms with this chapter or a regulation prescribed under this chapter. . ."

According to 33 CFR 181.23(a),

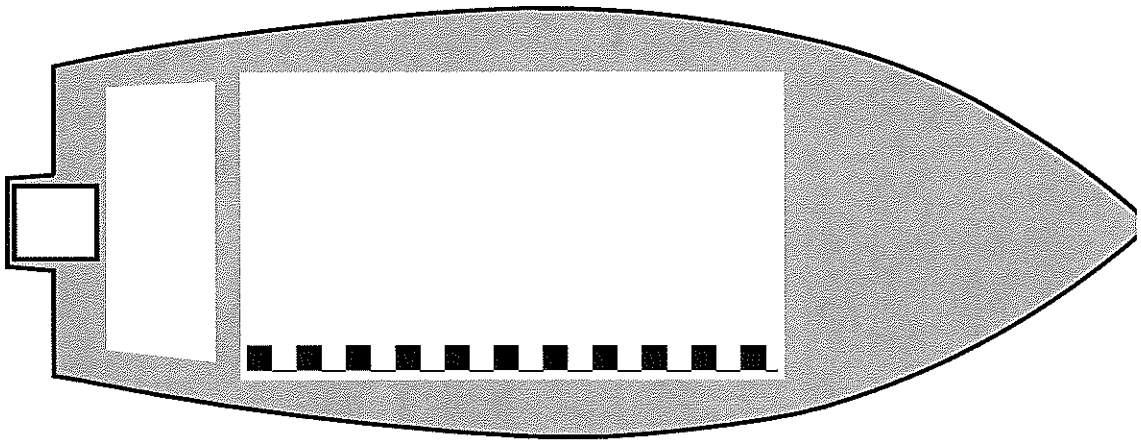
"A manufacturer (or importer) as defined in 181.3 of this part, must identify each boat produced or imported with two hull identification numbers that meet the requirements of this subpart."

The Coast Guard is one of several regulatory agencies which participated in the development of a Mutual Recognition Agreement (MRA) with the European Community (EC).

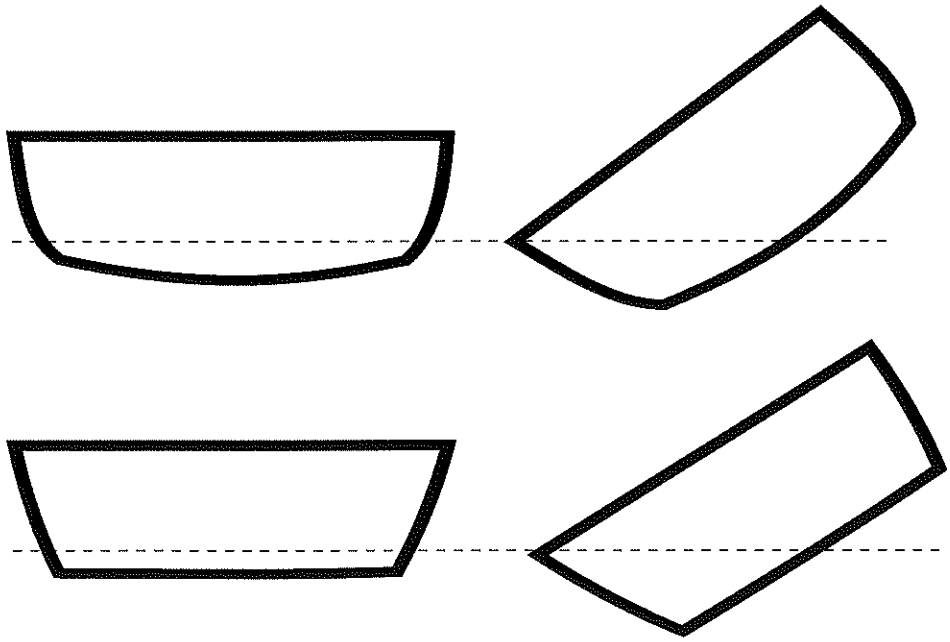
According to Section 2(b) of the Sectoral Annex for Recreational Craft (recreational boats), the EC has agreed that the relevant requirements for boats exported from Europe to the United States are any product falling under the scope of 46 U.S.C. Chapter 43; 33 CFR Parts 81, 84, 159, 179, 181, 183; and 46 CFR Part 58.

Therefore, boats exported from Europe must bear Hull Identification Numbers consisting of a MIC the U.S. Coast Guard assigned to the U.S. importer. Sale of a boat in the United States with an HIN consisting of the MIC another country assigned to a foreign manufacturer is prohibited.

WHAT IS THE MEANING OF THE TERM, OUTBOARD EXTREMITY OF EACH PASSENGER CARRYING AREA AS THE TERM IS USED IN SUBPARAGRAPHS 183.39(a)(2)(ii) and 183.41(a)(2)(iii) OF THE SAFE LOADING STANDARD?



WHAT IS THE MEANING OF THE TERM, UNTIL THE BOAT ASSUMES MAXIMUM LIST OR TRIM OR BOTH WITHOUT WATER COMING ABOARD AS THE TERM IS USED IN SUBPARAGRAPHS 183.39(a)(2)(ii) and 183.41(a)(2)(iii) OF THE SAFE LOADING STANDARD?



RADAR REFLECTORS - A GOOD WAY TO PREVENT COLLISIONS

Over the past few years all navigable waterways have experienced an increase in the number of users competing for access, but none more so than in coastal areas. Deep draft vessels have grown in size and number of transits; the inshore fishing fleet continues to be strong; confidence in our economy has prompted more people to purchase recreational craft, especially personal watercraft, and, more recently, there has been an increase in the number of high-speed ferries.

With the advent of improved radar technology and collision avoidance systems, mariners have increased their reliance on radar for navigation, especially when navigating in restricted visibility conditions. Radar is an effective navigational tool; however, for this technology to work effectively, a strong, repeatable radar return is required. Small vessels, especially those with non-metallic hulls, often go undetected on radar because of the weak radar returns they produce. A strong radar signature is vital for these vessels to reduce the risk of collision in low visibility conditions.

The most reliable way to ensure a strong radar signature is to provide flat metal surfaces well above the waterline, facing all directions. The easiest solution is to install a commercially available radar reflector at the highest point possible on the vessel. Although not a panacea because of their limited effectiveness, radar reflectors are highly recommended for all vessels of wood or fiberglass construction. They are readily available at marine supply stores and are relatively inexpensive. Radar reflectors come in many shapes and sizes and also have varying levels of effectiveness, so take some time to evaluate which one would be best suited for your particular vessel and boating environment.

NAVIGATION LIGHTS - BUYERS BEWARE

Navigation lights are essential to safe navigation at night. This has led some light manufacturers and some vessel operators to believe that having more lights or different lights will make your vessel more easily seen by other vessel operators. Actually, the Navigation Rules (COMDTINST M16672.2D) otherwise known as the "Rules of the Road," are very specific about the characteristics (color specifications and/or arcs of visibility) of navigation lights. Therefore, purchasers should avoid lights advertised as providing "an extra margin of safety" or as "an enhancement to their boat's existing navigation lighting system," because the use of such lights is a violation of the Navigation Rules.

According to Rule 20:

"The Rules concerning lights shall be complied with from sunset to sunrise, and ***during such times, no other lights shall be exhibited****, except such lights as cannot be mistaken for the lights specified in these Rules . . ."*

Rule 21 defines the placement and arcs of visibility for the various navigation light fixtures.

Annex I to the Rules requires certain color specifications and minimum intensities for navigation light fixtures to ensure their visibility.

The intent of these three requirements is to establish stand-alone positioning for the prescribed lights and to create distinctive navigation light patterns for various vessel types. **Conspicuity is improved only by correct placement and the use of bigger and brighter legal navigation lights.**

Finally, navigation lights are items of safety equipment. Boats offered for sale to the public which are equipped with navigation lights which do not meet applicable requirements in the Navigation Rules are subject to defect notification and recall.

CALL THE COAST GUARD INFOLINE

1-800-368-5647

FOR INFORMATION ON:

• REGISTERING OR DOCUMENTING A BOAT
• MANUFACTURER'S BOATING SAFETY RECALLS
• OPERATOR EQUIPMENT CARRIAGE REQUIREMENTS
• COAST GUARD APPROVED LIFEJACKETS
• BOATING SAFETY COURSES

U.S. Department of Transportation

United States Coast Guard

March 2001

Boating Safety Circular 82

COAST GUARD ADVISORY ON CARBON MONOXIDE HAZARD CAUSED BY GENERATOR EXHAUST GAS ACCUMULATIONS

Owners and operators of boats equipped with gasoline-powered generators with exhaust ports which exit through the transom beneath or near a swim platform should turn off their generators when passengers are on the swim platform or swimmers are in the water.

A September 2000 National Institute for Occupational Safety and Health (NIOSH) study of carbon monoxide deaths on Lake Powell in Arizona over the last 10 years showed seven fatalities involved houseboats with through-transom generator exhaust systems. A similar National Park Service (NPS) investigation found dangerous accumulations of carbon monoxide gases on houseboats with through-transom exhaust systems when the generator was running and exhaust fumes became trapped beneath the swim platform.

Carbon monoxide is a colorless, odorless and tasteless gas that accumulates rapidly. Carbon monoxide in high concentrations can be fatal in a matter of minutes. Unless the symptoms are severe, carbon monoxide poisoning is often misdiagnosed as seasickness; however, lower concentrations must not be ignored because the effects of exposure to carbon monoxide are cumulative and can be just as lethal.

Some houseboat transom designs consist of a recessed area amidships forward of the swim platform creating a cavity for engine and generator exhaust ports. When the generator is running the carbon monoxide gas buildup in this cavity, on or near the swim platform, and near the rear deck space is so high, that there is an imminent danger of death for anyone in or near the cavity for even a very short period of time.

The Coast Guard has conducted a preliminary investigation into the problem and has sent a letter to all known houseboat manufacturers informing them of the hazard and soliciting their ideas for reducing the danger.

The National Marine Manufacturers Association has published a pamphlet, "Carbon Monoxide Poisoning -- Know More About It," which is reprinted in this issue of the **Boating Safety Circular**. Pamphlets such as this, as well as other boater educational materials, have historically concentrated on carbon monoxide hazards created by the exhaust of the main engines while underway. Although these hazards still exist and need to be addressed, new educational materials need to be developed that include more emphasis on the additional carbon monoxide hazards of gasoline powered generators especially while a vessel is not underway.

While the NIOSH study and the NPS investigation were limited to houseboats, the problem can exist on any boat with a gasoline-powered generator exhaust port located adjacent to a swim platform on the transom. A common practice of running gasoline-powered generators to power air conditioning, entertainment centers and galley appliances while anchored or moored exacerbates the problem.

For that reason, all owners and operators of boats equipped with swim platforms and gasoline-powered generators with exhaust ports on the transom are advised to turn off their generators when their boats are at anchor or moored and passengers are on or near the swim platform or swimmers are in the water.

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RECREATIONAL BOAT FACTORY VISIT PROGRAM

On August 21, 2000 the Coast Guard Recreational Boating Product Assurance Division awarded a contract to Resource Network International (RNI) of Silver Spring, Maryland to train 14 Compliance Associates and to have them conduct approximately 1,000 factory visits annually.

The training, which was completed on December 14, 2000, covered Federal regulations and safety standards, voluntary standards such as those published by the American Boat and Yacht Council (ABYC) and Society of Automotive Engineers (SAE), compliance testing, procedures and policies, and manufacturer liaison. The purpose of the factory visit program is to emphasize the need to comply with Federal safety standards and regulations, to ensure each manufacturer understands the regulations and to assist manufacturers in certifying compliance with the regulations.

The first factory visit was conducted on January 8, 2001and authorized Compliance Associates from RNI will be contacting and visiting all recreational boat manufacturers and importers on a scheduled basis.

The factory visit program should lead to a heightened understanding of both Federal and voluntary safety standards and regulations, and thereby provide the public with safer recreational boats.

DEFECT NOTIFICATION AND RECALL CAMPAIGNS

Problem Descriptions:

Basic Flotation: Most inboard, inboard/ outdrive and jetdrive powered motorboats less than 20 feet in length are required to contain sufficient flotation so that some portion of the boat remains above the surface of the water if the boat is swamped. Boats with "Basic Flotation" problems will sink if they capsize or swamp.

Level Flotation: Most outboard powered motorboats less than 20 feet in length are required to float level when they are swamped and to support a certain percentage of the weight which they are rated to carry. Boats with "Level Flotation" problems do not float level when swamped.

Capacity Label Missing, Maximum Persons Capacity Overrated, Maximum Weight Capacity Overrated or Horsepower Capacity Overrated: Almost all motorboats less than 20 feet in length are required to bear a "U.S. Coast Guard Maximum Capacities" label. If the label is missing or the values are overrated, an operator who is unfamiliar with a particular boat may try to carry too much weight or, in the case of outboard powered boats, too much horsepower. Some insurance companies will not insure a boat that lacks the label or bears a label with incorrect information.

The recall list includes new campaigns as well as old ones. The new campaigns begun since December 1999, follow:

AMERICAN SUZUKI MOTOR CORPORATION

(Brea, CA)(990116T)
Year: 1998 and 1999
Models: DF60 and DF70
Units: 1,769
Problem: Shift rod connecting pin and clip may fall out; potential loss of shifting control

ARCTIC CAT, INC.

Thief River Falls, MN (010003T)
Year: 1999
Models: Tigershark 1100 LI
Units: 522
Problem: Throttle bodies may wear/corrode causing stiff throttle operation and return; may result in throttle remaining in open position; danger of collision

ARCTIC CAT, INC.
Thief River Falls, MN (000201T)
Year: 1997
Models: Tigershark:
Daytona 770 and 1000,
Monte Carlo 640, 770 &
1000
Units: 9,436
Problem: A crack may develop in base of fuel filler neck permitting liquid fuel or vapor leakage; possible fire/explosion if ignition source present

BACK COUNTRY BY CHAMPION
(Sarasota, FL)(991626S)
Year: 1996 - 1999
Models: 151 Pro Guide
Units: 55
Problem: Level Flotation

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000069T)
Year: 2000
Models: Speedster, Challenger & Islandia
Units: 1,216
Problem: Throttle may stick at high RPM; possibility of collision; fuel pickup neck may be too thin; possible fuel leakage may lead to fire/explosion

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000124T)
Year: 2000
Models: Sea Doo RX 5513 and 5514
Units: 1,112
Problem: Sponsons may loosen and fall reducing steering ability at high speed; possible danger of collision

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(0000125T)
Year: 2000
Models: Sea Doo RX DI and GTX DI
Units: 3,272
Problem: Possible fuel leak between direct air injector and fuel rail assembly; possible fire or explosion if ignition source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000087T)
Year: 2000
Models: GTX and GTX RFI
Units: 10,273
Problem: Fuel fill is adjacent to ventilation system opening and operator could inadvertently fill engine compartment with fuel; possible fire/ explosion if ignition source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000145T)
Year: 2000
Models: GTX, XP, RX DI, GTX DI, AND LRV (5513, 5514, 5544, 5545, 5646, 5649, 5651, 5653, 5655, 5656, 5659, 5669 and 5688)
Units: 3,476
Problem: Clip securing air intake silencer could release and allow gaskets to fall into throttle bodies; for DI (direct injection) models only, fogging tube inside air silencer could also be drawn into the rear throttle body; resulting in loss of speed control and possible collision

U.S. Department of Homeland Security
United States Coast Guard

September 2003

Boating Safety Circular 83

FUEL SYSTEM MAINTENANCE

YEAR	TYPE OF ACCIDENT	TOTAL	FATALITIES	INJURIES	PROPERTY DAMAGE
2001	Fire of Explosion of Fuel	153	2	73	$3,179,323
2000	Fire or Explosion of Fuel	183	2	93	$2,580,764
1999	Fire or Explosion of Fuel	222	2	125	$2,804,796
1998	Fire or Explosion of Fuel	202	4	90	$3,878,520
1997	Fire or Explosion of Fuel	160	0	76	$3,355,236

The numbers* speak for themselves. From 1997 to 2001 there were an average of 184 boating fires and explosions annually. Had more boat owners performed regular fuel system maintenance, many of these accidents could have been prevented.

Be alert for damage to your boat's fuel system. Over a period of time fuel fittings and fuel hoses wear out and must be replaced. Inspect fuel system fittings and hoses regularly, especially near the engine where engine heat can speed up deterioration.

• Inspect fuel tanks at least annually. Pay particular attention to bottom surfaces which may have been in contact with bilge water and any part of the tank which touches the boat structure. The tank could have rusted or been damaged due to rubbing and abrasion. Permanently installed fuel tanks should be vented to the outside of the hull and outside of closed compartments.

• Be sure the fuel fill pipe is tightly fitted to the fill plate. The fill pipe should also be located where any spilled fuel will be directed overboard. Look for fuel fill hoses that are dry and cracked or soft and mushy. Such hoses should be replaced with equivalent "USCG Type" or marine fuel hoses immediately. If a fuel hose or fuel tank is leaking, replace it before using your boat.

* Based on reported boating accidents. These figures do not include accidents involving only slight injury which did not involve medical treatment beyond first aid, or property damage less than $500.00.

• On a boat with portable fuel tanks, make sure the vents can be closed and that each tank has a vapor-tight, leakproof cap. The vent on a portable tank should be open when the engine is running, but when the tank is not in use, the vent and the cap should be tightly closed. Do not store portable fuel tanks in enclosed areas, including the engine room (even though it may be "ventilated").

• If the boat has powered ventilation (a bilge blower), make sure the blower operates. Verify good airflow at the vent located on the boat.

• Be sure heating and cooking appliances on board are secured and operate properly. Refer to the owner's manual for the appliance for guidance on inspecting for leaks in valves and connections; never use a match.

• Make sure flammable items are stowed safely and cannot come into contact with cooking or heating appliances or hot engine parts.

• Make sure Coast Guard approved fire extinguishers on board are in working order - that gauges register and that nozzles are clear. Take a boating safety course that teaches the correct use

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of a fire extinguisher aboard a boat. The time to learn is before a fire occurs.

• Look for bare wires or loose electrical connections. They might cause a short in your boat's electrical system, which could start a fire.

• Do not store small disposable propane cylinders or charcoal lighter fluid on board.

• Conduct a bow to stern inspection checking for fuel leaks, gas fumes and any malfunctioning instruments.

Before Casting Off --

"Sniff" your bilges. Usually your sense of smell is the best fuel/vapor detector. It means getting down on your hands and knees, but is the best way to do it.

Operate the bilge blower for at least four minutes before starting an inboard (or sterndrive) engine. If you still smell fumes, try to locate the source and make repairs before starting the engine.

Make sure your passengers know where fire extinguishers are located.

When refueling, close all hatches, ports and other openings; shut off all engines and motors; and refrain from smoking. Fill portable tanks on the dock.

After refueling, wipe up or wash off any excess fuel; open all hatches and ports; and let the boat air out. "Sniff" the boat's bilges. Operate the bilge blower for at least four minutes before starting an inboard or sterndrive engine.

Make these suggestions and regular engine and fuel system maintenance part of your boating routine.

COAST GUARD PUBLISHES FINAL RULE ON NAVIGATION LIGHTS

At the back of this issue of the **Boating Safety Circular** is a Final Rule covering navigation lights which was published in the Federal Register on November 1, 2001. The effect of the rule will be to require domestic manufacturers of vessels to install only certified navigation lights on all new uninspected commercial vessels and recreational vessels. This rule aligns the requirements for these lights with those for inspected commercial vessels and with requirements for all other mandatory safety equipment carried on board all vessels. A second Federal Register notice delays the effective date of the navigation light final rule until November 1, 2003.

The rule directs manufacturers of uninspected commercial vessels and recreational vessels to install only navigation lights certified and labeled as meeting the technical requirements of the Navigation Rules. It will standardize the navigation light requirement for uninspected commercial vessels and recreational vessels with the requirement for inspected commercial vessels.

Before April 1997, a manufacturer of navigation lights for uninspected commercial vessels and recreational vessels could voluntarily apply for a "Letter of Acceptance" from the U.S. Coast Guard for its light models. The Coast Guard would compare a laboratory report for each model sent by the manufacturer with the technical requirements of the International and Inland Navigation Rules (together referred to as the "Navigation Rules"). If the reported data indicated that the light met the requirements of the Navigation Rules, the Coast Guard would grant a "Letter of Acceptance," allowing the manufacturer to label the light as "U.S. Coast Guard Accepted." The public often interpreted the acceptance label as meaning that a light was "Coast Guard Approved."

To eliminate confusion, the Coast Guard stopped issuing Letters of Acceptance in April 1997. Consequently, vessel manufacturers, owners, surveyors, vessel inspectors, and boarding officials could rely only on a statement from the navigation light manufacturer that a model of light complied with the technical requirements of the Navigation Rules.

In 1997 the National Boating Safety Advisory Council (NBSAC)— representing operators and manufacturers of recreational vessels, State boating officials, and national boating organizations—and the National Association of State Boating Law Administrators (NASBLA) passed resolutions asking the Coast Guard to require that navigation lights installed on recreational vessels offered for sale to the public be certified. The Navigation Safety Advisory Council (NAVSAC) passed a similar resolution relating to uninspected commercial vessels. In the report, "Recreational Boat Collision Accident Research," Underwriters Laboratories recommended that the Coast Guard take stronger measures to ensure that navigation lights installed in recreational vessels meet the requirements established by the Navigation Rules.

The new requirement will provide evidence of compliance to vessel manufacturers, surveyors, owners, inspectors, and boarding officials. It includes the same requirements as those for navigation lights for inspected commercial vessels; however, the light test requirements are less stringent. It also aligns with the International Navigation Rule requirement (COLREGS) for "Approval" (33 CFR, subchapter D, Annex I). The rule does not apply to the replacement of existing navigation lights on vessels completed before the designated effective date.

Certification will place navigation lights under regulatory control comparable to that affecting all other items of mandatory safety equipment. This will result in a general improvement in reliability, quality, and effectiveness of domestic and imported lights available to domestic manufacturers of vessels.

With the addition of Subpart M - Navigation Lights as a new safety standard in 33 CFR Part 183, beginning on November 1, 2003 all U.S. boat manufacturers who install navigation lights and all U.S. importers of foreign-built boats with navigation lights installed must now affix the certification label required in 33 CFR 181.15.

This rule will discourage the practice of installing lights, custom-made or other, that are not compliant with the Navigation Rules. Navigation lights are safety equipment with the designated purpose of preventing collisions.

RECREATIONAL BOATING STANDARDS POLICY GUIDELINE: U.S. COAST GUARD COMPLIANCE TESTING

Periodically the Coast Guard contractor testing boats for compliance with the Display of Capacity Information, Safe Loading and Flotation Standards buys boats on the open market and physically tests them in a tank for compliance with the standards. Experience with the Coast Guard compliance test program has shown that there are certain procedures followed in the test lab that the regulations,the compliance guidelines and the test procedures do not explicitly describe. This Compliance Testing Policy Guideline explains those procedures.

SAFE LOADING TESTS

1. Openings Sealed During the Maximum Weight Capacity Test:

Background: In the Safe Loading Standard the test for the Maximum Weight Capacity (MWC) of an outboard powered boat (33 CFR 183.35) allows the boat manufacturer to seal only one (1) hole in the motor well (with a maximum dimension of three (3) inches) for outboard motor controls or fuel lines. Unfortunately, this penalizes boats with large drain holes and other openings.

Policy: The MWC is based on the gross volume of water displaced by the boat at its maximum level immersion. Therefore, the test lab will seal hull openings during the test for MWC except where specifically prohibited by the CFR or the compliance test procedures. The test lab will seal the following openings:

(1) all scuppers, freeing ports (with or without flaps) or back flow devices, regardless of size;

(2) drain holes in the bow;

(3) bait, fish, and anchor well fill/drain holes;

(4) holes in the motorwell with boots (in addition to the 3-inch hole already allowed by the regulations); and

(5) the hull-to-deck joint.

However, transom doors or equivalent may be open during normal boat use and are left open during testing. Drain holes or scuppers that may flood the boat during normal boat use are reviewed on a case by case basis, and may be considered major down flooding or water ingress points.

FLOTATION TESTS

1. Permanently Installed Fuel Tanks:

Background: During compliance testing, permanently installed fuel tanks must be filled with fuel. Due to the hazards of handling, storing, and testing with gasoline indoors, Coast Guard policy has allowed the test lab to substitute iron weights for the weight of gasoline. These iron weights are normally placed on top of the tank during testing, and the tank is left empty.

Policy: Weights equivalent to the weight of fuel are placed on the deck over the center of gravity of

the fuel tank. If the boat fails to comply with flotation requirements, then the iron weights are removed and the fuel tank is filled to three-fourths capacity with water. If the boat still fails to comply, then the tank is completely filled with water. If the boat still fails to comply, the Coast Guard will send the manufacturer a report describing the compliance test failure.

2. Time Allowed To Stabilize Between Flotation Tests:

Background: No duration is specified before a flotation compliance test is considered valid.

Policy: The time allowed for a boat to comply with the flotation safety standards is 15 minutes after all test conditions have been met, and the water levels inside and outside the boat are equal. If a boat is still bailing out or filling up with water at the end of 15 minutes, but is within passing test parameters, then the boat passes the test.

3. Flooded Wells (bait, anchor, and fish wells, coolers, etc.) During Flotation Tests:

Background: The regulations do not provide guidance on how to treat bait wells, anchor wells or coolers during tests for compliance with the Flotation Standard.

Policy: The lab will remove risers and drain plugs (if they can be removed) and let wells flood or drain during tests.

4. Trolling Motors and Flotation testing:

Background: Many boats sold today are equipped with mounting pads, battery locations, and electrical harnesses for trolling motors. In some cases, no flotation is installed for future installation of these devices.

Policy: If a boat is equipped or wired for a trolling motor, the lab will place weights from the table below at the normal operating positions of the trolling motor and battery during compliance testing. A least one dedicated battery is assumed for the trolling motor. If the actual weight of the trolling motor is known, or if the boat or trolling motor manufacturer provides the weight of the motor, the lab will use that weight, instead of the weight from the table below.

Trolling Motor Thrust In Pounds	Weight in Pounds (does not include batteries)*
40	12
50	23
60	34
70	50
80	56
90	68
100	79
110	90
120	101
130	112

* For battery weight see Table 4 of Subpart H

5. Kicker Engines and Flotation Testing:

Background: Some boats sold today are equipped with mounting pads, battery locations, and electrical harnesses for kicker engines. In some cases, no flotation is installed for future installation of these devices.

Policy: If a boat is equipped with a pad or wiring for a kicker engine, then the manufacturer should provide flotation for the swamped weight of the engine and controls. If the manufacturer does not provide a label on the boat specifying the horsepower of the kicker engine, then the lab will assume the kicker engine horsepower is 10 percent (10%) of the main engine's horsepower rating. Weights for the kicker engine will be obtained from Table 4 in Subpart H of 33 CFR Part 183, and placed in the location of the engine and battery. The kicker engine weight will not be subtracted from the maximum weight capacity to determine person's capacity.

UPDATE ON RECREATIONAL BOAT FACTORY VISIT PROGRAM

Since January 8, 2001, 14 Compliance Associates working under a Coast Guard contract for Resource Network International (RNI) of Silver Spring, Maryland have been conducting recreational boating factory visits. The purpose of the factory visit program is to emphasize the need to comply with Federal safety standards and regulations; to ensure each manufacturer understands the regulations; and to assist manufacturers in certifying compliance with the regulations.

The Recreational Boating Product Assurance

Division assigns all recreational boat manufacturers a three character Manufacturer Identification Code (MIC). Using the Coast Guard MIC database (see http://www.uscgboating.org/recalls/mic_database.htm) the RNI Compliance Associates are contacting and visiting all recreational boat manufacturers and importers on a scheduled basis.

The compliance associate (CA) usually contacts the manufacturer a couple of times before a visit. The first contact—a few weeks before a visit—is to arrange an inspection date, and to confirm information such as address and types of boats produced. The second contact—a few days before the visit—is to reconfirm the date and time of the visit.

Typically, a CA will ask to inspect current production and will look for:

1. Noncompliances with Federal regulations which are manufacturer requirements;
2. Noncompliances with Federal regulations which are operator requirements; and
3. Manufacturing practices for which voluntary industry safety standards and recommended practices are available.

At the end of the visit, which normally takes a couple of hours, the CA discusses the results with the manufacturer. Then the CA files a report with the Recreational Boating Product Assurance Division at Coast Guard Headquarters. Usually, for minor, non-safety-related problems, corrective action is limited to future production. Headquarters may also direct the manufacturer to conduct defect notification for any serious non-compliances with Federal safety standards.

The factory visit program should lead to a heightened understanding of both Federal and voluntary safety standards and regulations, and thereby provide the public with safer recreational boats.

PROBLEMS NOTICED IN THE FIELD:

1. Certification labels on products not subject to 33 CFR Part 181.

According to Section 181.5 **Purpose and applicability** of the Manufacturer Certification of Compliance regulations:

"This subpart prescribes requirements for the certification of boats and associated equipment to which 46 U.S.C. Chapter 43 applies and to which a safety standard in Part 183 of this chapter applies."

Some component manufacturers have interpreted this to mean that fuel pumps or gasoline generator sets, for example, must bear a manufacturer certification of compliance statement.

Part 183 of Title 33, Code of Federal Regulations prescribes the safety standards and regulations for: (1) boats; and (2) associated equipment to which certification requirements in 33 CFR Part 181 apply. Each of the safety standards in Part 183, from Subpart B through Subpart L, contains an applicability section. With the exception of Subpart L, all the subparts in Part 183 apply to **boats.**

For example, Subparts B through H of Part 183 apply to certain **monohull boats** less than 20 feet in length; Subparts I and J apply to all **boats** that have gasoline engines, except outboard engines, for electrical generation, mechanical power, or propulsion; and Subpart K applies to all **boats** that have gasoline engines for electrical generation, mechanical power, or propulsion. Subpart L, on the other hand, applies to outboard motors and starting controls, and is the **only** subpart in Part 183 that currently applies to associated equipment. Had the Coast Guard intended to regulate electrical generators or other pieces of associated equipment, we would have done so as we did with outboard motors and starting controls. That is to say, we would have done so in a separate subpart.

Sections 183.405 of Subpart I and 183.507 of Subpart J of Part 183 do specifically state that each electrical component on a boat and each fuel system component on a boat subject to those subparts must meet the requirements of the Electrical and Fuel System Standards. Boats subject to those subparts, however, only include boats in their original, manufactured form. As evidence of this, 33 CFR 181, which prescribes requirements for the certification of boats and associated equipment, defines associated equipment as: "any system, part, or component of a boat **as originally manufactured** ..."

If, for example, a gasoline fueled electrical generator set is part of a boat as originally manufactured, then the certification of the boat as a unit indicates certification of the generator set, and the generator set itself is not required to be certified. Alternatively, if the generator set is installed in a boat as an after-market component, then it is not included in the certification of the boat as a unit.

Subpart B of Part 181 of Title 33, Code of Federal Regulations requires a boat manufacturer to certify that each boat is in compliance with applicable Coast Guard safety standards in Part 183 when it is sold to the public. In so doing, the boat manufacturer is certifying that all of the components on the boat meet the requirements of the regulations. Therefore, manufacturers of components such as gasoline fuel pumps or gasoline powered generator sets should certify to their customer, the boat manufacturer, on an invoice or other document, that their components will not adversely affect a boat's compliance with the regulations.

If some time in the future the Coast Guard were to begin compliance testing of electrical or fuel system components installed on boats, we would expect the components to pass. If they did not, the boat manufacturers would be required to conduct recall campaigns, and would probably look to the component manufacturers for compensation.

The Coast Guard does not keep files on associated equipment known to comply with the regulations. Also, while there currently is no regulatory requirement for manufacturers to maintain records about the compliance of equipment they are installing, our compliance associates may ask a boat manufacturer to show evidence that a component has been certified by the manufacturer.

Finally, manufacturers of products other than boats, outboard engines and starting controls should be aware that Chapter 639 of Title 14, United States Code states, in part, that "No individual, association, partnership, or corporation shall, without authority of the Commandant, use the combination of letters "USCG," ... or any combination or variation of such letters or words ... by way of advertisement to induce the effect of leading the public to believe ... that any project or business in which he or it is engaged, or product which he or it manufactures, deals in, or sells, has in any way been endorsed, authorized, or approved by the Coast Guard. Every person violating this section shall be fined not more than $1000, or imprisoned not more than one year, or both."

Therefore, unless the Coast Guard grants permission to use the term "U.S. Coast Guard," display of a certification label meeting the requirements of 33 CFR Part 181 on a product other than a boat is improper and illegal.

2. Fuel System Pressure Test. Sec. 183.542 Fuel systems.

(a) Each fuel system in a boat must have been tested by the boat manufacturer and not leak when subjected to the greater of the following pressures:

(1) Three pounds per square inch; or

(2) One and one-half times the pressure created in the lowest part of the fuel system when it is filled to the level of overflow with fuel.

(b) The test pressure shall be obtained with air or inert gas.

This section requires a test of the entire fuel system, up to the engine fuel inlet. The engine fuel inlet may be a fuel filter, fuel pump or carburetor, depending upon what components are supplied with and mounted on the engine.

The entire fuel system includes:

- Fuel fill(s)
- Fuel vent(s)
- Fuel tank(s)
- Fuel distribution line(s)

Compliance associates have reported that some factories perform the test by clamping or pinching the fuel vent line where it attaches to the vent fitting. This is not an acceptable industry practice. The vent fitting must be plugged on the exterior of the boat.

If manufacturers are having problems with vent fittings that can't be plugged, then we recommend that they find another fitting supplier or find a unique way to plug the fitting. If component suppliers are getting fancier with their fittings and making it difficult for boat manufacturers to properly conduct the pressure test as required, then let the market fix the problem - don't buy vents that can't be plugged.

3. Grounding of Fuel Systems on Boats with Metal Hulls. Sec. 183.572 Grounding.

Each metallic component of the fuel fill system and fuel tank which is in contact with fuel must be statically grounded so that the resistance between the ground and each metallic component of the fuel fill system and fuel tank is less than 100 ohms.

Fuel flowing from the dispensing nozzle into a fuel tank is a potential source of a static electric charge which could cause a spark between the dispensing nozzle and a metal component of the fuel tank fill system. To prevent such a spark from occurring, metallic components of the fuel tank fill system and metallic fuel tanks must be grounded. Grounding or bonding may be accomplished by connecting the metallic components electrically by running a wire from one component to the next, and so forth to the boat's ground. Grounding can usually be accomplished by a connection to the common bonding conductor or the engine negative terminal.

But what about grounding the fuel system on a boat with a metal hull, twin inboard engines and both AC and DC electrical systems?

One builder asserted that since both engines were grounded to the aluminum hull, they did not need a bond wire between the blocks. However, since the boat also had an AC electrical system on board, this was not the case and improper installation could have resulted in a potentially fatal situation.

When properly installed, AC systems and DC systems are connected at the same point, usually the ground to the engine block or to a common ground buss. They should not be grounded anywhere else on the boat.

Improper grounding creates a serious hazard to the boating community. If the ground is connected to the metal hull, a serious shock hazard exists should a ground fault occur in the primary conductor (the black wire) or the grounded conductor (also called the neutral or white wire) in the AC system. When this ground fault occurs, 110 volts is impressed on the metal hull. Anyone touching the hull or any metal on the boat that is connected to the hull could be electrocuted to death. In addition, a current is created in the water surrounding the boat, and anyone swimming nearby will receive a potentially fatal shock. If not electrocuted to death, the swimmer will be paralyzed by the AC current and drown.

The most common reason for this hazard is the use of household appliances aboard a metal-hulled boat. In household appliances, the green grounding wire and the white neutral wire are connected inside the appliance. If household appliances are installed on a boat and the two wires are not disconnected, a ground fault will occur as discussed above.

If the engines are grounded to the hull then that ground must be disconnected. Grounded cranking motor circuits must also be connected to each other by a common conductor circuit that can carry the starting current of each of the grounded cranking motor circuits. We recommend that builders follow the American Boat and Yacht Council Standards for installing both DC and AC systems.

If a boat has only a DC system, grounding the engines to the hull would not present a danger of shock hazard should a ground fault occur in the DC system. With a locked rotor condition in one of the starters or should the windings in the armature short out, the hull would provide a path to ground. The only problem would be stray currents causing corrosion to the metal hull. Stray current corrosion is not a safety problem and is not covered by the Coast Guard safety standards.

DEFECT NOTIFICATION AND RECALL CAMPAIGNS

Problem Descriptions:

Basic Flotation: Most inboard, inboard/outdrive and jetdrive powered motorboats less than 20 feet in length are required to contain sufficient flotation so that some portion of the boat remains above the surface of the water if the boat is swamped. Boats with "Basic Flotation" problems will sink if they capsize or swamp.

Level Flotation: Most outboard powered motorboats less than 20 feet in length are required to float level when they are swamped and to support a certain percentage of the weight which they are rated to carry. Boats with "Level Flotation" problems do not float level when swamped.

Capacity Label Missing, Maximum Persons Capacity Overrated, Maximum Weight Capacity Overrated or Horsepower Capacity Overrated: Almost all motorboats less than 20 feet in length are required to bear a "U.S. Coast Guard Maximum Capacities" label. If the label is missing or the values are overrated, an operator who is unfamiliar with a

particular boat may try to carry too much weight or, in the case of outboard powered boats, too much horsepower. Some insurance companies will not insure a boat that lacks the label or bears a label with incorrect information.

The recall list includes new campaigns as well as old ones. The new campaigns begun since January 2002, follow:

AMERICAN HONDA MOTOR CORP.
(Torrance, CA)(020129T)
Year: 2002
Models: ARX1200T3 with HINs:
HPSA0001J102 to HPSA3548J102
ARX1200N3 with HINs:
HPSB0001J102 to HPSB1506J102
Units: 5,037
Problem: Bearings within throttle body subject to corrosion; throttle may not return to idle position; possibility of collision

AMERICAN HONDA MOTOR CORP.
(Torrance, CA)(030056T)
Year: 2002 & 2003
Models: Honda 200 & 225 HP Outboard Motors:
2002 BF200 w/ serial nos.:
BAEJ-1000001 to BAEJ-1000969
BAFJ-1000001 to BAFJ-1000222
2003 BF200 w/ serial nos.:
BAEJ-1100001 to BAEJ-1100708
BAFJ-1100001 to BAFJ-1100120
2002 BF225 w/ serial nos.:
BAGJ-1000001 to BAGJ-1003344
BAHJ-1000001 to BAHJ-1000601
2003 BF225 w/ serial nos.:
BAGJ-1100001 to BAGJ-1101489
BAHJ-1100001 to BAHJ-1100662
Units: 5,805
Problem: Potential interference between wire harness and throttle body may lead to short circuit which blows a fuse, stops the engine or overheats the throttle cable; throttle could stick; possible collision

BAYLINER MARINE CORP.
(Everett, WA)(030085T)
Year: 2002 & 2003
Models: 2109 and 209 Deck Boats
Units: 40
Problem: (See Blue Sea Systems on next page)

BOMBARDIER RECREATIONAL PRODUCTS
(Sturtevant, WI)(020082T)
Year: 2001 & 2002
Models: 2001 Utopia 185 models:
5452, 5454, 5456 and 5458
2001 Challenger 2000 model 5448
2002 Utopia 185 & 205 models:
5462, 5475, 5476 and 5745
2002 Islandia model 5709
Units: 473
Problem: Engine wiring harness has three exposed wires (one of which carries battery voltage); possible spark if battery wire contacts metal while engine is running; possible fire/explosion if fuel or vapor source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(030010T)
Year: 2003
Models: Sportster 4-TEC Sport Boats
Model 5770 w/ HINs:
US-CEC55000L203 -
US-CEC55183A303
Model 5768 w/ HINs:
US-CEC65001L203 -
US-CEC65055A303
Units: 178
Problem: Fuel tank air vent nipple might have been deformed during clamp torquing procedure; potential fuel leak; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS
(Sturtevant, WI)(020153T)
Year: 2002
Models: Utopia 185 and 205 Sport Boats
Units: 437
Problem: Starboard and/or port console may come loose. If starboard console comes loose, operator might lose steering/control causing danger of collision. If port console comes loose handhold may separate from deck causing passengers to lose balance

BLUE SEA SYSTEMS
(Bellingham, WA)(030062T)
Year: 2002 & 2003
Models: T-1 Thermal Circuit Breakers:

Part Number	Amperage	Part Number	Amperage
7120	25	7020	25
7121	30	7021	30
7122	35	7022	35
7123	40	7023	40
7124	50	7024	50
7125	60	7025	60
7126	70	7026	70
7127	80	7027	80
7128	90	7028	90
7129	100	7029	100
7130	110	7030	110
7131	120	7031	120
7132	135	7032	135
7133	150	7033	150

shipped to the following OEM purchasers:

Atlas Boat Works, Inc.
Beneteau Mfg. USA, Inc.
BH Electronics, Inc.
Carver Boat Corp.
Chantiers Beneteau SA
Chuckhouse, Inc.
Cruisers Yachts
Davis Boats
Endeavor Catamaran
Ennals Ives
Fleet Safety Supply
Florida Bow Thrusters
Good Automatic Windlass
Harken, Inc.
Hells Bay Boat Works
High Tech Marine, Inc.
Hinckley Company
Ideal Windlass Co., Inc.
Ironwind, Inc.
DBA Moose Boats
M & G Electronics Corp.
Marintek
Medeiros Boat Wks. Ltd.
Nordic Tugs, Inc.
Novatron Corporation
Ocean Technologies
Pacer Marine
Pacific Mariner, Inc.
Pacific Trawlers NW
Regal
S2 Yachts, Inc.
Sabre Corp.
Safe Boat
Scandik, Inc.
Sea Ray - Merritt Is.
Sea Sport Boats, Inc.
Sea Vee Boats
Seaward Products
Seawolf Marine Mfg.
Sharpe Marine
Silver Ships, Inc.
Silverton Marine Corp.
Team Supreme
Thoroughbred Cruisers
Thunderbird Products
TOMCO Marine Group
Trans Fbgls. Boat Co.
Tri Tec Systems, Inc.
US Marine Corp.
WESCO (non-marine vehicle market)
Wood Mfg. Company
DBA Ranger Boats

Units: 54,193
Problem: Potential fire risk if circuit breaker handle is held in the "on" position after the unit is tripped and the circuit breaker contacts weld together; if the contacts weld and the short circuit is not corrected, heat may be generated that may damage attached or adjacent wiring; possible fire/explosion if fuel or vapor source present

LIFE JACKET RECALL

SOSpenders Corporation of Fruitland, Idaho is recalling approximately 7,200 automatic inflatable personal floatation devices (PFDs). Approximately 300 defective Hammar units in one lot of 500 were loaded incorrectly and will not inflate the vest. SOSpenders Corp. has made the decision to recall all Hammar products for 100% safety inspection.

This unit malfunction was discovered by SOSpenders in-house testing and immediately communicated to the appropriate individuals to take corrective action. SOSpenders has received no reports of units malfunctioning. No injuries have been reported.

The PFDs have the brand name SOSpenders. The affected PFDs can be identified by a Yellow Hammar MA1 Manual/Automatic Inflator Cap:

The recalled vests include the following items and part numbers:

8030264 STD 38 MILLENIUM-WM 38HSTDM-W (PFD)

8030265 HAR 38 MILLENIUM-WM 38HHARM-W (PFD)

8030266 STD 38 MILLENIUM 38HSTDM (PFD)

8030267 HAR 38 MILLENIUM 38HHARM (PFD)

8030233 REARM 38 AUTO HAMMAR CMH38ARP (ACCESSORY)

8030313 COMMERCIAL VEST SOLAS F1 38CMH (PFD)

8030315 TACT VEST W/POC-AUTO HAM 38HTV/9-CG (PFD)

8030354 MILLENIUM ,AUT, LNG, BLK 38HSTDM/7 (PFD)

8030318 PRO 38 MILLENIUM 8HPROM (PFD)

8030268 TACT VEST W/POC-AUTO HAM 38HTV/9 (PFD)

8030316 ULTRA LITE 38 HAMMAR 38HUL/9 (PFD)

Consumers should stop using the vests and immediately.

(1) Follow the procedures provided by SOS at their website www.sospenders.com and click on "recall."
(2) Contact SOSpenders customer service department at 1-800-858-5876 8:00 a.m. and 5:00 p.m. PST Monday through Friday for shipping instructions.

SOS, Inc. indicated that approximately 300 defective Hammar inflators in one lot of 500 were assembled incorrectly and will not inflate the PFD with CO2 gas either automatically or manually. Only oral inflation of the PFDs with the incorrectly assembled inflators will provide any buoyancy to the user.

Since there may be a significant risk of drowning if these PFDs are not inflated, SOS, Inc. has made the decision to recall all products using the Hammar inflator for a 100% safety inspection. SOS, Inc. will apply an additional marking on each inflator that passes this inspection.

The Coast Guard points out that this recall demonstrates why it is so **important for consumers to register their inflatable PFDs or any consumer product with the manufacturer**. When a safety recall such as this is necessary, the manufacturer must have a registration on file to effectively contact affected consumers in a timely manner.

Unfortunately it appears that less than five percent (5%) of owners have registered their inflatable PFDs. Therefore the Coast Guard strongly recommends that consumers always fill out and return the consumer registration card; regardless of the product. Such action promotes safety and provides econonic protection. Fortunately, it appears that West Marine, which sold most of these PFDs to recreational boaters, can identify about 75 percent (75%) of their customers. The affected PFDs have the brand name SOSPENDERS. These PFDs ımar MA1, Manual/Automatic Inflator Cap (see Figure 1):

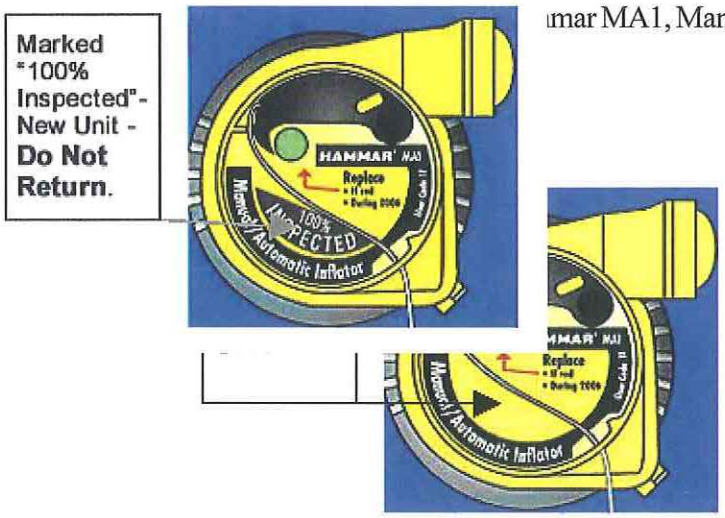

Figure 1

BOMBARDIER MOTOR CORP. OF AMERICA
(Waukegan, IL)(020139T)
Year: 2002
Models: 25 & 30 HP Johnson Outboards
Units: 1,046
Problem: Due to shift linkage misadjustment engines might not have start-in-gear protection

BOMBARDIER RECREATIONAL PRODUCTS
(Sturtevant, WI)(020185S)
Year: 2002
Models: Fish Hawk 170CC, 180CC, 210CC, 230CC, 210WA, 230WA, 200BF & 220BF Sport Boats
Units: 465
Problem: Improper fuel hoses between the fuel tank, squeeze bulb, fuel filter and engine

CRESTLINER, INC.
(Little Falls, MN)(020206S)
Year: 2001 & 2002
Models: 2001 & 2002 Sportfish 1850 and Superhawk 1800 and 2002 Eagle 2300
Units: 1,217
Problem: Fuel tank hold down brackets may dig into top surface of tank during expansion causing fuel leak; possible fire/explosion if ignition source present

CRUSADER ENGINES
(Sterling Heights, Michigan)(020198S)
Year: 2002 & 2003
Models: 5.0L MPI w/ aluminum hood and 5.7L MPI w/ aluminum hood
Units: 425
Problem: Possible arcing or open flame at the coil wire connection to the ignition coil and/or distributor cap; possible fire/explosion if fuel or vapor source present

CRUSADER ENGINES
(Sterling Heights, Michigan)(030013S)
Year: 2002 - 2003
Models: 8.1L MPI STD
8.1L MPI HO
Units: 218
Problem: Fuel line connections at fuel rail may not be fully locked into place; potential fuel leak; possible fire/explosion if ignition source present

DAVE'S CUSTOM BOATS
(El Cajon, CA)(02R0360S)
Year: Models delivered prior to 12/02/02
Models: 22 Extreme, 24 Extreme, 28 Extreme, Mach 22, Mach 26, Mach F-26 and Mach F-34 delivered prior to 12/02/02
Units: 213
Problem: Metallic objects can contact ungrounded battery terminals; positive terminal of starter not protected against shorting

GATOR BOATS
(Sullivan, MO)(02R0300S)
Year: 2001
Models: 2060
Units: 54
Problem: Inadequate opening/duct sizes in natural ventilation system

GLASTRON BOATS
(Little Falls, MN)(030063T)
Year: 2003
Models: GX 225
Units: 95
Problem: Operator and passenger seat bases might not be properly installed; possible personal injury to user

JERSEY MARINE INDUSTRIES
(West Berlin, NJ)(02R0362S)
Year: 2003
Models: Silverhawk
Units: 44
Problem: Metallic fuel fill not grounded

KOHLER CO.
(Kohler, WI)(030088T)
Year: 1950 - 1989
Models: L600 or L654 gasoline engines: 2R, 2A, 2.5R, 2.5A, 3.5R, 3.5A, 4R, 4A, 5R, 5A, 6.5R, 6.5A, 7.5R, 7.5A
Problem: Failure of the black iron wet exhaust pipe may cause carbon monoxide poisoning

LARSON BOATS
(Little Falls, MN)(030060T)
Year: 1999 - 2003
Models: Cabrio 333
Units: 90
Problem: Isolation bulkheads not properly sealed and fuel vapors could reach areas containing electrical equipment; possible fire/explosion if ignition source present

MAXUM MARINE
(Salisbury, MD)(020202T)
Year: 2000 & 2001
Models: 2955 SCR Sun Cruisers
Units: 453
Problem: Isolation bulkheads not properly sealed and fuel vapors could reach areas containing electrical equipment; possible fire/explosion if ignition source present

PLEASURECRAFT ENGINE GROUP
(Little Mountain, SC)(020196S)
Year: 2002-2003
Models: 5.7/5.0L MPI w/ serial nos.
420733 - 430688
Units: 1093
Problem: Internal lead in coil wire not positioned correctly; possible fire/explosion if fuel or vapor source present

POLARIS INDUSTRIES, INC.
(Medina, MN)(020091T)
Year: 2002
Models: Virage i & Virage TXi Personal Watercraft
Units: 3,458
Problem: Some fuel tanks may have a hole under the fuel pump retaining nut threads; possible fire/explosion if ignition source present

RINKER BOAT CO., INC.
(Syracuse, IN)(02R0311S)
Year: 2002
Models: 212 Captiva
Units: 1,081
Problem: Insufficient blower capacity in powered ventilation system

SEA MAX
(Little Mountain, SC)(020197S)
Year: 2002-2003
Models: 5.7/5.0L MPI w/ serial nos.
225050 - 225200 - Model Year 2002
235026 - 235051 - Model Year 2003
Units: 50
Problem: Internal lead in coil wire not positioned correctly; possible fire/explosion if fuel or vapor source

SPLENDOR BOATS
(Silver Lake, IN)(02R0259S)
Year: 1998 - 2001
Models: 240 Platinum
Units: 79
Problem: Inadequate natural and powered ventilation systems; battery switch not ignition-protected

SUMERSET CUSTOM HOUSEBOATS
(Somerset, KY)(020189T)
Year: 1992 - 1999
Models: Various
Units: 252
Problem: Shore power service circuit breakers on boats with dual shorepower option improperly wired

TRACKER MARINE L.P.
(Springfield, MO)(030015T)
Year: 2003
Models: Bass Buggy 18
produced 9/3/02 - 2/25/03
Fishin Barge 21
produced 8/10/02 - 2/25/03
Fishin Barge 25
produced 8/10/02 - 2/25/03
220F, Grn, Blu
produced 8/10/02 - 2/25/03
240F, Grn, Blu
produced 8/10/02 - 2/25/03
Units: 762
Problem: Incorrectly installed fuel feed fitting; potential fuel leakage; possible fire/explosion if ignition source present

TRACKER MARINE L.P.
(Springfield, MO)(021065S)
Year: 2003
Models: Laker 14 & 1436AWS
Units: 541
Problem: Level Flotation

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(030115T)
Year: 2003
Models: SR230 (SRT1000-B and C-B) Sport Boats
Units: 452
Problem: Hose clamps on fuel tank vent hose and fuel tank vent check valve cannot be tightened to proper specification and fuel tank vent check valve may have burrs on plastic fittings which could prevent proper sealing allowing vapor to escape; possible fire/explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(020072T)
Year: 2002
Models: GP1200A-A ("GP1200R")
XA1200A-A ("XL1200")
XA800A-A("XLT800")
Units: 2,097
Problem: Fuel sender assembly not adequately clamped to its rubber fuel tank fitting allowing vapor to escape; possible fire/explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(020128T)
Year: 2002
Models: FX1000-A & FX1000C-A
Units: 3,666
Problem: Fuel pump module not sealed properly to fuel tank surface; potential for vapor to escape; possible fire/explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(020176T)
Year: 2002
Models: FX1000C-A (FX140)
Units: 6,459
Problem: Wire harness inside air cleaner case may interfere with throttle linkage and keep throttle open; danger of collision

YAR-CRAFT, INC.
(Menominee, MI)(021067S)
Year: 2001
Models: 1785 Wrangler DC
Units: 48
Problem: Level Flotation

The following are the other campaigns still in progress that began before January 2002:

AMERICAN SUZUKI MOTOR CORP.
(Brea, CA)(010159T)
Year: 2001 & 2002
Models: 2001 DF90 with serial nos.:
09001F-151013 through 152573
2001 DF115 with serial nos.:
11501F-151046 through 153960
2002 DF90 with serial nos.:
09001F-251066 through 251077
2002 DF115 with serial nos.:
11501F-251257 through 251314
2002 DF115 with serial nos.:
11501F-251527 through 251540
Units: 2,701
Problem: Under rapid acceleration clutch rod may contact steering bracket bending clutch rod; clutch shaft holder may break causing loss of shift control; possibility of collision

ARCTIC CAT, INC.
Thief River Falls, MN (010003T)
Year: 1999
Models: Tigershark 1100 LI
Units: 522
Problem: Throttle bodies may wear/corrode causing stiff throttle operation and return; may result in throttle remaining in open position; danger of collision

ARCTIC CAT, INC.
Thief River Falls, MN (000201T)
Year: 1997
Models: Tigershark:
Daytona 770 and 1000,
Monte Carlo 640, 770 & 1000
Units: 9,436
Problem: A crack may develop in base of fuel filler neck permitting liquid fuel or vapor leakage; possible fire/explosion if ignition source present

BACK COUNTRY BY CHAMPION
(Sarasota, FL)(991626S)
Year: 1996 - 1999
Models: 151 Pro Guide
Units: 55
Problem: Level Flotation

BAJA BOATS INC.
(Bucyrus, OH)(970122T)
Year: 1997 & 1998
Models: 1997: 232, 252, 272, 302, 192 Islander, 212 Islander, 232 Islander, 252 Islander, 272 Islander, 24 Outlaw, 32 Outlaw, 38 Special, 29 Outlaw (Single), 29 Outlaw (Twin), Hammer, 36 Outlaw
1998: 272, 322, 212 Islander, 232 Islander, 252 Islander, Hammer, 29 Outlaw (Twin), 38 Special, 36 Outlaw
Units: 353
Problem: Captains Call exhaust wiring routed too close to engine; insulation may melt causing a short circuit; possible fire/explosion if fuel or vapor source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000145T)
Year: 2000
Models: GTX, XP, RX DI, GTX DI, AND LRV (5513, 5514, 5544, 5545, 5646, 5649, 5651, 5653, 5655, 5656, 5659, 5669 and 5688)
Units: 3,476
Problem: Clip securing air intake silencer could release and allow gaskets to fall into throttle bodies; for DI (direct injection) models only, fogging tube inside air silencer could also be drawn into rear throttle body; loss of speed control and possible collision

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000124T)
Year: 2000
Models: Sea Doo RX 5513 and 5514
Units: 1,112
Problem: Sponsons may loosen and fall reducing steering ability at high speed; possible danger of collision

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(980165T)
Year: 1998
Models: Speedster and Challenger 1800 jetboats
Units: 2,265
Problem: Seat swivel plates may crack or break; operator or passengers may fall; potential for injury

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000087T)
Year: 2000
Models: GTX and GTX RFI
Units: 10,273
Problem: Fuel fill adjacent to ventilation system opening; operator could inadvertently fill engine compartment with fuel; possible fire/explosion if ignition source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000125T)
Year: 2000
Models: Sea Doo RX DI and GTX DI
Units: 3,272
Problem: Possible fuel leak between direct air injector and fuel rail assembly; possible fire or explosion if ignition source present

GLASTRON BOATS
(Little Falls, MN)(010093S)
Models: I/O powered:
1999-2001 175SX
2000-2001 185SX
2000-2001 195SX
2000-2001 205SX
Units: 4,464
Problem: Basic Flotation

GRAND BANKS YACHTS LTD.
(Norwalk, CT)(010161T)
Year: 1999 - 2001
Models: East Bay 49 with hull nos.: 001-015, 017-035, 042 and 043
Grand Banks 66 with hull no.: 002
Units: 38
Problem: Seal housing on propeller shaft may crack in cold weather allowing water to enter engineroom

HAMILTON JET
(Seattle, WA)(000197T)
Year: 1998
Models: HJ212 steering assemblies with serial nos.: 0001-2114
HJ213 steering assemblies with serial nos.: 0001-0299
Units: 1,261
Problem: Cracks in steering nozzle; possible steering failure and danger of collision

HAMILTON JET
(Seattle, WA)(000085T)
Year: 1998 & 1999
Models: HJ 212 with serial nos. 964 - 1774
HJ 213 with serial nos. 001 - 234
Units: 676
Problem: Flange inserts on some jet units are oversized and may become stiff or stick under certain circumstances; possible steering failure and danger of collision

HARRIS KAYOT
(Fort Wayne, IN)(000248T)
Year: 1998 - 2001
Models: Pontoon boats equipped with Mercury Outboards with the following last four characters in their HINs: K798 - J001.
Units: 1,081
Problem: Wire on ignition interrupter switch may not be connected; emergency shutoff switch might not operate

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(000225T)
Year: 1999 & 2000
Models: JH 1200-A1 AND JH 1200-A2
Units: 8,749
Problem: On 1999 JH 1200-A1 and 2000 JH 1200-A2, end of fuel tank vent hose can drop into engine compartment, if incorrectly installed during vessel pre-sale setup or during service involving steering column. Pressure buildup in tank can expel gasoline or fumes from vent hose into engine compartment. Also, under certain conditions, with vent hose in correct position, fuel can be expelled onto deck and run into engine compartment; possible fire/explosion if ignition source present.

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(990186T)
Year: 1998 & 1999
Models: 1998 JT1100-B1 (7,986 units)
1998 JH1100-A3 (5,982 units)
1999 JT900-B1 (3,097 units)
1999 JT1100-B2 (4,193 units)
1999 JH1100-A4 (1,982 units)
Units: 23,240
Problem: Engine backfire can rupture fuel pump diaphragm causing fuel leakage; possible fire/explosion if ignition source present

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(010023T)
Year: 2000 & 2001
Models: JT-1100 C-1 (2000) & F-1 (2001)
Units: 6,065
Problem: Fuel pumps may be subject to corrosion causing possible fuel leaks into engine compartment; possible fire/explosion if ignition source present

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(990167T)
Year: 1999
Models: Ultra 150
Units: 2,859
Problem: Overtightening of steering cable mounting nut may cause nut to fail causing loss of steering control

LARSON BOATS
(Little Falls, MN)(010066S)
Year: 2001
Models: SEI 180 BR I/O, SEI 190 BR SF
SEI 190 BR I/O and LXI 190 BR I/O
Units: 697
Problem: Basic Flotation

LOWE SUNCRUISER PONTOON BOATS
(Syracuse, IN)(010104T)
Year: 2000 & 2001
Models: Boats equipped with Fikes Plastics fuel tanks with tank serial nos. 001431-003129
Units: 212
Problem: Fuel tank material degradation could lead to cracking of the sidewall and leaks; possible fire/explosion if ignition source present

MASTERCRAFT BOAT COMPANY
(Vonore, TN)(990151T)
Year: 1999
Models: Maristar 205V, ProStar 205 V & X-Star
Units: 554
Problem: Possible friction between fuel tank and shaft coupler may damage fuel tank; possible fire or explosion if ignition source present

MAXUM MARINE
(Everett, WA)(010122T)
Year: 2001
Models: 2100 SD
Units: 91
Problem: Isolation bulkheads not properly sealed and fuel vapors could reach areas containing electrical equipment; possible fire/explosion if ignition source present

MERCURY MARINE
(Fond du Lac, WI)(000247T)
Year: 2000 & 2001
Models: 240 HP M2 Jet Drive with serial nos.: 0E370718 to 0E394131
Units: 4,440
Problem: Potential short in voltage regulator; possible fire/explosion if fuel or vapor source present

MERCURY MARINE
(Fond du Lac, WI)(010074T)
Year: 2001
Models: MCM 496 MAG Sterndrive Engines
MCM 496 MAG HO Sterndrive Engines
MIE 8.1S Horizon Inboard Engines
MIE 8.1S HO Inboard Engines
All have serial numbers in the range between 0M025000 - 0M061418
Units: 2,501
Problem: Fuel line/ fuel rail outlet plug may not be properly connected to fuel rail and may cause fuel leakage; possible fire/explosion if ignition source present

MERCURY MARINE
(Fond du Lac, WI)(010063T)
Year: 1999 & 2000
Models: 225/250 HP Mercury/Mariner
200/225 HP Optimax
3.0L Carb/Work versions
These are outboards with serial nos.: 0G927950 to 0T264046
Units: 14,108
Problem: Insufficient weld penetration between bracket and shift cable attaching stud; potential loss of shift control

MERCURY MARINE
(Fond du Lac, WI)(990173T)
Year: 1998 and 1999
Models: Mercury and Mariner 225/250 HP, 3.0 Litre (Carb/EFI) XL, CXL, XXL and CXXL
3.0 Litre (OptiMax) XL, CXL, XXL and CXXL with serial nos.: 0G644802 thru 0G870075
Units: 6,830
Problem: Steering arm attaching bolt may fail; possible loss of steering control

MERCURY MARINE
(Fond du Lac, WI)(020177S)
Year: 2003
Models: Mercury Racing 575 Sci
Units: 128
Problem: Fuel line between fuel filter and throttle bodies on some Mercury 575 Sci engines may crack allowing fuel to leak; possible fire/explosion if ignition source present

PRO-LINE BOATS
(Crystal River, FL)(980233T)
Models: 1997: 2810 W/A, 2700 Sport, 251 W/A
1998: MM2810W/A, SJ2700 Sport, WA251 W/A, WW2610 W/A
1999: MM2810 - W/A, SJ2700 Sport, WA251 - W/A, 2610 W/A
Units: 651
Problem: Sea Land sani pump used to drain cockpit deck fish boxes may have a circuit board subject to corrosion/short circuit

PRO-LINE BOATS
(Crystal River, FL)(990192T)
Year: 2000
Models: All boats with breaker box manufactured by ESI South, Inc.
Units: 147
Problem: Breaker box may contain non ignition-protected circuit breakers; possible fire/explosion if fuel or vapor source present

PURSUIT/S2 YACHTS, INC.
(Fort Pierce, FL)(000106S)
Year: 2000
Models: 2260 Denali w/ HINs:
SSUF2099G900 - SSUF2107K900
2460 Denali w/ HINs:
SSUF4362F900 - SSUF439IL900
Units: 39
Problem: Blower warning label missing

PURSUIT FISHING BOATS DIV. OF TIARA YACHTS
(Ft. Pierce, FL)(980041T)
Year: 1995 - 1997
Models: 2870 Offshore & 2870 Walkaround
Units: 185
Problem: Novatron 110 V shore power units wired incorrectly; possible shock hazard

RIVIERA CRUISER
(Columbia City, IN)(990117S)
Year: 1999
Models: Pontoon Boats equipped with built-in Fikes Plastics Fuel Tanks w/ serial nos: 904001 - 905159
Units: 97
Problem: Fuel tank leakage; possible fire or explosion if ignition source present

SEA RAY BOATS
(Knoxville, TN)(970080T)
Year: 1997
Models: 190BR & 210BR
Units: 1,259
Problem: Abrasion of fuel vent line by alternator; possible fire/explosion if ignition source present

SEA RAY BOATS
(Knoxville, TN)(010092S)
Year: 2001
Models: 225WE with hull nos.: 3016-3102, 3104-3109, 3111-3117, 3119-3126, 3128-3191, 3193-3200, 3202-3216, 3218-3231, 3234, 3236-3246, 3248-3263, 3265-3295, 3297-3307, 3310-3314
240DA with hull nos.: 3341-3358, 3361-3378, 3380, 3382, 3384-3385, 3387-3390, 3392-3419
240SD with hull nos.: 3358, 3568, 3571, 3575, 3580, 3585, 3590, 3595, 3596, 3600, 3602, 3605, 3609, 3613, 3618, 3619, 3626, 3630, 3636, 3638, 3642, 3643, 3647, 3654, 3656, 3658, 3664, 3666, 3670, 3671, 3675, 3682, 3684, 3686, 3692, 3694, 3698, 3699, 3703, 3710, 3712, 3714, 3720, 3722, 3726, 3727, 3731, 3738, 3740, 3742, 3748, 3750, 3753, 3756, 3760, 3763, 3767, 3770, 3774, 3777, 3781, 3784, 3788, 3791, 3792
245WE with hull nos.: 3158-3182, 3187-3188, 3202, 3206-3210, 3218, 3221-3222, 3229-3230, 3233-3235, 3237-3238
Units: 466
Problem: Potential fuel leak at fuel tank pickup hose connection; possible fire/explosion if ignition source present

SEA RAY BOATS
(Knoxville, TN)(010089S)
Year: See below
Models: 370 AC (1997 - 2000) (186 units)
400 DB (1996 - 2001) (500 units)
420 AC (1996 - 2001) (223 units)
450 EB (1998 - 2001) (132 units)
460 DA (1999 - 2001) (130 units)
480 DB (1998 - 2001) (313 units)
540 CMY (2001) (19 units)
540 DA (1998 - 2001) (150 units)
560 DB (1998 - 2001) (109 units)
580 SS (1997 - 2000) (35 units)
Units: See above
Problem: Lack of overcurrent protection could lead to heat buildup in electrical wiring; possible fire/explosion if fuel or vapor source present
CONTINUED ON PAGE 21

DEPARTMENT OF HOMELAND SECURITY

Coast Guard

33 CFR Part 181

[USCG–2003–14272]

RIN 1625–AA53

Country of Origin Codes and Revision of Regulations on Hull Identification Numbers

AGENCY: Coast Guard, DHS.

ACTION: Notice of proposed rulemaking.

SUMMARY: The Coast Guard proposes to allow U.S. manufacturers of recreational boats to display a 2-character, country of origin code before the 12-character Hull Identification Number (HIN) without separating the 2-character code by means of borders or on a separate label as is currently required by the HIN regulations. The current prohibition adversely affects U.S. manufacturers who seek to export some of their recreational boats. The removal of the current restriction would allow U.S. manufacturers to comply with the International Organization for Standardization (ISO) HIN standard, without changing the information collected by States on undocumented vessels they register.

DATES: Comments and related material must reach the Docket Management Facility on or before September 18, 2003.

ADDRESSES: You may submit comments identified by the Coast Guard docket number USCG–2003–14272 to the Docket Management Facility at the U.S. Department of Transportation. To avoid duplication, please use only one of the following methods:

(1) *Web site: http://dms.dot.gov.*

(2) *Mail:* Docket Management Facility, U.S. Department of Transportation, 400 Seventh Street SW., Washington, DC 20590–0001.

(3) *Fax:* 202–493–2251.

(4) *Delivery:* Room PL–401 on the Plaza level of the Nassif Building, 400 Seventh Street SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The telephone number is 202–366–9329.

(5) *Federal Rulemaking Portal: http://www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT: If you have questions on this proposed rule, call Mr. Alston Colihan, Office of Boating Safety, Coast Guard, telephone 202–267–0984. If you have questions on viewing or submitting material to the docket, call Ms. Dorothy Beard, Chief, Dockets, Department of Transportation, telephone 202–366–5149.

SUPPLEMENTARY INFORMATION:

Public Participation and Access to Comments

We encourage you to participate in this rulemaking by submitting comments and related materials. All comments received will be posted, without change, to *http://dms.dot.gov* and will include any personal information you have provided. We have an agreement with the Department of Transportation (DOT) to use the Docket Management Facility. Please see the "Privacy Act" paragraph below.

Submitting comments. If you submit a comment, please include your name and address, identify the docket number for this rulemaking (USCG–2003–14272), indicate the specific section of this document to which each comment applies, and give the reason for each comment. You may submit your comments and material by electronic means, mail, fax, or delivery to the Docket Management Facility at the address under ADDRESSES; but please submit your comments and material by only one means. If you submit them by mail or delivery, submit them in an unbound format, no larger than 812 by 11 inches, suitable for copying and electronic filing. If you submit them by mail and would like to know that they reached the Facility, please enclose a stamped, self-addressed postcard or envelope. We will consider all comments and material received during the comment period. We may change this proposed rule in view of them.

Viewing comments and documents: To view comments, as well as documents mentioned in this preamble as being available in the docket, go to *http://dms.dot.gov* at any time and conduct a simple search using the docket number. You may also visit the Docket Management Facility in room PL–401 on the Plaza level of the Nassif Building, 400 Seventh Street SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

Privacy Act. Anyone can search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review the Department of Transportation's Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477), or you may visit *http://dms.dot.gov.*

Public Meeting

We do not now plan to hold a public meeting. But you may submit a request for one to the Docket Management Facility at the address under ADDRESSES explaining why one would be beneficial. If we determine that one would aid this rulemaking, we will hold one at a time and place announced by a later notice in the **Federal Register**.

Background and Purpose

In 1995, the International Organization for Standardization (ISO) issued a Hull Identification Number standard (ISO 10087:1995(E)) consisting of the same format as the existing Coast Guard 12-character HIN (manufacturer's identification, serial number, month of manufacture, year of manufacture, and model year) preceded by a 2-character country code and a hyphen. Under the ISO HIN standard, a boat made in the U.S. for export to a foreign country would bear a HIN such as:

US–ABC12345G303.

Boat manufacturers in the United States that export to Europe started using the ISO HIN standard beginning with the 1996 model year. According to ISO 10087:1995(E), paragraph (4), Composition of HIN, "A HIN shall consist of 14 consecutive characters plus a hyphen * * *." But our regulation for displaying information near the HIN, 33 CFR 181.27, states, "If additional information is displayed on the boat within two inches of the hull identification number, that information must be separated from the hull identification number by means of borders or must be on a separate label so that it will not be interpreted as part of the hull identification number." While the ISO HIN standard includes a paragraph with language that is nearly identical to § 181.27, these ISO requirements do not apply to the country code and hyphen, which precede our 12-character HIN.

The American Boat and Yacht Council (ABYC) develops voluntary consensus safety standards for the design, construction, equipage, maintenance, and repair of small craft. An ABYC Technical Committee studying the ISO HIN standard and our HIN standard concluded that the differing requirements create a problem for U.S. builders exporting to Europe. One large U.S. manufacturer that exports to Europe pointed out that use of a separate tape to create the border

required by our HIN standard often results in misalignment and other flaws that may be confused with attempts to alter an HIN. This proposal was discussed at the October 29, 2001 meeting of the National Boating Safety Advisory Council and there were no objections by State Boating Law Administrators in attendance at the meeting. (66 FR 49445, September 27, 2001). The NBSAC unanimously passed a resolution requesting the Coast Guard to immediately pursue rulemaking for an exception to current regulations to allow the USA HIN system to conform to the ISO HIN standard while still allowing the states to not require the "Country Code" in their registration process.

Discussion of Proposed Rule

This rule would relieve manufacturers of recreational boats who sell both internationally and domestically of the burden of separating the country of origin code for the United States, "US-", from the other 12 characters in a HIN by means of borders or a separate label. Any other information would still have to be separated from characters in the HIN by means of borders or a separate label.

Regulatory Evaluation

This proposed rule is not a "significant regulatory action" under section 3(f) of Executive Order 12866, Regulatory Planning and Review, and does not require an assessment of potential costs and benefits under section 6(a)(3) of that Order. The Office of Management and Budget has not reviewed it under that Order. It is not "significant" under the regulatory policies and procedures of the Department of Homeland Security (DHS).

We expect the economic impact of this proposed rule to be so minimal that a full Regulatory Evaluation under the regulatory policies and procedures of DHS is unnecessary. Allowing manufacturers to separate the Country of Origin Code without the use of borders or a separate label would relieve a burden and thereby reduce the costs of complying with the HIN display requirement.

Small Entities

Under the Regulatory Flexibility Act (5 U.S.C. 601–612), we have considered whether this proposed rule would have a significant economic impact on a substantial number of small entities. The term "small entities" comprises small businesses, not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000.

The Small Business Administration (SBA) has set up size standards for each SIC code based on the number of employees or annual receipts. The only type of small entity that this rule would affect would be small businesses. There were 4,420 U.S. manufacturers of recreational boats in 2002, an estimated 80 percent of which qualify as small businesses by the size standards of the SBA. However, we have observed that the businesses we have identified as small do not manufacture as many boats as their larger competitors. In addition, most of the businesses we have identified as small do not export to the European market and therefore would not follow the ISO HIN format.

Therefore, the Coast Guard certifies under 5 U.S.C. 605(b) that this proposed rule would not have a significant economic impact on a substantial number of small entities. If you think that your business, organization, or governmental jurisdiction qualifies as a small entity and that this rule would have a significant economic impact on it, please submit a comment to the Docket Management Facility at the address under **ADDRESSES**. In your comment, explain why you think it qualifies and how and to what degree this rule would economically affect it.

Assistance for Small Entities

Under section 213(a) of the Small Business Regulatory Enforcement Fairness Act of 1996 (Pub. L. 104–121), we want to assist small entities in understanding this proposed rule so that they can better evaluate its effect onthem and participate in the rulemaking. If the rule would affect your small business, organization, or governmental jurisdiction and you have questions concerning its provisions or options for compliance, please contact Mr. Alston Colihan, Project Manager, Office of Boating Safety, by telephone at (202) 267–0981 or by e-mail at *acolihan@comdt.uscg.mil*.

Collection of Information

This proposed rule would call for no new collection of information under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501–3520).

Federalism

A rule has implications for federalism under Executive Order 13132, Federalism, if it has a substantial direct effect on State or local governments and would either preempt State law or impose a substantial direct cost of compliance on them. We have analyzed this proposed rule under that Order and have determined that it does not have implications for federalism.

Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1531–1538) requires Federal agencies to assess the effects of their discretionary regulatory actions. In particular, the Act addresses actions that may result in the expenditure by a State, local, or tribal government, in the aggregate, or by the private sector of $100,000,000 or more in any one year. Though this proposed rule would not result in such an expenditure, we do discuss the effects of this rule elsewhere in this preamble.

Taking of Private Property

This proposed rule would not affect a taking of private property or otherwise have taking implications under Executive Order 12630, Governmental Actions and Interference with Constitutionally Protected Property Rights.

Civil Justice Reform

This proposed rule meets applicable standards in sections 3(a) and 3(b)(2) of Executive Order 12988, Civil Justice Reform, to minimize litigation, eliminate ambiguity, and reduce burden.

Protection of Children

We have analyzed this proposed rule under Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This rule is not an economically significant rule and would not create an environmental risk to health or risk to safety that might disproportionately affect children.

Indian Tribal Governments

This proposed rule does not have tribal implications under Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, because it would not have a substantial direct effect on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes.

Energy Effects

We have analyzed this proposed rule under Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use. We have

determined that it is not a "significant energy action" under that order because it is not a "significant regulatory action" under Executive Order 12866 and is not likely to have a significant adverse effect on the supply, distribution, or use of energy. The Administrator of the Office of Information and Regulatory Affairs has not designated it as a significant energy action. Therefore, it does not require a Statement of Energy Effects under Executive Order 13211.

Environment

We have analyzed this proposed rule under Commandant Instruction M16475.lD, which guides the Coast Guard in complying with the National Environmental Policy Act of 1969 (NEPA)(42 U.S.C. 4321–4370f), and have concluded that there are no factors in this case that would limit the use of a categorical exclusion under section 2.B.2 of the Instruction. Therefore, this rule is categorically excluded, under figure 2–1, paragraph (34)(a) of the Instruction, from further environmental documentation. The proposed rule to remove the requirement to separate the 2-character country of origin code from the 12-character HIN by means of borders or on a separate label relates to the documentation of vessels and is not expected to have any environmental impact.

A draft "Environmental Analysis Check List" and a draft "Categorical Exclusion Determination" are available in the docket where indicated under **ADDRESSES.** Comments on this section will be considered before we make the final decision on whether the rule should be categorically excluded from further environmental review.

List of Subjects in 33 CFR Part 181

Labeling, Marine safety, Reporting and recordkeeping requirements.

For the reasons set out in the preamble, the Coast Guard proposes to amend 33 CFR part 181 as follows:

PART 181—MANUFACTURER REQUIREMENTS

1. The authority citation for part 181 is revised to read as follows:

Authority: 46 U.S.C. 4302 and 4310; Pub. L. 103–206, 107 Stat. 2439; Department of Homeland Security Delegation No. 0170.

2. Revise § 181.27 to read as follows:

§ 181.27 Information displayed near hull identification number.

With the exception of the characters "US-", which constitute the country of origin code for the United States, if information is displayed on the boat within 2 inches of the hull identification number (HIN), that information must be separated from the HIN by means of borders or must be on a separate label, so that it will not be interpreted as part of the hull identification number.

Dated: June 12, 2003.

David S. Belz,

Rear Admiral, U.S. Coast Guard, Director of Operations.

[FR Doc. 03–15640 Filed 6–19–03; 8:45 am]

CONTINUED FROM PAGE 19

STARDUST CRUISERS, INC.
(Monticello, KY)(010047T)
Year: 1997 - 2000
Models: Houseboats with Mathers multistation propulsion control system with hull nos.: TKZ00850 - TKZ01100
Units: 343
Problem: Engine control relays not ignition-proof; possible fire/explosion if fuel or vapor source present

SUMERSET CUSTOM HOUSEBOATS
(Somerset, KY)(010012T)
Year: 1984 - 1997
Models: Various
Units: 377
Problem: Routing of generator exhaust beneath swim platform causes dangerously high concentrations of carbon monoxide

TRACKER MARINE L.P.
(Springfield, MO)(961490S)
Year: 1996
Models: Super GV14T with HINs: BUJ16639H596 - BUJ36157E696
Units: 87
Problem: Level Flotation

VOLVO PENTA OF THE AMERICAS, INC.
(Chesapeake, VA)(980145T)
Year: 1997
Models: BY engines w/ serial nos.: 4110155491 - 4110159682
Units: 2,000
Problem: Improperly machined fuel pump inlet fitting may cause fuel leakage; possible fire/explosion if ignition source present

WELLCRAFT MARINE CORP.
(Sarasota, FL)(010147S)
Year: 2000 & 2001
Models: Wellcraft and Aquasport models equipped with gasoline generators
Units: 187
Problem: Fuel filter fails to meet Federal requirements

DEPARTMENT OF TRANSPORTATION

Coast Guard

33 CFR Parts 84 and 183

46 CFR Part 25

[USCG–1999–6580]

RIN 2115–AF70

Certification of Navigation Lights for Uninspected Commercial Vessels and Recreational Vessels

AGENCY: Coast Guard, DOT.

ACTION: Final rule.

SUMMARY: The Coast Guard is requiring domestic manufacturers of vessels to install only certified navigation lights on all newly manufactured uninspected commercial vessels and recreational vessels. This rule aligns the requirements for these lights with those for inspected commercial vessels and with requirements for all other mandatory safety equipment carried on board all vessels. The Coast Guard expects the resulting reduction in the use of noncompliant lights to improve safety on the water.

DATES: This final rule is effective November 1, 2002. The incorporation by reference of certain publications listed in the rule is approved by the Director of the Federal Register as of November 1, 2002.

ADDRESSES: Comments and material received from the public, as well as documents mentioned in this preamble as being available in the docket, are part of docket USCG–1999–6580 and are available for inspection or copying at the Docket Management Facility, U.S. Department of Transportation, room PL–401, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also find this docket on the Internet at http://dms.dot.gov.

FOR FURTHER INFORMATION CONTACT: If you have questions on this rule, call Richard Blackman, Project Manager, Office of Boating Safety, Coast Guard, by telephone at 202–267–6810 or by e-mail at rblackman@comdt.uscg.mil. If you have questions on viewing the docket, call Dorothy Beard, Chief, Dockets, Department of Transportation, telephone 202–366–5149.

SUPPLEMENTARY INFORMATION:

Regulatory History

The Coast Guard published a notice of proposed rulemaking (NPRM) to establish requirements for approval, certification, installation, and performance of navigation lights on vessels less than 20 meters in length in the **Federal Register** on September 7, 1978 (43 FR 39946), and a supplemental notice on December 29, 1980 (45 FR 85468). It published a notice withdrawing the proposed rulemaking in the **Federal Register** on January 7, 1982 (47 FR 826). The proposed rule was withdrawn because a newly established voluntary standard and Coast Guard enforcement policies were deemed sufficient.

On October 9, 1997, the Coast Guard published in the **Federal Register** (62 FR 52673) a request for comments on whether navigation lights on uninspected commercial vessels and recreational vessels need to be regulated. We received 34 comments. On August 4, 2000, we published a notice of proposed rulemaking (NPRM) entitled Certification of Navigation Lights for Uninspected Commercial Vessels and Recreational Vessels in the **Federal Register** (65 FR 47936). We received 11 comments on the proposed rule. No public hearing was requested and none was held.

Background and Purpose

The rule will direct manufacturers of uninspected commercial vessels and recreational vessels to install only navigation lights certified and labeled as meeting the technical requirements of the Navigation Rules. It will standardize the navigation light requirement for uninspected commercial vessels and recreational vessels with the requirement for inspected commercial vessels. This action is consistent with the treatment for all other items of safety equipment.

Previously, only lights specifically manufactured for inspected commercial vessels were regulated. These regulations appear in Title 46 CFR subchapter J-Electrical Engineering, and they state in part that each light must "be certified by an independent laboratory to the requirements of [Underwriters Laboratories, Inc. (UL)] 1104 or an equivalent standard" and be so labeled. The "independent laboratory" must be recognized by the Coast Guard as bonafide and have been placed on a list, which is available from G–MSE–3 at U.S. Coast Guard Headquarters, 2100 Second Street, SW., Washington, DC 20593–0001.

Rulemakings to establish regulatory controls of navigation lights on uninspected commercial vessels and recreational vessels were proposed in September 1978 and December 1980. They were withdrawn in January 1982 because a newly established voluntary standard and Coast Guard enforcement policies were deemed sufficient to eliminate the need for the regulation. However, by 1997, several entities concerned with recreational boating safety were calling for regulations.

Before April 1997, a manufacturer of navigation lights for uninspected commercial vessel and recreational vessels could voluntarily apply for a "Letter of Acceptance" from the U.S. Coast Guard for its light models. The Coast Guard would compare a laboratory report for each model sent by the manufacturer with the technical requirements of the International and Inland Navigation Rules (together referred to as the "Navigation Rules"). If the reported data indicated that the light met the requirements of the Navigation Rules, the Coast Guard would grant a "Letter of Acceptance," allowing the manufacturer to label the light as "U.S. Coast Guard Accepted." The public often interpreted the acceptance label as meaning that a light was "U.S. Coast Guard Approved."

To eliminate the confusion, the Coast Guard stopped issuing Letters of Acceptance in April 1997. Consequently, vessel manufacturers, owners, surveyors, vessel inspectors, and boarding officials could rely only on a statement from the navigation light manufacturer that a model of light complied with the technical requirements of the Navigation Rules. In 1997 the National Boating Safety Advisory Council (NBSAC)—representing operators and manufacturers of recreational vessels, State boating officials, and national boating organization—and the National Association of State Boating Law Administrators (NASBLA) passed resolutions asking the Coast Guard to require that navigation lights installed on recreational vessels offered for sale to the public be certified. The Navigation Safety Advisory Council (NAVSAC) passed a similar resolution relating to uninspected commercial vessels. In the report, "Recreational Boat Collision Accident Research," UL recommended that the Coast Guard take stronger measures to ensure that navigation lights installed in recreational vessels meet the requirements established by the Navigation Rules.

A request for comments on the proposed rulemaking was published in the **Federal Register** on October 9, 1997. State law-enforcement personnel, vessel owners, marine professionals (manufacturers and marine surveyors), standard-setting organizations, manufacturers of navigation lights, and

a laboratory testing navigation lights submitted comments. Of the 34 respondents, 28 favored the rule. Some expressed concern about installing lights in vessels with bow-high cruising trim angles that tend to obstruct sidelight visibility. While it would not require certification of navigation light installations, the rule will require that the installed lights be certified as compliant with the visibility requirements established by the Navigation Rules. A complete discussion of these comments was included in the NPRM, which may be found in the docket at the locations listed under **ADDRESSES**.

In its response to the October 1997 request for comments, UL stated that during the past 20 years compliance with the Navigation Rules for navigation lights has steadily declined. UL stated that about half of the lights tested have failed to meet minimum performance requirements.

To address this decline in compliance, the rule requires that vessel manufacturers install only lights that are certified. The new requirement will provide evidence of compliance to vessel manufacturers, surveyors, owners, inspectors, and boarding officials. It includes the same requirements as those for navigation lights for inspected commercial vessels; however, the light test requirements are less stringent. It also aligns with the International Navigation Rule requirement (COLREGS) for "Approval" (33 CFR, subchapter D, Annex I.)

The rule does not apply to the replacement of existing navigation lights on vessels completed before the designated effective date.

Discussion of Comments and Changes

Respondents to the NPRM published August 4, 2000, included State law-enforcement officials, a marine safety service, a tug operator, several tug and tow operation companies, and two waterways associations representing the towing industry. Of the nine respondents, four favored the rulemaking.

All opposing comments came from representatives of the towing industry. Some cited the expense of certifying barge mooring lights; however, barge mooring lights are outside the scope of this rule because they are not generally installed by the builder.

Other comments requested that commercial vessel lights be grandfathered. Although the NPRM did not specify that this rulemaking applied to only newly manufactured vessels, that was the original intent. This has been clarified in the final rule by adding an applicability section to the new subpart 25.10 in 46 CFR. We also added a definition section to the new subpart 25.10. Furthermore, only uninspected commercial vessels and recreational vessels are within the rule's scope, as inspected commercial vessels are covered in other regulations.

Another comment recommended that when non-certified lights need to be replaced that they be replaced with certified lights. The Coast Guard disagrees with this comment. A planned amendment to Navigation Rule 38 will grandfather all existing lights, whether installed or on the shelf, implying that original equipment may be replaced in kind.

Comments also expressed concern about bulb "monopolies" resulting from this rulemaking. The labeling requirements call for "identification of the bulb used in the compliance test." Although "identification" will include bulb make along with specifications regarding wattage, rated voltage, and filament configuration, this rule does not preclude the use of any make bulb that allows the performance requirements of the light to be satisfied.

One towing company cited lack of enforcement of the Navigation Rules as the crux of the problem while another objected to using "pre-focus lamps" (lamps with screened lenses designed to meet the sector requirements) rather than "incandescent rough service lamps." Neither of these comments are within the scope of this rule. However, the intent of this rulemaking is to discourage the use of non-compliant lights on uninspected commercial vessels and recreational vessels as a step in enforcing the Navigation Rules. A requirement for "approval," or third-party certification, has always existed in the International Navigation Rules. The intent to establish a similar requirement in the Inland Rules is evidenced by Inland Rule, Annex I, 84.25 Approval, currently marked "reserved." This rule satisfies that intent.

Additionally, the need for this rule is reflected in a memo from Marine Safety Office, New Orleans to the Executive Director, Navigation Safety Advisory Committee that details problems associated with lights noncompliant with the International Navigation Rules and the Inland Rules and includes accident examples implicating improper navigation lights. This memo has been placed in the docket for this rulemaking as supplemental information and may be viewed at the locations listed on the **ADDRESSES** section of this document.

Of those favoring the rulemaking, a comment from a State law-enforcement agency reported that a significant number of collisions occur during the hours of darkness or reduced visibility, and that not seeing the other vessel's navigation lights is commonly cited as the cause. The U.S. Coast Guard agrees with this comment and has placed a letter from the City of Fort Lauderdale and the U.S. Coast Guard's response in the docket for this rulemaking as supplemental information. The letter refers to a horrendous nighttime collision in November 1997, which prompted an accident record review that caused city officials to question the adequacy of the navigation lights.

One comment recommended a more stringent labeling requirement. The Coast Guard agrees and has amended the labeling requirement to read that the label must be permanent and indelible and that it be visible without removing or disassembling the light. Another comment favoring the rulemaking stated that UL 1104 is too stringent as a testing standard. The Coast Guard also agrees with this comment. ABYC A–16, the most basic standard, has been substituted for UL 1104.

The aforementioned comments, combined with those received from UL in response to our original request for comments on October 9, 1997, indicate substantial support for the rulemaking. The UL comments state that more than half of the lights for small craft, which are not regulated, do not comply with minimum Navigation Rule requirements, but most regulated lights, that is, those for commercial vessels, do.

The new rule will be placed in Title 33 CFR, Part 183, subpart M, and not subpart I. We noticed after publication of the NPRM that subpart I applies only to gasoline-powered vessels. To ensure that the regulation properly applies to all uninspected commercial and recreational vessels, as originally stated in the preamble to the NPRM (65 FR 47938), we are recodifying the regulation in a new subpart. This has required that we draft new applicability and definitions sections to be placed in subpart M. These additions do not change the rule.

Regulatory Evaluation

This rule is not a 'significant regulatory action' under section 3(f) of Executive Order 12866 and does not require an assessment of potential costs and benefits under section 6(a)(3) of that Order. The Office of Management and Budget (OMB) has not reviewed this rule under that Order. Since we

expect the economic effect of this rule to be very minimal, a full Regulatory Evaluation under paragraph 10(e) of the regulatory policies and procedures of DOT is not necessary.

Costs of the Rule

(1) Manufacturers of navigation lights will incur initial costs for laboratory tests to certify that their lights comply with Navigation Rules. This may result in a minor increase in the market price for certified lights. Navigation light manufacturers will pass these costs on to vessel manufacturers. In turn, the vessel manufacturers will charge consumers more. We conclude that these increases should be so small that their effect on vessel manufacturers and consumers will be negligible.

Most recreational vessel manufacturers install navigation lights on their vessels. We have discovered that eight types of lights are now on the market, and each light manufacturer may make multiple models of each type. Our survey of available lights determined that each manufacturer produces an average of 10 models for each type and introduces 3 new models a year. Certification will require that a representative light of each model pass a performance test before it is marketed. Specifically, we identified nine domestic manufacturers of lights that this rule might affect. To conduct a cost analysis involving these nine manufacturers we must allow a one-year delay in the effective date of this rule. The one-year delay will allow the navigation light manufacturers time to alter their products and procedures to meet certification requirements. Consequently, initial costs will not begin to incur until the year 2002, when the rule becomes effective. Given that 3 new models are introduced each year, we will set a period of 15 years over which the analysis of the impacts of this rule will span. For the first year, 2002, we have analyzed the cost of certifying currently available models. For the remaining fourteen years, 2003–2016, we analyze the cost of certifying new models.

An e-mail exchange between the Office of Boating Safety and a navigation light manufacturer regarding costs associated with this rule can be found in the docket for this rulemaking. In conversations with UL and Imanna Laboratory, testing laboratories approved by the Coast Guard, we developed an estimate of $500 for a performance test of each model. Volume discounts for multiple model tests from these laboratories will decrease the cost of each model to $400. We can therefore calculate a partial cost of the rule as follows.

Types of light	X	No. of models	X	No. of manufacturers	X	Cost per test for each model	=	Total cost
8		10		9		$400		$288,000

To account for the current value of benefits and costs in the future, we determined the present value of this cost to 2001 through discounting. The present value represents the expected value of any benefits or costs-one-time or recurring-discounted by the interest rate compounded over the period of analysis. The Office of Management and Budget requires that all Federal Agencies, including the Department of Transportation, use a standard discount rate of 7 percent, which we incorporate into our cost analysis. A partial calculation of the total cost of the rule is therefore the following: ($288,000)/(1.07)1 = $269,158.88 = Partial Cost 1

This figure is the one-time testing cost for the total of all existing models of lights occurring during the first year of the regulation. If a manufacturer decides to introduce a new model of light, that model will also have to be tested by an independent laboratory approved by the Coast Guard before it can be marketed. When calculating costs, we must also account for the three new models of lights that each manufacturer sends yearly to the market. In order to perform this calculation we sum the cost over the remaining 14 years using a discount rate of 7 percent through the following formula:

$$\sum_{n=2}^{15}[(\text{no. of manufacturers}) \times (\text{no. of models}) \times (\text{testing cost per light})]/(1.07)^n$$

We know that the nine manufacturers of navigation lights introduce three new models each year with a testing cost of $400 per model. We can say that the cost associated with testing three new models each year can be calculated by inserting the number of manufacturers, number of models, and testing costs into the above equation,

$$\sum_{n=2}^{15}[(9) \times (3) \times ($400)]/(1.07)^n = \$88,272.00 = \text{Partial Cost 2}$$

The present value of the total testing over 15 years is therefore: $269,158.88 + $88,272.00 = $357,430.88

(2) New labeling requirements for the certified lights will add to the cost of the regulation. Much of the verification will be printable on an insert with the package, or on a sticker (described in Title 33 CFR 183.810). This rule will not involve modification of the package to accommodate the labeling. Using estimates from labeling companies, we have determined that manufacturers will pay about $240 for 1,000 labels. Since the Notice of Proposal for Rulemaking, we have obtained a more accurate cost for labels and have revised our analysis to include $240 for labeling costs in the formula. When computing labeling costs, we make the following assumptions: each model will need 1000 labels, each of 9 manufacturers produces 10 models of each of 6 light types, and each manufacturer introduces 3 new models per year. We first compute the one-time cost of labeling for the 10 models of each type of light.

Types of light	X	No. of models	X	No. of manufacturers	X	Cost per test for each model	=	Total cost
8		10		9		$240		$172,800

In computing the cost of labeling we must also include a one-time $45 plate charge for each model. This means that 10 ×9 ×8 ×45 = $32,400 must be added to $172,800 for obtaining $205,500 as the labeling cost for the existing ten models. The present value of this cost is $205,500/1.07 or $192,056.

The cost of labeling for the three new models of lights introduced can be computed as follows:

$$\sum_{n=2}^{15}[(9 \text{ manufacturers} \times 3 \text{ new models} \times \$240)]/(1.07)^n = \$52,963.$$

Calculating labeling costs for the three new models would again require us to add the one-time cost of the plate.

$$\sum_{n=2}^{15}[(9 \text{ manufacturers} \times 3 \text{ new models} \times \$45)]/(1.07)^n = \$695.14.$$

The total cost of labeling would therefore be $192,056 + 52,963 + 695.14 or $245,714.14. This represents Partial Cost 3. Finally we can say that the present value of the total cost of the rule is:

Partial Cost 1 + Partial Cost 2 + Partial Cost 3 = $269,158.88 + $88,272.00 + $245,714.14 = $60,3145.02

Benefits of the Rule

(1) Certification will place navigation lights under regulatory control comparable to that affecting all other items of mandatory safety equipment. This will result in a general improvement in reliability, quality, and effectiveness of domestic and imported lights available to domestic manufacturers of vessels.

(2) This rule will discourage the practice of installing lights, custom-made or other, that are not compliant with the Navigation Rules. Navigation lights are safety equipment with the designated purpose of preventing collisions. According to the 2000 Boating Accident Reporting Database (BARD) statistics collected by the U.S. Coast Guard, accidents due to collisions with another vessel account for 35 percent of all reported boating accidents occurring over the year. These collisions lead to fatalities and injuries as well as property damage. Consequently, fatalities and injuries due to a collision with another vessel comprise around 10 percent of all reported fatalities and 32 percent of all reported injuries arising from recreational boating accidents. These BARD statistics also indicate that accidents involving a collision with another vessel result in property damages amounting to $8,735,300. The intent of this regulation is to reduce these numbers and lessen the costs society pays in terms of property damage, lives lost, or injuries when collisions occur.

(3) Lack of compliance with rules for navigation lights has also led to recalls of certain recreational vessels. Under the Federal Boat Safety Act of 1971, the U.S. Coast Guard can declare non-complaint lights as "defective" once they are installed. Recreational boats with defective items are subject to recall completely at the vessel manufacturers' expense. According to U.S Coast Guard data on recalls, recreational vessels of 13 different makes have been recalled as a result of the navigation lights failing to comply with the Navigation Rules since 1990. This regulation would therefore minimize the recall cost burden placed on vessel manufacturers by assuring them that a light meets the Navigation Rules requirements before they begin installation.

(4) Certification will also facilitate exports to countries enforcing the requirement of the COLREGS for approval of navigation lights.

Small Entities

Under the Regulatory Flexibility Act (5 U.S.C. 601–612), we have considered whether this rule would have a significant economic impact on a substantial number of small entities. The term "small entities" comprises small businesses, not-for-profit organizations independently owned and operated and not dominant in their fields, and governmental jurisdictions with populations of less than 50,000. We identified nine manufacturers who could be affected by this rule. Four out of the nine manufacturers qualify as small businesses by the size standards of the Small Business Association (SBA). However, we observed that the four businesses we identified as small entities offer fewer models of each type of light than their larger competitors. These 4 manufacturers offer between 1 and 5 models of each type, which is well below the average of 10 models each. Therefore, we do not believe that they will bear a disproportionate amount of the burden of this rule. We have found that these four manufacturers have annual revenues of $2.5m-$5.0m; $5.0m-$10m; $10m-$20m; and $20m-$50m. The greatest possible cost for testing and labeling incurred by these four light manufacturers would be $18,000, or $685 (testing + labeling costs) × 6 light types x 5 models per type. In addition to this, if they each test at least two new models per year then they will have to bear an extra $1,280, or $685 x 2. A total of $19,200 is well below 5 percent of the revenue of even the smallest company, indicating that this regulation will have a negligible effect on revenues to these small businesses. We expect prices in the industry will remain stable allowing companies to competitively enter the industry. Therefore, the Coast Guard certifies under 5 U.S.C. 605(b) that this final rule will not have a significant economic impact on a substantial number of small entities.

Assistance for Small Entities

Under section 213(a) of the Small Business Regulatory Enforcement Fairness Act of 1996 (Public Law 104–

121), we offered to assist small entities in understanding the rule so that they could better evaluate its effects on them and participate in the rulemaking. Small businesses may send comments on the actions of Federal employees who enforce, or otherwise determine compliance with, Federal regulations to the Small Business and Agriculture Regulatory Enforcement Ombudsman and the Regional Small Business Regulatory Fairness Boards. The Ombudsman evaluates these actions annually and rates each agency's responsiveness to small business. If you wish to comment on actions by employees of the Coast Guard, call 1–888–REG–FAIR (1–888–734–3247).

Collection of Information

This rule would call for a new collection of information under the Paperwork Reduction Act of 1995 [44 U.S.C. 3501–3520]. As defined in 5 CFR 1320.3(c), "collection of information" comprises reporting, recordkeeping, monitoring, posting, labeling, and other similar actions. The title and description of the collections, a description of those who perform them, and an estimate of the total annual burden follow. The estimate covers the time for submitting a new model of light to the third-party certifier and for designing a label for each model of light.

Summary of the Collection of Information

The rule will impose a new burden of collection of information on manufacturers of navigational lights for uninspected commercial vessels and recreational vessels. Each manufacturer of the lights would incur a one-time burden of submitting paperwork to the third-party certifier and of designing labeling for each model of light.

Need and Proposed Use for Information

This collection of information is necessary to accomplish the third-party certification and the labeling. The third-party certifier would use the information to document and test the models of lights. Once the model had passed performance testing, the manufacturer of the light would design and provide a label for its product so the consumer would know that the product was certified.

Description of Respondents

The collection of information would affect the current manufacturers of navigational lights for recreational and uninspected vessels. It would also affect any future manufacturers that may enter the market.

Number of Respondents

There are nine manufacturers of lights in the market. This collection of information will affect them all.

Frequency of Response

This collection would take place only when a manufacturer undertook to place a new light on the market.

Burden of Response

We estimate that it would take one employee about one hour to prepare the paperwork to submit a light for performance tests. He or she would be an administrative assistant and, as such, would cost around $24 an hour. If each of these manufacturers submitted three new models of lights for testing each year, the burden for the submitted would be 27 hours and $648.

We also estimate that it would take one employee about one hour to update the labeling for each new model. He or she, too, would cost around $24 an hour. The burden for the labeling requirement would likewise be 27 hours and $648 if each of nine manufacturers submitted 3 new models for testing each year.

Estimate of Total Annual Burden

Using the above estimates, the total burden in hours would be 54 and the total cost would be $1,296.

As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 35)7(d), we have submitted a copy of this rule to the Office of Management and Budget (OMB) for its review of the collection of information. OMB has approved the collection. The section numbers are 33 CFR part 183 and 46 CFR 25. The corresponding approval number from OMB is OMB Control Number 2115–0645, which expires on September 9, 2003. You are not required to respond to a collection of information unless it displays a currently valid OMB Control Number.

Federalism

A rule has implications for federalism under Executive Order 13132, Federalism, if it has a substantial direct effect on State or local governments and would either preempt State law or impose a substantial direct cost of compliance on them. We have analyzed this rule under that Order and have determined that it does not have implications for federalism.

It is well settled that States may not regulate in categories reserved for regulation by the Coast Guard. It is also well settled, now, that all of the categories covered in 46 U.S.C. 3306, 3703, 7101, and 8101 (design, construction, alteration, repair, maintenance, operation, equipping, personnel qualification, and manning of vessels), as well as the reporting of casualties and any other category in which Congress intended the Coast Guard to be the sole source of a vessel's obligations, are within the field foreclosed from regulation by the States. (See the decision of the Supreme Court in the consolidated cases of *United States* v. *Locke and Intertanko* v. *Locke*, 529 U.S. 89, 120 S.Ct. 1135 (March 6, 2000).) Because the States may not regulate within this category, preemption under Executive Order 13132 is not an issue.

Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1531–1538) requires Federal agencies to assess the effects of their discretionary regulatory actions. In particular, the Act addresses actions that may result in the expenditure by a State, local, or tribal government, in the aggregate, or by the private sector of $100,000,000 or more in any one year. Though this rule will not result in such an expenditure, we do discuss the effects of this rule elsewhere in this preamble.

Taking of Private Property

This rule will not effect a taking of private property or otherwise have taking implications under Executive Order 12630, Governmental Actions and Interference with Constitutionally Protected Property Rights.

Civil Justice Reform

This rule meets applicable standards in sections 3(a) and 3(b)(2) of Executive Order 12988, Civil Justice Reform, to minimize litigation, eliminate ambiguity, and reduce burden.

Protection of Children

We have analyzed this rule under Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This rule is not an economically significant rule and does not create an environmental risk to health or risk to safety that may disproportionately affect children.

Indian Tribal Governments

This rule does not have tribal implications under Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, because it does not have a substantial direct effect on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes.

Energy Effects

We have analyzed this rule under Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use. We have determined that it is not a "significant energy action" under that order because it is not a "significant regulatory action" under Executive Order 12866 and is not likely to have a significant adverse effect on the supply, distribution, or use of energy. It has not been designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action. Therefore, it does not require a Statement of Energy Effects under Executive Order 13211.

Environment

We have considered the environmental impact of this rule and concluded that, under figure 2–1. paragraph (34)(d), of Commandant Instruction M16475.1C, this rule is categorically excluded from further environmental documentation. A requirement for certification of navigation lights should not have any environmental impact. A Determination of Categorical Exclusion is available in the docket where indicated under **ADDRESSES**.

List of Subjects

33 CFR Part 84

Navigation (water), Waterways.

33 CFR Part 183

Incorporation by reference, Marine safety.

46 CFR Part 25

Fire prevention, Incorporation by reference, Marine safety, Reporting and recordkeeping requirements.

For the reasons discussed in the preamble, the Coast Guard amends 33 CFR parts 84 and 183, and 46 CFR part 25, as follows:

PART 84—ANNEX I: POSITIONING AND TECHNICAL DETAILS OF LIGHTS AND SHAPES

1. The citation of authority for part 84 continues to read as follows:

Authority: 33 U.S.C. 2071; 49 CFR 1.46.

2. Add § 84.25 to read as follows:

§ 84.25 Approval.

The construction of lights and shapes and the installation of lights on board the vessel must satisfy the Commandant, U.S. Coast Guard.

PART 183—BOATS AND ASSOCIATED EQUIPMENT

3. The citation of authority for part 183 continues to read as follows:

Authority: 46 U.S.C. 4302; 49 CFR 1.46.

4. Amend § 183.5 (b) by adding in alphabetical order the following standard:

§ 183.5 Incorporation by reference.

* * * * *

(b) * * *

American Boat and Yacht Council, Inc., 3069 Solomons Island Road, Edgewater, Maryland 21037–1416

ABYC A–16 Electric Navigation Lights-1997 § 183.810

* * * * *

5. Add subpart M to part 183 to read as follows:

Subpart M—Navigation Lights

Sec.

183.801 Applicability.

183.803 Definitions.

183.810 Navigation light certification requirements.

§ 183.801 Applicability.

This subpart applies to recreational vessel manufacturers, distributors, and dealers installing such equipment in new recreational vessels constructed after November 1, 2002.

§ 183.803 Definitions.

As used in this subpart:

Dealer means any person who is engaged in the sale and distribution of recreational vessels to purchasers who the seller in good faith believes to be purchasing any such recreational vessel for purposes other than resale.

Distributor means any person engaged in the sale and distribution of recreational vessels for the purpose of resale.

Manufacturer means any person engaged in:

(1) The manufacture, construction, or assembly of recreational vessels, or

(2) The importation of recreational vessels into the United States for subsequent sale.

Navigation lights are those lights prescribed by the Navigation Rules (Commandant Instruction 16672.2 series) to indicate a vessel's presence, type, operation, and relative heading.

§ 183.810 Navigation light certification requirements.

(a) Except as provided by paragraph (b) of this section, each navigation light must—

(1) Meet the technical standards of the applicable Navigation Rules;

(2) Be certified by a laboratory listed by the Coast Guard to the standards of ABYC A–16 (incorporated by reference, see § 183.5) or equivalent, although portable battery-powered lights need only meet the requirements of the standard applicable to them; and

(3) Bear a permanent and indelible label that is visible without removing or disassembling the light and that states the following:

(i) "USCG Approval 33 CFR 183.810."

(ii) "MEETS....." (Insert the identification name or number of the standard under paragraph (a)(2) of this section, to which the laboratory type-tested.)

(iii) "TESTED BY....." (Insert the name or registered certification-mark of the laboratory listed by the Coast Guard that tested the fixture to the standard under paragraph (a)(2) of this section.)

(iv) Name of manufacturer.

(v) Number of model.

(vi) Visibility of the light in nautical miles.

(vii) Date on which the light was type-tested.

(viii) Identification and specifications of the bulb used in the compliance test.

(b) If a light is too small to attach the required label—

(1) Place the information from the label in or on the package that contains the light; and

(2) Mark each light "USCG" followed by the certified range of visibility in nautical miles (nm), for example, "USCG 2nm". Once installed, this mark must be visible without removing the light.

46 CFR PART 25—REQUIREMENTS

6. The citation of authority for part 25 continues to read as follows:

Authority: 33 U.S.C. 1903(b); 46 U.S.C. 3306, 4302; 49 CFR 1.46.

7. Amend § 25.01–3(b) by adding the following standard in numerical order to those listed under American Boat and Yacht Council as follows:

§ 25.01–3 Incorporation by reference.

* * * * *

(b) * * *

Standard A–16–97, Electric Navigation Lights, July 1997 § 25.10–3

* * * * *

8. Add subpart 25.10 to part 25 to read as follows:

§ 25.10–1 Applicability.

This subpart applies to vessel manufacturers, distributors, and dealers installing navigation lights on all uninspected commercial vessels, except those completed before November 7, 2002.

§ 25.10–2 Definitions.

As used in this subpart:

Dealer means any person who is engaged in the sale and distribution of vessels to purchasers who the seller in good faith believes to be purchasing any such vessel for purposes other than resale.

Distributor means any person engaged in the sale and distribution of vessels for the purpose of resale.

Manufacturer means any person engaged in:

(1) The manufacture, construction, or assembly of vessels, or

(2) The importation of vessels into the United States for subsequent sale.

Navigation lights are those lights prescribed by the Navigation Rules (Commandant Instruction 16672.2 series) to indicate a vessel's presence, type, operation, and relative heading.

§ 25.10–3 Navigation light certification requirements.

(a) Except as provided by paragraph (b) of this section, each navigation light must—

(1) Meet the technical standards of the applicable Navigation Rules;

(2) Be certified by a laboratory listed by the Coast Guard to the standards of ABYC A–16 (incorporated by reference, see § 25.01–3), or equivalent, although portable battery-powered lights need only meet the requirements of the standard applicable to them; and

(3) Bear a permanent and indelible label stating the following:

(i) "USCG Approval 33 CFR 183.810"

(ii) "MEETS _." (Insert the identification name or number of the standard under paragraph (a)(2) of this section, to which the light was type-tested.)

(iii) "TESTED BY _." (Insert the name or registered certification-mark of the laboratory listed by the Coast Guard that tested the fixture to the standard under paragraph (a)(2) of this section.)

(iv) Name of Manufacturer.

(v) Number of Model.

(vi) Visibility of the light in nautical miles (nm).

(vii) Date on which the light was type-tested.

(viii) Identification of bulb used in the compliance test.

(b) If a light is too small to attach the required label—

(1) Place the information from the label in or on the package that contains the light; and

(2) Mark each light "USCG" followed by the certified range of visibility in nautical miles, for example, "USCG 2nm." Once installed, this mark must be visible without removing the light.

Dated: October 4, 2001.

Kenneth T. Venuto,

Rear Admiral, U.S. Coast Guard, Acting Assistant Commandant for Operations.

[FR Doc. 01–27385 Filed 10–31–01; 8:45 am]

DEPARTMENT OF TRANSPORTATION

Coast Guard

33 CFR Parts 84 and 183

46 CFR Part 25

[USCG–1999–6580]

RIN 2115–AF70

Certification of Navigation Lights for Uninspected Commercial Vessels and Recreational Vessels

AGENCY: Coast Guard, DOT.

ACTION: Final rule; delay of effective date.

SUMMARY: The Coast Guard is delaying the effective date of the final rule on Certification of Navigation Lights for Uninspected Commercial Vessels and Recreational Vessels published in the **Federal Register** on November 1, 2001. The final rule requires domestic manufacturers of vessels to install only certified navigation lights on all newly manufactured uninspected commercial vessels and recreational vessels. This rule aligns the requirements for these lights with those for inspected commercial vessels and with requirements for all other mandatory safety equipment carried on board all vessels. The Coast Guard expects the resulting reduction in the use of noncompliant lights to improve safety on the water.

EFFECTIVE DATE: The final rule is effective on November 1, 2003.

ADDRESSES: Comments and material received from the public, as well as documents mentioned in this preamble as being available in the docket, are part of docket USCG–1999–6580 and are available for inspection or copying at the Docket Management Facility, U.S. Department of Transportation, room PL–401, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5p.m., Monday through Friday, except Federal holidays. You may also find this docket on the Internet at *http://dms.dot.gov*.

FOR FURTHER INFORMATION CONTACT: If you have questions on this rule, contact Richard Blackman, Project Manager, Office of Boating Safety, Coast Guard, by telephone at 202–267–6810 or by e-mail at *rblackman@comdt.uscg.mil*. If you have questions on viewing the docket, call Dorothy Beard, Chief, Dockets,Department of Transportation, bytelephone at 202–366–5149.

SUPPLEMENTARY INFORMATION: On November 1, 2001, the Coast Guard published a final rule entitled "Certification of Navigation Lights for Uninspected Commercial Vessels and Recreational Vessels" in the **Federal Register** (66 FR 55086). The final rule, which was to become effective on November 1, 2002, directs manufacturers of uninspected commercial vessels and recreational vessels to install only navigation lights certified and labeled by a laboratory listed by the Coast Guard as meeting the technical requirements of the Navigation Rules.

Upon publication of the final rule, the Coast Guard noted that the implementation date may not provide enough time to complete the testing of navigation lights by laboratories listed by the Coast Guard to allow the recreational boat manufacturers to comply with the regulation. July 2002 is the date most of next year boat models will appear on show room floors. Photo boats for sales brochures will be built in March and April 2002 so that these brochures can be printed in time for the introductions. Actual new model year production will start in April and May 2002. Thus, boat builders must make their navigation light selections for the upcoming model year as early as February 2002. Each navigation light manufacturer will have to make tooling changes to meet the new marking requirements, and many will have to retest their applicable product line.

Sufficient time is not available to do this by February 2002. The alternative would be to pull all unsold boats off the market on November 1, 2002, replacing them either with new boat models equipped with compliant navigation lights or modifying their navigation lights to meet the new marking and certification requirements. Most, if not all, agree that this latter alternative is not a reasonable course to take.

Based upon this concern, the Coast Guard is delaying the effective date of the final rule to November 1, 2003.

Accordingly, in FR Doc. 01–27320 published in the **Federal Register** on November 1, 2001, at 66 FR 55086, the effective date for the referenced final rule is changed from November 1, 2002, to November 1, 2003.

Dated: January 9, 2002.

Terry M. Cross,

Rear Admiral, U. S. Coast Guard, Assistant Commandant for Operations.

[FR Doc. 02–1252 Filed 1–16–02; 8:45 am]
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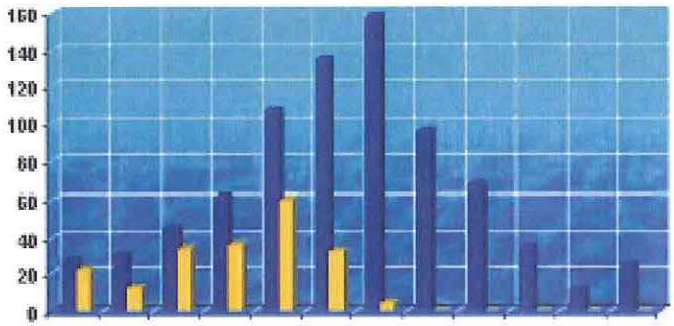
Take America's Boating Course®

Welcome to the official website of the U.S. Coast Guard Office of Boating Safety! Learn how to prevent accidents, injuries, and fatalities while boating. Review safety tips, news, recalls, defects, and laws and regulations you should know.

Comparison of U.S. Recreational Boating Fatalities

The numbers are declining! (Figures for 2002 and 2003 are preliminary.)

Fatality Statistics



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
27	31	45	61	107	135	158	96	67	35	11	25
22	12	34	36	60	33	4	-	-	-	-	-

Average monthly fatalities based on cumulative data for 1999-2003

2003 Statistics

Beacons

Carbon Monoxide -THAT SILENT KILLER -

Carbon Monoxide -THAT SILENT KILLER- Finds Yet Another Way To Kill: Coast Guard warns public of dangers associated with: "Teak Surfing" ...more>>

Interim Life Jacket Rule Effective Dec 23, 2002

The United States Coast Guard's interim life jacket rule for children under 13 becomes effective December 23, 2002 ...more>>

National Boating Safety Advisory Council Vacancy

Vacancy announcement and application procedures for NBSAC ...more>>

U.S.C.G Recalls Houseboats Due to Carbon Monoxide

Get a free Vessel Safety Check

Take a Boating Safety Course

Wear Your Life Jacket

Never Boat Under the Influence

You're In Command

You're In Command Resource Center

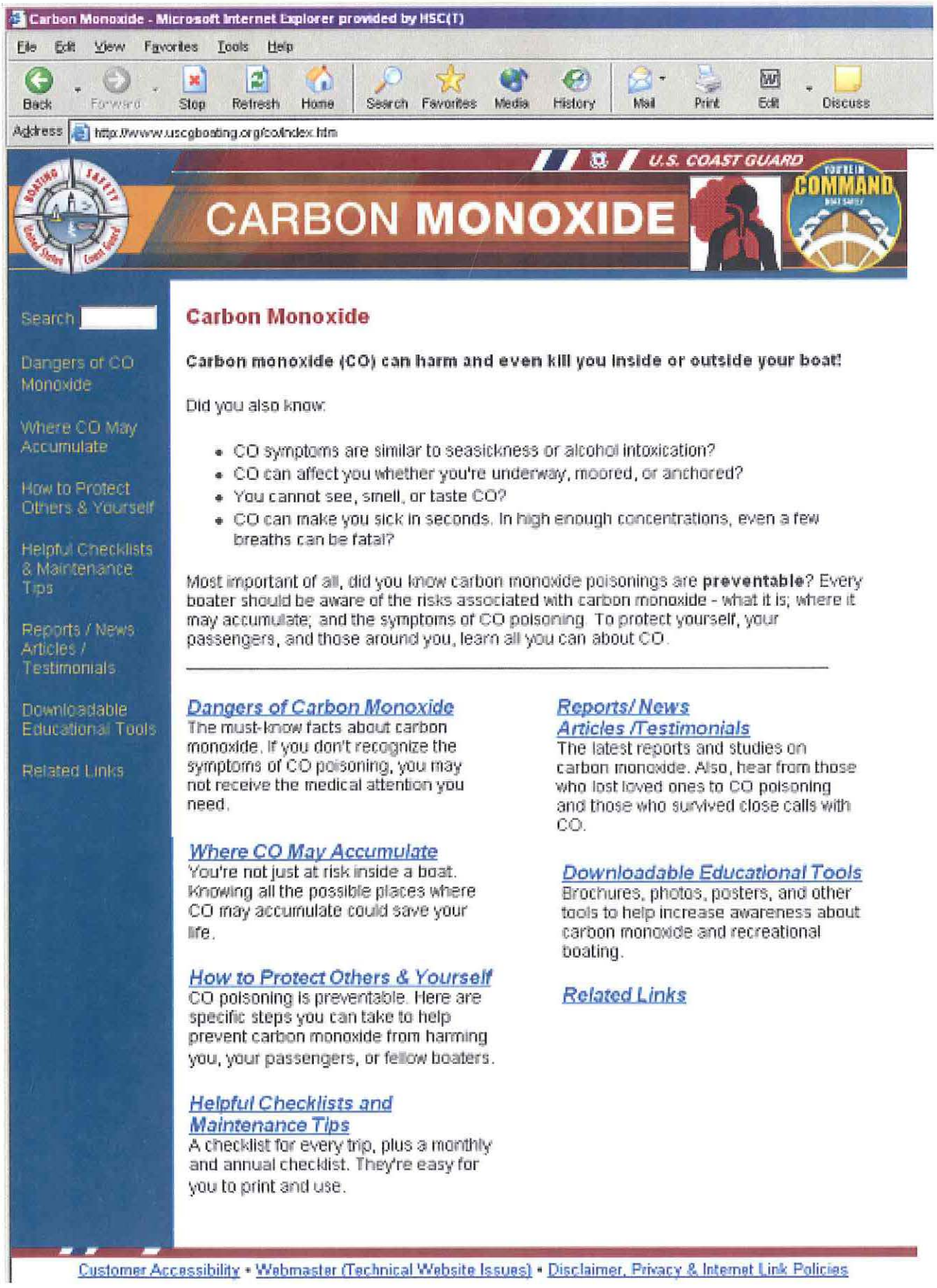
Carbon Monoxide Information

Alerts!

100-Yard-Approach
Do not approach within ...more>>

KOHLER Generator Recall
A carbon monoxide hazard ...more>>

Television Antennae Interference With GPS
Some active television antennae cause ...more>>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Where CO May Accumulate
How to Protect Others & Yourself
Helpful Checklists & Maintenance Tips
Reports / News Articles / Testimonials
Downloadable Educational Tools
Related Links
Carbon Monoxide
Carbon monoxide (CO) can harm and even kill you inside or outside your boat!
Did you also know:
CO symptoms are similar to seasickness or alcohol intoxication?
CO can affect you whether you're underway, moored, or anchored?
You cannot see, smell, or taste CO?
CO can make you sick in seconds. In high enough concentrations, even a few breaths can be fatal?
Most important of all, did you know carbon monoxide poisonings are preventable? Every boater should be aware of the risks associated with carbon monoxide - what it is; where it may accumulate; and the symptoms of CO poisoning. To protect yourself, your passengers, and those around you, learn all you can about CO.
Dangers of Carbon Monoxide
The must-know facts about carbon monoxide. If you don't recognize the symptoms of CO poisoning, you may not receive the medical attention you need.
Where CO May Accumulate
You're not just at risk inside a boat. Knowing all the possible places where CO may accumulate could save your life.
How to Protect Others & Yourself
CO poisoning is preventable. Here are specific steps you can take to help prevent carbon monoxide from harming you, your passengers, or fellow boaters.
Helpful Checklists and Maintenance Tips
A checklist for every trip, plus a monthly and annual checklist. They're easy for you to print and use.
Reports/ News Articles /Testimonials
The latest reports and studies on carbon monoxide. Also, hear from those who lost loved ones to CO poisoning and those who survived close calls with CO.
Downloadable Educational Tools
Brochures, photos, posters, and other tools to help increase awareness about carbon monoxide and recreational boating.
Related Links
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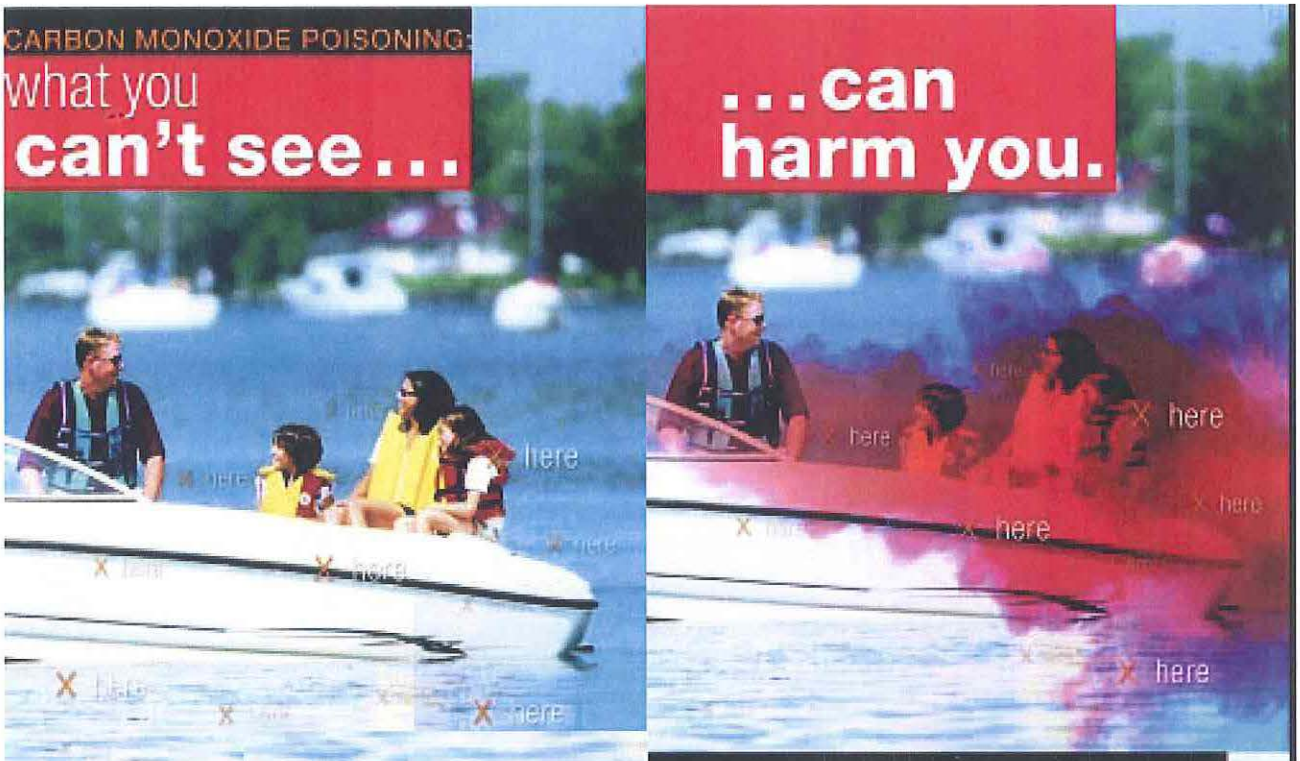
U.S. Department of Homeland Security
United States Coast Guard

July 2004

Boating Safety Circular 84



If you could see carbon monoxide accumulating around your boat, it might look like this.

WHAT IS CARBON MONOXIDE?

Carbon monoxide (CO) is a colorless, odorless, and tasteless gas. It is produced when a carbon-based fuel—such as gasoline, propane, charcoal, or oil—burns.

Sources on your boat may include engines, gas generators, cooking ranges, space and water heaters.

WHY IS IT SO DANGEROUS?

Carbon monoxide (CO) enters your bloodstream through the lungs, blocking the oxygen your body needs. Prolonged exposure to low concentrations or very quick exposure to high concentrations can kill you.

Early symptoms of CO poisoning include irritated eyes, headache, nausea, weakness, and dizziness. They are often confused with seasickness or intoxication, so those affected may not receive the medical attention they need.

Inside:

Belt Pack Inflatable PFD Tests (1) 4
Belt Pack Inflatable PFD Tests (2) 6
Factory Visit Program 8
Recall Campaigns 8
Final Rule: Country of Origin Codes and HINs 17

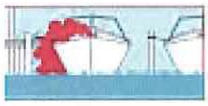
where can CO **accumulate?**

ANYWHERE in or around your boat.

how can CO **accumulate?**

Inadequately ventilated canvas enclosures.

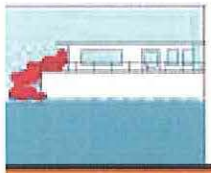
Exhaust gas trapped in enclosed places.



Blocked exhaust outlets.

Another vessel's exhaust.
CO from the boat docked next to you can be just as deadly.

"Station wagon effect" or back drafting.



At slow speeds, while idling, or stopped.
Be aware that CO can remain in or around your boat at dangerous levels even if your engine or the other boat's engine is no longer running!

HOW CAN YOU **protect others and yourself?**

- Know where and how CO may accumulate in and around your boat.
- Maintain fresh air circulation throughout the boat at all times.
- Know where your engine and generator exhaust outlets are located and keep everyone away from these areas.
- Never sit on the back deck, teak surf, or hang on the swim platform while the engines are running.
- Never enter areas under swim platforms where exhaust outlets are located unless the area has been properly ventilated.
- Although CO can be present without the smell of exhaust fumes, if exhaust fumes are detected on the boat, take immediate action to ventilate these fumes.
- Treat symptoms of seasickness as possible CO poisoning. Get the person into fresh air immediately. Seek medical attention—unless you're sure it's not CO.
- Install and maintain CO detectors inside your boat. Do not ignore any alarm. Replace detectors as recommended by the manufacturer.
- Follow the checklist provided in this pamphlet.
- Get a Vessel Safety Check.

THE U.S. COAST GUARD **wants you to know...**

- CO can harm and even kill you inside or outside your boat.
- CO symptoms are similar to seasickness or alcohol intoxication.
- CO can affect you whether you're underway, moored, or anchored.
- You cannot see, smell, or taste CO.
- CO can make you sick in seconds. In high enough concentrations, even a few breaths can be fatal.

...CO poisonings are preventable.

DO NOT OPERATE YOUR BOAT WITHOUT DOING THE FOLLOWING:

TRIP CHECKLIST FOR CARBON MONOXIDE

- ☐ Make sure you know where exhaust outlets are located on your vessel.
- ☐ Educate all passengers about the symptoms of CO poisoning and where CO may accumulate.
- ☐ When docked or rafted with another boat, be aware of exhaust emissions from the other boat.
- ☐ Confirm that water flows from the exhaust outlet when the engines and generator are started.
- ☐ Listen for any change in exhaust sound, which could indicate an exhaust component failure.
- ☐ Test the operation of each CO detector by pressing the test button.

BOATER'S MONTHLY MAINTENANCE CHECKLIST

- ☐ Make sure all exhaust clamps are in place and secure.
- ☐ Look for exhaust leaking from exhaust system components. Signs include rust and/or black streaking, water leaks, or corroded or cracked fittings.
- ☐ Inspect rubber exhaust hoses for burned, cracked, or deteriorated sections. All rubber hoses should be pliable and free of kinks.

ANNUAL CHECKLIST HAVE A QUALIFIED MARINE TECHNICIAN:

- ☐ Replace exhaust hoses if cracking, charring, or deterioration is found.
- ☐ Ensure that your engines and generators are properly tuned, and well maintained.
- ☐ Inspect each water pump impeller and the water pump housing. Replace if worn. Make sure cooling systems are in working condition.
- ☐ Inspect all metallic exhaust components for cracking, rusting, leaking, or loosening. Check the cylinder head gasket, exhaust manifold, water injection elbow, and the threaded adapter nipple between the manifold and the elbow.
- ☐ Clean, inspect, and confirm proper operation of the generator cooling water anti-siphon valve (if equipped).

want to know more?

For more information about how you can prevent carbon monoxide poisoning on recreational boats, or for other boating safety information, contact:

United States Coast Guard
Office of Boating Safety (S-OPB-3)
2100 Second Street SW
Washington, DC 20593-0001
www.uscgboating.org
1-800-368-5647

National Marine Manufacturers Association
200 East Randolph Drive
Suite 5100
Chicago, IL 60601-9301
www.nmma.org
312-946-6200

American Boat & Yacht Council, Inc.
3069 Solomon's Island Road
Edgewater, MD 21037-1416
www.abycinc.org
410-956-1050

For information on how to get a **free VESSEL SAFETY CHECK**, visit www.VesselSafetyCheck.org
or contact your local U.S. Coast Guard Auxiliary or United States Power Squadrons®.

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foundation findings
Number 37

By Joni Sralla Turken
Originally published by the BoatU.S. Foundation in BoatUS Magazine, January 2004

How Much is that Belt Pack in the Window?

Testers take seven belt pack inflatables for a walk in the park

Belt pack inflatable life jackets are the hippest new thing in boating safety, giving boaters a cutting-edge option for staying out of harm's way while on the water. Compact and clever, these life jackets will charm the topsiders off the boater who's got to have the absolute latest in boating gear, while their safety side will pique the curiosity of even the most stoic mariner.

Just like that adorable puppy in the pet store window that catches your eye, belt packs will steal your affection. But are these diminutive little PFDs really as lovable and loyal as they look? In Foundation Findings #37, we set out to find everything there was to know about these new models. In this issue, Part I of our two-part article, we'll tell you all about the care and feeding of your belt pack inflatable. In Part II, we'll take our testing to the water and tell you how it feels to wear one in real-life conditions.

The Latest Litter

In order to check out the latest in belt pack technology, we scoured boat store shelves and the Internet for U.S. Coast Guard-approved inflatable belt pack models. We came up with seven including two from SoSpenders, three from Stearns, one from Mustang, and one from SeaPro. For this article, we created a short-hand name for each unit that includes the manufacturer name and cylinder size (for instance, the Stearns Inflatabelt Max Manual Belt Pack is simply the Stearns 25).

Talk about evolving technology: After conducting these tests last fall, we learned almost immediately that two readily-available models were being discontinued, and new versions were already on the way but not yet available for testing. With new models rapidly hitting the market, we decided to focus this article on qualities to look for in a belt pack, rather than the best or worst models.

A Walk Around the Park

With seven models in hand, we started our three-tiered test. We began with a repacking exercise for four boaters who were interested in, but not knowledgeable about, belt packs. In a quiet room, one by one, they were given a fully inflated jacket and were asked to read each unit's instructions for three minutes.

To simulate conditions out on a boat, they read only the instructions attached to the jacket, not the entire user's manual. Each of the testers repacked the jackets in a different order, to ensure fairness.

Each tester deflated their jacket, rearmed it with a CO2 cartridge, and repacked it into the pouch while a knowledgeable staff member observed. Finally, at the end of repacking, each tester put the unit around their waist, imagined they were jumping into stormy seas, then pulled the jerk cord and hoped for the best.

We were curious about the quality of the instructions and were eager to know if regular boaters could master rearming and repacking. We also wanted to address an unanticipated piece of information we ran across: that a large majority of people we talked to — experienced boaters and staff members included — had never inflated their own inflatable life jackets. Surprised? So were we, but more on that later.

Paper Training

Our testers found little uniformity with the instructions, even among jackets from the same manufacturer. Across the board, instructions with pictures were a favorite. In particular, the SoSpenders 16 and 38 models had simple and clear pictograms, however, the testers were disappointed when the pictures did not exactly match the way the units looked when folded. On all but one jacket, the Mustang 33, the rearming instructions were placed separately from the repacking instructions, which was difficult to follow. In addition to having written instructions, the Mustang 33 and Stearns Auto 33 got high marks for the dotted lines right on the life jacket bladder that said "Fold here."

Because of the nearly ubiquitous small print and poor organization of the attached directions, we concluded that a belt pack owner's first experience with the instructions should definitely be in a stable well-lit room at home, rather than a rolling galley table midway through a cruise.

Obedience Issues

Our testers spent anywhere from five to 25 minutes repacking and rearming the jackets. By far, most frustrating for testers was simply trying to squeeze every hint of air out of the bladder before attempting to get it back into its pouch. Most models were intricately folded and required fastidious attention to the instructions.

Rearming the jacket with CO2, which would seem to be the most difficult part actually proved to be the easiest. All testers successfully rearmed each jacket, though in two of our 28 repackings, the lever attached to the jerk cord was not set correctly and accidentally pierced the cylinder, instantly inflating the jacket.

One reason the testers were so successful in rearming could be the relative consistency of rearming mechanisms. On all inflatable life jackets, to show if a jacket is ready to inflate, a red and green color coding system is in place. Essentially red means stop and green means go. To show this, almost all models require you to install a green plastic "pin" into part of the lever arm during rearming. About the size of an earring, this pin is easy to lose or break. The pin comes with the CO2 cylinder as part of your jacket's specific "rearming kit."

On most models, the rearming mechanism is hidden inside the belt pack. However, we loved the extra safety of the SoSpenders 16 and Stearns 16 models in which a clear plastic window showed the cylinder and conse-

quently the green pin that indicates the unit is ready. The SeaPro 25 went further by having the cylinder assembly on the outside of the pack for excellent viewing, but we felt uncomfortable about it being exposed where the cord could accidentally get caught on something. Another great safety feature of this model is its rearming mechanism that shows readiness by green automatically appearing in a small window (as opposed to remembering to insert the pin) when you screw the cylinder in all the way.

When it came time to take that deep breath and imagine going overboard, all our testers' life jackets inflated when the jerk cord was pulled — except one. In this case, the tester had run out of patience while repacking the SoSpenders 38 and had simply forced the bladder into the pouch. After it failed to inflate during testing, she freed the bladder from the pouch manually and the jerk cord worked fine.

Old Dog, New Tricks?

After going through the rearming and repacking exercise, several testers commented that wearing an inflatable belt pack without going through this process — or supplying one to an unknowing guest — was just plain dumb. And you know what? We did feel dumb, since many of us had to admit we had never actually inflated our own life jackets. Gulp.

Why hadn't we inflated our jackets? The main reason, we decided, was the high cost of CO2 cylinders. We concluded that the cost of testing the unit — at least once — should be factored into the cost of owning the jacket. In lieu of that, remember that every jacket can be inflated orally either to test the jacket onshore or to inflate it in an emergency.

A belt pack's low profile means it doesn't interfere with tasks around the boat.

A Big Commitment

Having the coolest, most current technology will get you nowhere if you don't understand the animal you've brought home. To become a good owner, we cannot stress enough that you must spend time reading the user's manual. Then, practice rearming and repacking. You'll feel better wearing the belt pack if you understand how it works. Additionally, we strongly suggest you buy a couple of spare rearming kits when you purchase the unit.

For those up to the commitment, we found belt packs offer an economic, easy-to-wear life jacket for cruising, sailing, kayaking, or dinghying around in warmer, inland waters. A belt pack can be a perfect transition into safer boating, especially for the boater who simply isn't in the habit of wearing a life jacket.

For even more information on our two-part Foundation Findings on belt pack inflatables, please visit www.BoatUS.com/foundation.

The BoatU.S. Foundation is a national nonprofit 501(c)(3) organization primarily supported by donations from individuals and grants.

Model	SoSpenders 16 Gram Scout Belt Pack	Stearns Multipurpose Inflatabelt-Lite Manual	Sea Pro Marine Swimmer Safety Belt	Stearns Inflatabelt Max Manual Belt Pack +	Mustang Survival Airforce Inflatable Pouch PDF	Stearns Inflata-belt Max Automatic/ Manual Belt Pack	SoSpenders World Class Belt Pack +
Shorthand Name	SoSpenders 16	Stearns 16	Sea Pro 25	Stearns 25	Mustang 33	Stearns Auto 33	SoSpenders 38
Cylinder Gram Weight	16 Grams	16 Grams	25 Grams	25 Grams	33 Grams	33 Grams	38 Grams
Belt Pack MSRP	$59.99	$59.99	$139.95	$69.99	$80.00*	$95.99	$69.99
Rearming Kit MSRP	$9.99	$9.99	$25.00 for 3	$13.99	$15.00*	$21.99	$16.99
Dimensions of Pack L x H x W	10 x 3.5 x 2.25"	24.5 x 3.5 x 2"	16.5 x 2.75 x 2.25"	9.5 x 4.75 x 2.5"	8 x 4.25 x 2.5"	10.5 x 4.75 x 3.25"	8.5 x 5.55 x 3"
Overall Pack Weight	13.4 oz	12.8 oz	17.4 oz	17.0 oz	19.6 oz	22.0 oz	21.8 oz
Rearming and Repacking Test Ratings							
Speed of Repack Rating 1=fastest; 7=slowest	4	1	6	3	2	5	7
Ease of Repack Rating 1=easiest; 7=hardest	3	1	4	1	2	3	5

+ Discontinued * No MSRP available, average price

foundation findings
Number 38

By Joni Sralla Turken
Originally published by the BoatU.S. Foundation in BoatUS Magazine, March 2004

Belt Pack Inflatables Take the Plunge

In Part I of this series, we introduced you to some of the smallest, most high-tech life jackets on the market: belt pack inflatables. We took these products home, repacked and rearmed them, and treated them like our own. Now, in Part II, we've taken these life savers to the water and put them to the test.

Proving Ground

For our testing, we used seven of the most current U.S. Coast Guard-approved belt pack inflatable models from a variety of manufacturers, including six manual inflation models and one automatic.

First, we asked five testers of various body types to wear each of the jackets uninflated for 30 minutes as they went about their daily tasks. Each jacket definitely met its claim of being compact and easy to forget. But while wearing a belt pack around a boat is one thing, wearing it in the water is quite another. Belt pack models: report for duty!

Field Exercises

In a static swimming pool, four "victims" tried on each of the inflated belt packs. Here, we made measurements on the jackets' fit while in the water and asked the victims to perform a series of tests. We also asked them subjective questions about how they felt in the jackets. Second, we visited a local wave pool to try out the personal flotation devices (PFDs) in choppier conditions of two- to four-foot seas. Belt pack inflatables are intended for inland waters where help isn't too far away, so we wanted to see how the jackets would feel and behave during a relatively short time in the water.

The victims' first task in the water was to yank the cord to inflate the jacket. The Stearns Auto 33 eliminates the first of these steps by automatically inflating when immersed. (For this article we created a short-hand name for each unit that includes the manufacturer's name and cylinder size. Full names of products can be found in the chart at right). Then came "secondary donning," or pulling the jackets over their heads. After donning the jackets, the victims felt they had to make additional adjustments to make the unit fit comfortably in about a third of the cases. We found that snugging the belt very tight around your waist so it was comfortable out of the water made it fit too tightly once you were in the water. One test subject, a large male, had difficulty tying the under-chin straps on some jackets, and preferred the buckle snaps on the Stearns 25. Another victim commented that he needed more instructions right on the jacket where he could see them while he was in the water.

All agreed on this point: an uninflated belt pack would be of little use to an unconscious victim, and even an injured boater could be in real trouble since this process does take some strength and coordination. Trying out the life jacket ahead of time, in a pool if possible, is the best way to build competence in donning the jacket in a pressure situation.

We also asked the victims to try to swim in the jackets. We found that because the jackets were specifically designed to flip a person onto his or her back, swimming on your stomach was very difficult, so kicking on your back was the best way to get around.

In the turn test, we were thrilled to find that the inflated belt packs turned an "unconscious" victim up from a face-down position in almost every single test — much more often than a typical Type II or Type III foam life jacket. This was one of the most impressive life-saving discoveries of our testing.

Feelings of Safety and Comfort

When we asked our victims how safe they felt in each jacket, there were three jackets that got perfect five-star ratings from all testers: the Stearns 25, Mustang 33, and SoSpenders 38. The Mustang 33 in particular had a unique square shape that kept victims' faces an average of 6.9 inches above the water—the highest freeboard tested. All the other jackets had freeboard ranging from 5 to 5.7 inches.

The life jacket bladder on a manual belt pack inflatable is stored in a small pouch around your waist. When needed, you pull a cord and the jacket inflates, like on the SoSpenders 16 above. After that, you must pull the unit over your head and make adjustments to the straps. On some boaters a little air might need to be released for the jacket to fit comfortably; in some cases, it may need to be added. This additional work is called "secondary donning."

But feeling safe in the water did not necessarily mean feeling comfortable. For example, the Mustang 33 strained the neck of one tester, and made it hard for others to swim. The extra oral inflator on the

All the jackets met their claims of being compact and easy to wear around the boat, plus they're a cool, safe alternative on a hot day

SoSpenders 38 poked some victims in the chest. The Sea Pro 25 was most popular for the feeling of comfort in the water, mainly because of the intuitive position of a strap adjustment tab in the center of the jacket. The innovative design of the Stearns 16 made it the least popular choice for a long stretch in the water, since the neck strap dug painfully into the necks of the victims.

The Debrief

While a belt pack is not going to be the only life jacket on our boat or in our closet, we feel strongly that it fills an important niche for boaters. Belt packs offer boaters a less expensive inflatable and a less bulky option for specific types of inland boating where you don't expect huge seas or dramatic weather, and where you expect help to arrive fairly quickly.

All inflatables can be blown up orally, but the two 16 gram models we tested can also be orally inflated up to 22 grams during secondary donning.

On the Stearns 16 the flotation is located in a pillow shape over your belly. A strap then goes around your neck to hold your head up.

But remember, these inflatables are different from the average Type II or III foam life jackets that are most common to boating. They fit different, they act different, they need more maintenance, and their owners need to inflate them and get familiar with how they work well before an emergency.

So which jacket is best? Our answer: the one you will wear! Think about your boating lifestyle, check out the chart, and take the plunge!

For even more information on our two-part Foundation Findings on belt pack inflatables, please visit www.BoatUS.com/foundation.

The BoatU.S. Foundation is a national nonprofit 501(c)(3) organization. Our work is primarily supported by donations from individuals and grants.

Belt Pack Inflatable Test Results

SoSpenders 16

SoSpenders 16 Gram Scout Belt Pack
16 Gram Cylinder Unit: $59.99 Rearm Kit: $9.99

Sense of Security	●	◐			
Wearability	●	●	●	◐	
In-Water Comfort	●	●	●		

Stearns 16

Stearns Multipurpose Inflata-Belt Lite-Manual
16 Gram Cylinder Unit: $59.99 Rearm Kit: $9.99

Sense of Security	●	◐			
Wearability	●	●	●	●	◐
In-Water Comfort	●	●	●		

Sea Pro 25

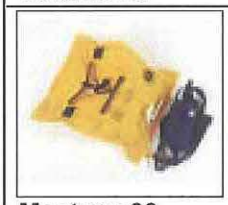
Sea Pro Marine Swimmer Safety Belt
25 Gram Cylinder Unit: $139.99 Rearm Kit: $25.00 (3 pack)

Sense of Security	●	●	●	●	◐
Wearability	●	●	●	◐	
In-Water Comfort	●	●	●	●	◐

Stearns 25

Stearns Inflata-Belt Max Manual Belt Pack
25 Gram Cylinder Unit: $69.99 Rearm Kit: $13.99

Sense of Security	●	●	●	●	●
Wearability	●	●	●	◐	
In-Water Comfort	●	●	●	●	



Mustang 33

Mustang Survival Airforce Inflatable Pouch PFD
33 Gram Cylinder Unit: $80.00 Rearm Kit: $15.00

Sense of Security	●	●	●	●	●
Wearability	●	●	●	●	
In-Water Comfort	●	●	●	◐	

Stearns Auto 33

Stearns Inflata-Belt Max Auto/Manual Belt Pack
33 Gram Cylinder Unit: $95.99 Rearm Kit: $21.99

Sense of Security	●	●	●	●	◐
Wearability	●	●	◐		
In-Water Comfort	●	●	●	●	

SoSpenders 38

SoSpenders World Class Belt Pack
38 Gram Cylinder Unit: $69.99 Rearm Kit: $16.99

Sense of Security	●	●	●	●	●
Wearability	●	●	◐		
In-Water Comfort	●	●	●		

To obtain these results, we asked our testers a series of subjective questions, including: How safe do you feel in this jacket while in the water? How comfortable is it to wear around the boat? and How comfortable do you feel in the water?

FACTORY VISIT PROGRAM UPDATE

The Coast Guard Recreational Boating Product Assurance Division recently awarded a contract for the Recreational Boat Factory Visit Program to Parroco Production Group (PPG). The purpose of the factory visit program is to emphasize the need to comply with Federal safety standards and regulations; to ensure each manufacturer understands the regulations; and to assist manufacturers in certifying compliance with the regulations.

The Recreational Boating Product Assurance Division assigns all recreational boat manufacturers a three character Manufacturer Identification Code (MIC). Using the Coast Guard MIC database (see http://www.uscgboating.org/recalls/mic_database.htm) the PPG Compliance Associates are contacting and visiting all recreational boat manufacturers and importers on a scheduled basis.

The compliance associate (CA) usually contacts the manufacturer a couple of times before a visit. The first contact—a few weeks before a visit—is to arrange an inspection date, and to confirm information such as address and types of boats produced. The second contact—a few days before the visit—is to reconfirm the date and time of the visit.

Typically, a CA will ask to inspect current production and will look for:

1. Noncompliances with Federal regulations which are manufacturer requirements;
2. Noncompliances with Federal regulations which are operator requirements; and
3. Manufacturing practices for which voluntary industry safety standards and recommended practices are available.

At the end of the visit, which normally takes a couple of hours, the CA discusses the results with the manufacturer. Then the CA files a report with the Recreational Boating Product Assurance Division at Coast Guard Headquarters. Usually, for minor, non-safety-related problems, corrective action is limited to future production. Headquarters may also direct the manufacturer to conduct defect notification for any serious noncompliances with Federal safety standards.

The factory visit program should lead to a heightened understanding of both Federal and voluntary safety standards and regulations, and thereby provide the public with safer recreational boats.

If you have any questions or if you are a manufacturer who would like to schedule a visit, please contact CWO Doug Luper at 202/267-0384.

DEFECT NOTIFICATION AND RECALL CAMPAIGNS

Problem Descriptions:

Basic Flotation: Most inboard, inboard/outdrive and jetdrive powered motorboats less than 20 feet in length are required to contain sufficient flotation so that some portion of the boat remains above the surface of the water if the boat is swamped. Boats with "Basic Flotation" problems will sink if they capsize or swamp.

Level Flotation: Most outboard powered motorboats less than 20 feet in length are required to float level when they are swamped and to support a certain percentage of the weight which they are rated to carry. Boats with "Level Flotation" problems do not float level when swamped.

Capacity Label Missing, Maximum Persons Capacity Overrated, Maximum Weight Capacity Overrated or Horsepower Capacity Overrated: Almost all motorboats less than 20 feet in length are required to bear a "U.S. Coast Guard Maximum Capacities" label. If the label is missing or the values are overrated, an operator who is unfamiliar with a particular boat may try to carry too much weight or, in the case of outboard powered boats, too much horsepower. Some insurance companies will not insure a boat that lacks the label or bears a label with incorrect information.

The recall list includes new campaigns as well as old ones. The new campaigns begun since September 2003 follow:

AMERICAN HONDA MOTOR CORP.
(Torrance, CA)(040086T)
Models: BF8A 8 HP Outboard Motors w/ serial nos.:
BZBC-1300327 to BZBC-1800582
BACL-1213392 to BACL-1700048
BACS-1210688 to BACS-1700084
Units: 7,000
Problem: Some flywheels may develop hairline cracks; engine vibration or engine over-reving may cause flywheel to break; possible injury to operator or passengers

BAYLINER MARINE CORP.
(Arlington, WA)(040057S)
Year: 2003
Models: 2352 Walk Around Trophy
Units: 125
Problem: Fuel tank barbs lack anti-siphon protection

BAYLINER MARINE CORP.
(Arlington, WA)(040018S)
Year: 2003-2004
Models: 219 Sport Deck
Units: 315
Problem: Improper blower hose installation

BOMBARDIER MOTOR CORP. OF AMERICA
(Sturtevant, WI)(040019T)
Year: 2000-2003
Models: Following boats equipped with Mercury 240 EFI Engines:
2000-2003 Sea-Doo Islandia
2002 & 2003 Sea-Doo Utopia 205
2000-2002 Sea-Doo Challenger 2000
2002 Sea-Doo X-20
Units: 3,185
Problem: Throttle body may corrode; throttle may stick when starting engine causing boat to accelerate unexpectedly or throttle may fail to return to idle speed; danger of collision

BOMBARDIER MOTOR CORP. OF AMERICA
(Sturtevant, WI)(040022T)
Year: 2004
Models: Sporster LEDI , Sporster 4-TEC, Speedster 200
Units: 492
Problem: Insufficient thread engagement in the ball joint located at the steering nozzle may cause loss of steering control; danger of collision

BOMBARDIER MOTOR CORP. OF AMERICA
(Sturtevant, WI)(040017S)
Year: 2003-2004
Models: 2003 Sporster 4-TEC, 2004 Sporster 4-TEC
2004 Speedster 200
Units: 1,392
Problem: Hose clamps may be improperly positioned on end of fuel lines; potential for fuel leak; possible fire/ explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS
(Valcourt (Quebec) Canada)(040048T)
Year: 2004
Models: Sea-Doo RXP
Units: 1,000
Problem: Hood may crack near access cover hinge cover may fly off and hit operator and/or passenger; risk of injury

BOMBARDIER MOTR CORP. OF AMERICA
(Waukegan, IL)(040016T)
Year: 2004
Models: 100, 115, 135, 150, 175, 200, 225 and 250 HP Evinrude Direct Injection outboards
Units: 978
Problem: Fuel return manifold may contain excessive flashing on an elbow preventing an O-ring from properly seating causing a fuel leak; possible fire/explosion if ignition source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Waukegan, IL)(030178T)
Year: 2001-2003
Models: Side mounted remote control boxes (parts nos. 176380 and 176381) for use with Johnson and Evinrude outboards
Units: 20,420
Problem: Loose or improperly assembled fast idle levers may cause engine to stick in gear or in neutral or jam the throttle; danger of collision

MERCURY MARINE
(Fond du Lac, WI)(030176T)
Year: 2003-2004
Models: 225 EFI Four Stroke Outboards with serial nos.: OT653945 - OT862518
Units: 2,461
Problem: Binding in throttle system may prevent operator from disengaging the shift mechanism and shifting into neutral; danger of collision

NAUTIC STAR BOATS
(Amory, MS)(03R0168S)
Year: 2003
Models: Nautic Star 1900 Bay Boat
Units: 20
Problem: Trolling motor receptacle trim switch in bow not ignition-protected; possible fire/explosion if fuel/vapor source present

POLARIS INDUSTRIES, INC.
(Medina, MN)(030113T)
Year: 2003 - 2004
Models: MSX 140
Units: 4,187
Problem: Insufficient clearance between fuel return hoses and fuel injector brackets may create abrasion points allowing fuel to leak into engine compartment; possible fire/ explosion if ignition source present

POLARIS INDUSTRIES, INC.
(Medina, MN)(030113T)
Year: 1998 - 2001
Models: 1998 SLH (B984673), SLXH (B984690)
1999 SLH (B994673), SLX (B994690)
2000 SLH (W004673), SLX (W004699)
2000 PRO 1200 (W004999)
2001 SLH (W014697), SLX (W014699)
2001 PRO 1200 (W014999)
Units: 7,670
Problem: Hood hinge could fail and separate from the deck and strike the operator/passenger

PRAIRIE ADVENTURE OUTDOORS
(West Point, MS)(03R0169S)
Year: 2003
Models: 14-1531
Units: 20
Problem: Level Flotation

VOLVO PENTA OF THE AMERICAS
(Chesapeake, VA)(030207T)
Year: 2004
Models: 4.3 GL-D, 5.0 GL-E & 5.7 GL-E
Units: 550
Problem: Sealing O-ring may be missing from fuel fitting adapter resulting in a fuel leak; internal seal in fuel pump may have been omitted during manufacture of the pump; possible fire/explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(040065T)
Year: 2004
Models: FX1100/FX1100A
Units: 1,579
Problem: Main wiring harness may not be properly secured allowing it to rub against motor mount until insulation is worn through; possible fire/explosion if fuel or vapor source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(030208T)
Year: 2004
Models: SJ700B-C (SuperJet)
Units: 150
Problem: Fuel may leak from fuel tank into engine compartment due to possible pinhole in fuel tank wall; possible fire/explosion if ignition source present

ZODIAC OF NORTH AMERICA
(Stevensville, MD)(030210T)
Year: 2003
Models: Medline I, Medline II, Pro Open 550, Pro Open 650, Yachtline Deluxe 340, 380, 420 & 480
Units: 155
Problem: WEMA fuel sender gaskets on Kracor fuel tanks may deteriorate and develop leaks; possible fire/explosion if ignition source present

The following are the other campaigns still in progress that began before September 2003:

AMERICAN HONDA MOTOR CORP.
(Torrance, CA)(030056T)
Year: 2002 & 2003
Models: Honda 200 & 225 HP Outboard Motors:
2002 BF200 w/ serial nos.:
BAEJ-1000001 to BAEJ-1000969
BAFJ-1000001 to BAFJ-1000222
2003 BF200 w/ serial nos.:
BAEJ-1100001 to BAEJ-1100708
BAFJ-1100001 to BAFJ-1100120
2002 BF225 w/ serial nos.:
BAGJ-1000001 to BAGJ-1003344
BAHJ-1000001 to BAHJ-1000601
2003 BF225 w/ serial nos.:
BAGJ-1100001 to BAGJ-1101489
BAHJ-1100001 to BAHJ-1100662
Units: 5,805
Problem: Potential interference between wire harness and throttle body may lead to short circuit which blows a fuse, stops the engine or overheats the throttle cable; throttle could stick; possible collision

AMERICAN HONDA MOTOR CORP.
(Torrance, CA)(020129T)
Year: 2002
Models: ARX1200T3 with HINs:
HPSA0001J102 to HPSA3548J102
ARX1200N3 with HINs:
HPSB0001J102 to HPSB1506J102
Units: 5,037
Problem: Bearings within throttle body subject to corrosion; throttle may not return to idle position; possibility of collision

ARCTIC CAT, INC.
Thief River Falls, MN (010003T)
Year: 1999
Models: Tigershark 1100 LI
Units: 522
Problem: Throttle bodies may wear/corrode causing stiff throttle operation and return; may result in throttle remaining in open position; danger of collision

ARCTIC CAT, INC.
Thief River Falls, MN (000201T)
Year: 1997
Models: Tigershark: Daytona 770 and 1000
Tigershark: Monte Carlo 640, 770 & 1000
Units: 9,436
Problem: A crack may develop in base of fuel filler neck permitting liquid fuel or vapor leakage; possible fire/explosion if ignition source present

BLUE SEA SYSTEMS
(Bellingham, WA)(030062T)
Year: 2002 & 2003
Models: T-1 Thermal Circuit Breakers:

Part Number	Amperage	Part Number	Amperage
7120	25	7020	25
7121	30	7021	30
7122	35	7022	35
7123	40	7023	40
7124	50	7024	50
7125	60	7025	60
7126	70	7026	70
7127	80	7027	80
7128	90	7028	90
7129	100	7029	100
7130	110	7030	110
7131	120	7031	120
7132	135	7032	135
7133	150	7033	150

shipped to the following OEM purchasers:

Atlas Boat Works, Inc.
Beneteau Mfg. USA, Inc.
BH Electronics, Inc.
Carver Boat Corp.
Chantiers Beneteau SA
Chuckhouse, Inc.
Cruisers Yachts
Davis Boats
Endeavor Catamaran
Ennals Ives
Fleet Safety Supply
Florida Bow Thrusters
Good Automatic Windlass
Harken, Inc.
Hells Bay Boat Works
High Tech Marine, Inc.
Hinckley Company
Ideal Windlass Co., Inc.
Ironwind, Inc.
DBA Moose Boats
M & G Electronics Corp.
Marintek
Medeiros Boat Wks. Ltd.
Nordic Tugs, Inc.
Novatron Corporation
Ocean Technologies
Pacer Marine
Pacific Mariner, Inc.
Pacific Trawlers NW
Regal
S2 Yachts, Inc.
Sabre Corp.
Safe Boat
Scandik, Inc.
Sea Ray - Merritt Is.
Sea Sport Boats, Inc.
Sea Vee Boats
Seaward Products
Seawolf Marine Mfg.
Sharpe Marine
Silver Ships, Inc.
Silverton Marine Corp.
Team Supreme
Thoroughbred Cruisers
Thunderbird Products
TOMCO Marine Group
Trans Fbgls. Boat Co.
Tri Tec Systems, Inc.
US Marine Corp.
WESCO (non-marine vehicle market)
Wood Mfg.Company
DBA Ranger Boats

Units: 54,193
Problem: Potential fire risk if circuit breaker handle is held in the "on" position after the unit is tripped and the circuit breaker contacts weld together; if the contacts weld and the short circuit is not corrected, heat may be generated that may damage attached or adjacent wiring; possible fire/explosion if fuel or vapor source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(030010T)
Year: 2003
Models: Sportster 4-TEC Sport Boats
Model 5770 w/ HINs:
US-CEC55000L203 - US-CEC55183A303
Model 5768 w/ HINs:
US-CEC65001L203 - US-CEC65055A303
Units: 178
Problem: Fuel tank air vent nipple might have been deformed during clamp torquing procedure; potential fuel leak; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODS.
(Sturtevant, WI)(020082T)
Year: 2001 & 2002
Models: 2001 Utopia 185 models: 5452, 5454, 5456 and 5458; 2001 Challenger model 5448;
2002 Utopia 185 & 205 models: 5462, 5475, 5476 and 5745
2002 Islandia model 5709
Units: 473
Problem: Engine wiring harness has 3 exposed wires (one of which carries battery voltage); possible spark if battery wire contacts metal while engine running; possible fire/explosion if fuel/vapor source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000145T)
Year: 2000
Models: GTX, XP, RX DI, GTX DI, AND LRV (5513, 5514, 5544, 5545, 5646, 5649, 5651, 5653, 5655, 5656, 5659, 5669 and 5688)
Units: 3,476
Problem: Clip securing air intake silencer could release and allow gaskets to fall into throttle bodies; for DI (direct injection) models only, fogging tube inside air silencer could also be drawn into rear throttle body; loss of speed control and possible collision

BOMBARDIER MOTOR CORP. OF AMERICA
(Waukegan, IL)(020139S)
Year: 2002
Models: 25 & 30 HP Johnson Outboards
Units: 1,046
Problem: Due to shift linkage misadjustment engines might not have start-in-gear protection

BOMBARDIER RECREATIONAL PRODS.
(Sturtevant, WI)(020153T)
Year: 2002
Models: Utopia 185 and 205 Sport Boats
Units: 437
Problem: Starboard and/or port console may come loose. If starboard console comes loose, operator might lose steering/control causing danger of collision. If port console comes loose handhold may separate from deck causing passengers to lose balance

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000124T)
Year: 2000
Models: Sea Doo RX 5513 and 5514
Units: 1,112
Problem: Sponsons may loosen and fall reducing steering ability at high speed; possible danger of collision

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000087T)
Year: 2000
Models: GTX and GTX RFI
Units: 10,436
Problem: Fuel fill adjacent to ventilation system opening; operator could inadvertently fill engine compartment with fuel; possible fire/explosion if ignition source present

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(980165T)
Year: 1998
Models: Speedster and Challenger 1800 jetboats
Units: 2,265
Problem: Seat swivel plates may crack or break; operator or passengers may fall; potential for injury

BOMBARDIER MOTOR CORP. OF AMERICA
(Benton, IL)(000125T)
Year: 2000
Models: Sea Doo RX DI and GTX DI
Units: 3,272
Problem: Possible fuel leak between direct air injector and fuel rail assembly; possible fire or explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS
(Sturtevant, WI)(020185S)
Year: 2002
Models: Fish Hawk 170CC, 180CC, 210CC, 230CC, 210WA, 230WA, 200BF & 220BF
Units: 465
Problem: Improper fuel hoses between the fuel tank, squeeze bulb, fuel filter and engine

CRESTLINER, INC.
(Little Falls, MN)(020206S)
Models: 2001 & 2002 Sportfish 1850 and Superhawk 1800 and 2002 Eagle 2300
Units: 1,217
Problem: Fuel tank hold down brackets may dig into top surface of tank during expansion causing fuel leak; possible fire/explosion if ignition source present

CRUSADER ENGINES
(Sterling Heights, Michigan)(020198S)
Year: 2002 & 2003
Models: 5.0L MPI w/ aluminum hood and 5.7L MPI w/ aluminum hood
Units: 425
Problem: Possible arcing or open flame at the coil wire connection to the ignition coil and/or distributor cap; possible fire/explosion if fuel or vapor source present

CRUSADER ENGINES
(Sterling Heights, Michigan)(030013S)
Year: 2002 - 2003
Models: 8.1L MPI STD
8.1L MPI HO
Units: 218
Problem: Fuel line connections at fuel rail may not be fully locked into place; potential fuel leak; possible fire/ explosion if ignition source present

GLASTRON BOATS
(Little Falls, MN)(030063T)
Year: 2003
Models: GX 225
Units: 95
Problem: Operator and passenger seat bases might not be properly installed; possible personal injury to user

HAMILTON JET
(Seattle, WA)(000197T)
Year: 1998
Models: HJ 212 steering assemblies with serial nos.: 0001-2114
HJ 213 steering assemblies with serial nos.: 0001-0299
Units: 1,261
Problem: Cracks in steering nozzle; possible steering failure and danger of collision

HAMILTON JET
(Seattle, WA)(000085T)
Year: 1998 & 1999
Models: HJ 212 with serial nos. 964 - 1774
HJ 213 with serial nos. 001 - 234
Units: 676
Problem: Flange inserts on some jet units are oversized and may become stiff or stick under certain circumstances; possible steering failure and danger of collision

HARRIS KAYOT
(Fort Wayne, IN)(000248T)
Year: 1998 - 2001
Models: Pontoon boats equipped with Mercury Outboards with the following last four characters in their HINs: K798 - J001.
Units: 1,081
Problem: Wire on ignition interrupter switch may not be connected; emergency shutoff switch might not operate

JERSEY MARINE INDUSTRIES
(West Berlin, NJ)(02R0362S)
Year: 2003
Models: Silverhawk
Units: 44
Problem: Metallic fuel fill not grounded

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(010023T)
Year: 2000 & 2001
Models: JT-1100 C-1 (2000) & F-1 (2001)
Units: 6,065
Problem: Fuel pumps may be subject to corrosion causing possible fuel leaks into engine compartment; possible fire/explosion if ignition source present

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(990167T)
Year: 1999
Models: Ultra 150
Units: 2,859
Problem: Overtightening of steering cable mounting nut may cause nut to fail causing loss of steering control

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(000225T)
Year: 1999 & 2000
Models: JH 1200-A1 AND JH 1200-A2
Units: 8,749
Problem: On 1999 JH 1200-A1 and 2000 JH 1200-A2, fuel tank vent hose end can drop into engine compartment, if incorrectly installed during vessel setup or during service on steering column. Pressure buildup in tank can expel gasoline/vapor from vent hose into engine compartment. Under certain conditions, with vent hose in correct position, fuel expelled onto deck and into engine compartment; possible fire/explosion if ignition source present

KAWASAKI MOTOR CORP., U.S.A.
(Santa Ana, CA)(990186T)
Year: 1998 & 1999
Models: 1998 JT1100-B1 (7,986 units)
1998 JH1100-A3 (5,982 units)
1999 JT900-B1 (3,097 units)
1999 JT1100-B2 (4,193 units)
1999 JH1100-A4 (1,982 units)
Units: 23,240
Problem: Engine backfire can rupture fuel pump diaphragm causing fuel leakage; possible fire/explosion if ignition source present

KOHLER CO.
(Kohler, WI)(030088T)
Year: 1950 - 1989
Models: L600 or L654 gasoline engines: 2R, 2A, 2.5R, 2.5A, 3.5R, 3.5A, 4R, 4A, 5R, 5A, 6.5R, 6.5A, 7.5R, 7.5A
Problem: Failure of the black iron wet exhaust pipe may cause carbon monoxide poisoning

LARSON BOATS
(Little Falls, MN)(030060T)
Year: 1999 - 2003
Models: Cabrio 333
Units: 290
Problem: Isolation bulkheads not properly sealed and fuel vapors could reach areas containing electrical equipment; possible fire/explosion if ignition source present

LARSON BOATS
(Little Falls, MN)(010066S)
Year: 2001
Models: SEI 180 BR I/O, SEI 190 BR SF
SEI 190 BR I/O and LXI 190 BR I/O
Units: 697
Problem: Basic Flotation

MAXUM MARINE
(Everett, WA)(010122T)
Year: 2001
Models: 2100 SD
Units: 91
Problem: Isolation bulkheads not properly sealed and fuel vapors could reach areas containing electrical equipment; possible fire/explosion if ignition source present

MAXUM MARINE
(Salisbury, MD)(020202T)
Year: 2000 & 2001
Models: 2955 SCR Sun Cruisers
Units: 453
Problem: Isolation bulkheads not properly sealed and fuel vapors could reach areas containing electrical equipment; possible fire/explosion if ignition source present

MERCURY MARINE
(Fond du Lac, WI)(000247T)
Year: 2000 & 2001
Models: 240 HP M2 Jet Drive with serial nos.:
0E370718 to 0E394131
Units: 4,440
Problem: Potential short in voltage regulator; possible fire/explosion if fuel or vapor source present

MERCURY MARINE
(Fond du Lac, WI)(010063T)
Year: 1999 & 2000
Models: 225/250 HP Mercury/Mariner
200/225 HP Optimax
3.0L Carb/Work versions
These are outboards with serial nos.:
0G927950 to 0T264046
Units: 14,108
Problem: Insufficient weld penetration between bracket and shift cable attaching stud; potential loss of shift control

MERCURY MARINE
(Fond du Lac, WI)(010074T)
Year: 2001
Models: MCM 496 MAG Sterndrive Engines
MCM 496 MAG HO Sterndrive Engines
MIE 8.1S Horizon Inboard Engines
MIE 8.1S HO Inboard Engines
All have serial numbers in the range
between 0M025000 - 0M061418
Units: 2,501
Problem: Fuel line/ fuel rail outlet plug may not be properly connected to fuel rail and may cause fuel leakage; possible fire/explosion if ignition source present

MERCURY MARINE
(Fond du Lac, WI)(020177S)
Year: 2003
Models: Mercury Racing 575 Sci
Units: 128
Problem: Fuel line between fuel filter and throttle bodies on some Mercury 575 Sci engines may crack allowing fuel to leak; possible fire/explosion if ignition source present

PLEASURECRAFT ENGINE GROUP
(Little Mountain, SC)(020196S)
Year: 2002-2003
Models: 5.7/5.0L MPI w/ serial nos. 420733 - 430688
Units: 1,093
Problem: Internal lead in coil wire positioned incorrectly; possible fire/explosion if fuel/vapor source present

POLARIS INDUSTRIES, INC.
(Medina, MN)(020091T)
Year: 2002
Models: Virage i & Virage TXi PWCs
Units: 3,458
Problem: Some fuel tanks may have a hole under the fuel pump retaining nut threads; possible fire/explosion if ignition source present

PRO-LINE BOATS
(Crystal River, FL)(990192T)
Year: 2000
Models: All boats with breaker box
manufactured by ESI South, Inc.
Units: 147
Problem: Breaker box may contain non ignition-protected circuit breakers; possible fire/explosion if fuel or vapor source present

PURSUIT/S2 YACHTS, INC.
(Fort Pierce, FL)(000106S)
Year: 2000
Models: 2260 Denali w/ HINs:
SSUF2099G900 - SSUF2107K900
2460 Denali w/ HINs:
SSUF4362F900 - SSUF439IL900
Units: 39
Problem: Blower warning label missing

RINKER BOAT CO., INC.
(Syracuse, IN)(02R0311S)
Year: 2002
Models: 212 Captiva
Units: 1,081
Problem: Insufficient blower capacity in powered ventilation system

RIVIERA CRUISER
(Columbia City, IN)(990117S)
Year: 1999
Models: Pontoon Boats equipped with built-in Fikes Plastics Fuel Tanks w/ serial nos: 904001 - 905159
Units: 97
Problem: Fuel tank leakage; possible fire or explosion if ignition source present

SEA MAX
(Little Mountain, SC)(020197S)
Year: 2002-2003
Models: 5.7/5.0L MPI w/ serial nos.
225050 - 225200 - Model Year 2002
235026 - 235051 - Model Year 2003
Units: 50
Problem: Internal lead in coil wire not positioned correctly; possible fire/explosion if fuel or vapor source present

SEA RAY BOATS
(Knoxville, TN)(010092S)
Year: 2001
Models: 225WE with hull nos.: 3016-3102, 3104-3109, 3111-3117, 3119-3126, 3128-3191, 3193-3200, 3202-3216, 3218-3231, 3234, 3236-3246, 3248-3263, 3265-3295, 3297-3307, 3310-3314
240DA with hull nos.: 3341-3358, 3361-3378, 3380, 3382, 3384-3385, 3387-3390, 3392-3419
240SD with hull nos.: 3358, 3568, 3571, 3575, 3580, 3585, 3590, 3595, 3596, 3600, 3602, 3605, 3609, 3613, 3618, 3619, 3626, 3630, 3636, 3638, 3642, 3643, 3647, 3654, 3656, 3658, 3664, 3666, 3670, 3671, 3675, 3682, 3684, 3686, 3692, 3694, 3698, 3699, 3703, 3710, 3712, 3714, 3720, 3722, 3726, 3727, 3731, 3738, 3740, 3742, 3748, 3750, 3753, 3756, 3760, 3763, 3767, 3770, 3774, 3777, 3781, 3784, 3788, 3791, 3792
245WE with hull nos.: 3158-3182, 3187-3188, 3202, 3206-3210, 3218, 3221-3222, 3229-3230, 3233-3235, 3237-3238
Units: 466
Problem: Potential fuel leak at fuel tank pickup hose connection; possible fire/explosion if ignition source present

SEA RAY BOATS
(Knoxville, TN)(010089S)
Year: See below
Models: 370 AC (1997 - 2000) (186 units)
400 DB (1996 - 2001) (500 units)
420 AC (1996 - 2001) (223 units)
450 EB (1998 - 2001) (132 units)
460 DA (1999 - 2001) (130 units)
480 DB (1998 - 2001) (313 units)
540 CMY (2001) (19 units)
540 DA (1998 - 2001) (150 units)
560 DB (1998 - 2001) (109 units)
580 SS (1997 - 2000) (35 units)
Units: See above
Problem: Lack of overcurrent protection could lead to heat buildup in electrical wiring; possible fire/explosion if fuel or vapor source present

STARDUST CRUISERS, INC.
(Monticello, KY)(010047T)
Year: 1997 - 2000
Models: Houseboats with Mathers multistation propulsion control system with hull nos.: TKZ00850 - TKZ01100
Units: 343
Problem: Engine control relays not ignition-proof; possible fire/explosion if fuel or vapor source present

SUMERSET CUSTOM HOUSEBOATS
(Somerset, KY)(020189T)
Year: 1992 - 1999
Models: Various
Units: 252
Problem: Shore power service circuit breakers on boats with dual shorepower option improperly wired

TRACKER MARINE L.P.
(Springfield, MO)(021065S)
Year: 2003
Models: Laker 14 & 1436AWS
Units: 541
Problem: Level Flotation

TRACKER MARINE L.P.
(Springfield, MO)(030015T)
Year: 2003
Models: Bass Buggy 18 built 9/3/02 - 2/25/03
Fishin Barge 21 built 8/10/02 - 2/25/03
Fishin Barge 25 built 8/10/02 - 2/25/03
220F, Grn, Blu built 8/10/02 - 2/25/03
240F, Grn, Blu built 8/10/02 - 2/25/03
Units: 762
Problem: Incorrectly installed fuel feed fitting; potential fuel leakage; possible fire/explosion if ignition source present

VOLVO PENTA OF THE AMERICAS, INC.
(Chesapeake, VA)(980145T)
Year: 1997
Models: BY engines w/ serial nos.:
4110155491 - 4110159682
Units: 2,000
Problem: Improperly machined fuel pump inlet fitting may cause fuel leakage; possible fire/explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(030115T)
Year: 2003
Models: SR230 (SRT1000-B and C-B)
Sport Boats
Units: 452
Problem: Hose clamps on fuel tank vent hose and fuel tank vent check valve cannot be tightened to proper specification and fuel tank vent check valve may have burrs on plastic fittings which could prevent proper sealing allowing vapor to escape; possible fire/explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(020072T)
Year: 2002
Models: GP1200A-A ("GP1200R")
XA1200A-A ("XL1200")
XA800A-A("XLT800")
Units: 2,097
Problem: Fuel sender assembly not adequately clamped to its rubber fuel tank fitting allowing vapor to escape; possible fire/explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(020128T)
Year: 2002
Models: FX1000-A & FX1000C-A
Units: 3,666
Problem: Fuel pump module not sealed properly to fuel tank surface; potential for vapor to escape; possible fire/ explosion if ignition source present

YAMAHA MOTOR CORP., U.S.A.
(Cypress, CA)(020176T)
Year: 2002
Models: FX1000C-A (FX140)
Units: 6,459
Problem: Wire harness inside air cleaner case may interfere with throttle linkage and keep throttle open; danger of collision

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A	1	1				1			1	1			1	1	1	1			1							
B		1	1			1		1	1	1				5	1		1	1								1
C	1	1		1	1		1						3										1			1
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DEPARTMENT OF HOMELAND SECURITY

Coast Guard

33 CFR Part 181

[USCG–2003–14272]

RIN 1625–AA53

Country of Origin Codes and Revision of Regulations on Hull Identification Numbers

AGENCY: Coast Guard, DHS.

ACTION: Final rule.

SUMMARY: The Coast Guard is revising its regulations to allow U.S. manufacturers of recreational boats to display a 2-character, country of origin code before the 12-character Hull Identification Number (HIN) without separating the two by means of borders or on a separate label as is currently required by the HIN regulations. This removal of our previous restriction will allow U.S. manufacturers to comply with the International Organization for Standardization (ISO) HIN standard, without changing the information collected by States on undocumented vessels they register because the U.S. HINremains only 12 characters.

DATES: This final rule is effective August 16, 2004

ADDRESSES: Comments and material received from the public, as well as documents mentioned in this preamble as being available in the docket, are part of docket USCG–2003–14272 and are available for inspection or copying to the Docket Management Facility at room PL–401 on the Plaza level of the Nassif Building, 400Seventh Street SW., Washington, DC,between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also find this docket on the internet at http://*dms.dot.gov.*

FOR FURTHER INFORMATION CONTACT: If you have questions on this final rule, call Mr. Alston Colihan, Office of Boating Safety, Coast Guard, telephone 202–267–0984. If you have questions on viewing or submitting material to the docket, call Andrea M. Jenkins, Program Manager, Docket Operations, telephone 202–366–0271.

SUPPLEMENTARY INFORMATION:

Regulatory History

On June 20, 2003, we published in the **Federal Register** (68 FR 36957) a notice of proposed rulemaking (NPRM) entitled "Country of Origin Codes and Revision of Regulations on Hull Identification Numbers." We received six letters commenting on the proposed rule. No public hearing was requested and none was held.

Background and Purpose

In 1995, the International Organization for Standardization (ISO) finalized a hull identification number standard (ISO 10087:1995(E)) consisting of the existing Coast Guard 12-character HIN format preceded by a 2-character country code and a hyphen. Boat manufacturers in the United States that export to Europe started using the ISO HIN standard beginning with the 1996 model year. The ISO standard states that "A HIN shall consist of 14 consecutive characters plus a hyphen * * *." But 33 CFR 181.27 of our HIN standard states, "If additional information is displayed on the boat within two inches of the hull identification number, that information must be separated from the hull identification number by means of borders or must be on a separate label so that it will not be interpreted as part of the hull identification number." While the ISO HIN standard includes a paragraph, ISO 10087:1995(E)(6) entitled "Additional information," that contains language nearly identical to that in § 181.27, the ISO additional information requirements do not apply to the country code and hyphen, which are part of the 14-character, international HIN.

The American Boat and Yacht Council (ABYC) develops voluntary consensus safety standards for the design, construction, equipage, maintenance, and repair of small craft. An ABYC Technical Committee studying the ISO HIN standard and our HIN standard concluded that the differing requirements create a problem for U.S. builders exporting to Europe. One large U.S. manufacturer that exports to Europe pointed out that use of a separate tape to create the border required by our HIN standard often results in misalignment and other flaws that may be confused with attempts to alter an HIN.

This proposal was discussed at the October 29, 2001 meeting of the National Boating Safety Advisory Council (66 FR 49445, September 27, 2001) and there were no objections stated by State Boating Law Administrators in attendance at the meeting. The NBSAC passed a resolution requesting the Coast Guard to immediately pursue rulemaking for an exception to current regulations to allow the USA HIN system to conform to the ISO HIN standard while not requiring the states to include the country code in their registration process.

Discussion of Comments

By the close of the comment period on September 18, 2003, we received six comments from the following categories: one individual, one State boating official, one boat manufacturer, and three associations.

Rule Beneficial to Import-Export Community

The individual supported the rule because it removes the limitations of the separate label requirement and will be beneficial to the import-export community.

The boat manufacturer supported the rule because separation of the 2-character country of origin code from the HIN by means of borders or on a separate label is burdensome and costly due to the necessity to maintain two different HIN labeling systems: one for boats sold domestically and a second one for boats exported for sale overseas. Removal of the requirement for borders or a separate label around the country of origin code will allow U.S. manufacturers to comply with the ISO HIN standard, without changing the information collected by the States on undocumented vessels they register.

This manufacturer stated that one of the challenges the company faces as an exporter is being cost-effective while maintaining compliance with regulations in different countries or regions. The more the company can streamline production to meet global market standards, according to the manufacturer, the greater the company's effectiveness as global marketing competitors. As these views are consistent with our proposed rule, we made no changes in the rule based on these two comments.

Importance of Manufacturers and State Officials Being Aware that Country of Origin Codes are not Part of U.S. HINs

The State boating official was not opposed to the hyphen between the country of origin and the HIN. According to the official, one issue that may arise would be the entering of stolen boats into State and National Crime Information systems. If the country of origin is included as part of the HIN on a theft entry, that entry would not produce a "hit" if someone looking to see if a vessel was stolen simply uses the 12-digit HIN which does not include a country code. Therefore, the official suggests that it be made clear to manufacturers and state titling authorities that manufacturer's statements of origin and state titles only include the 12-digit HIN.

The Coast Guard agrees. Consistent with the NBSAC resolution, our rule brings the U.S. HIN system into conformity to the ISO HIN standard and does not require the states to include the country code in their registration process. The manufacturer's statements of origin and state titles are State

paperwork and ownership issues. Publication of the state official's concerns here in the **Federal Register**, however, should help ensure that manufacturers and State officials take note of this concern. In addition, we are revising our final rule to expressly include a reference in § 181.27, that the HIN is 12 characters long.

Advocates for Changing to 17-Character HIN

An association representing auto theft investigators opposed the proposed rule, because, according to the association, the addition of two new HIN characters would only serve to complicate and confuse the law enforcement and insurance communities, as well as various state registration departments and the general public. Also according to the comment, any HIN modification should result in the adoption of a 17-character HIN format as approved and submitted to the Coast Guard by the association representing auto theft investigators, the American Boat and Yacht Council (ABYC) and the National Association of State Boating Law Administrators (NASBLA).

Since the Coast Guard published the HIN regulations in 1972, boat manufacturers have had the option of including additional characters near the HIN, provided the additional characters were distinctly separate — by a hyphen from 1972 to 1984 and by means of borders or on a separate label from August 1, 1984 (48 FR 40716, September 9, 1983) to the present. United States manufacturers exporting overseas have been using the ISO HIN standards since 1996. In addition, the 17-character HIN format to which the comment refers is beyond the scope of this rulemaking.

An association representing State Boating Law Administrators as well as an association representing investigators of boat thefts also opposed the proposed rule and instead, supported adoption of the 17-character HIN format. Again, U.S. manufacturers exporting overseas have been using the ISO HIN standards since 1996; however, they have had to separate the country of origin code from the 12-character HIN by means of borders or with a separate label. This rule simply makes the U.S. HIN regulations more compatible with the ISO HIN Standard. In addition, the 17-character HIN format to which the associations refer is beyond the scope of this rulemaking that does not call for States to adjust for the addition of any characters to the HIN.

All three associations indicated we were creating a 14-character HIN. We are not. The country of origin code is separated by a hyphen and is not part of the U.S. HIN. As noted above, we have revised our final rule to reflect that our HIN remains 12 characters.

Discussion of Rule

We did not change the final rule from the rule we proposed in 2003 (68 FR 36957, June 20, 2003) with the exception of inserting a reference to the length of the HIN, 12 characters, in § 181.27. This final rule will relieve manufacturers of recreational boats who sell both internationally and domestically of the burden of the requirement to separate the country of origin code for the United States, "US-", from the 12-character HIN by means of borders or a separate label. Any other information would still have to be separated from the 12-character HIN by means of borders or a separate label.

Regulatory Evaluation

This rule is not a "significant regulatory action" under section 3(f) of Executive Order 12866, Regulatory Planning and Review, and does not require an assessment of potential costs and benefits under section 6(a)(3) of that Order. The Office of Management and Budget has not reviewed it under that Order. It is not "significant" under the regulatory policies and procedures of the Department of Homeland Security (DHS).

We expect the economic impact of this rule to be so minimal that a full Regulatory Evaluation under the regulatory policies and procedures of DHS is unnecessary. Allowing manufacturers following the ISO HIN format to separate the country of origin code without the use of borders or a separate label would relieve a burden and thereby reduce the costs of complying with the HIN display requirement.

Small Entities

Under the Regulatory Flexibility Act (5 U.S.C. 601-612), we have considered whether this rule would have a significant economic impact on a substantial number of small entities. The term "small entities" comprises small businesses, not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000. The Small Business Administration (SBA) has size standards for each industry and has established codes under the North American Industry Classification System (NAICS). Each NAICS code identifies an industry, and has a corresponding revenue- or employee-based small business size standard. The only type of small entity that this rule would affect would be small businesses.

There were 4,420 U.S. manufacturers of recreational boats in 2002, an estimated 80 percent of which qualify as small businesses by the size standards of the SBA. However, we have observed that the businesses we have identified as small manufacture fewer numbers of boats than their larger competitors. In addition, most of the businesses we have identified as small do not export to the European market and therefore would not follow the ISO HIN format.

Therefore, the Coast Guard certifies under 5 U.S.C. 605(b) that this rule would not have a significant economic impact on a substantial number of small entities.

Assistance for Small Entities

Under section 213(a) of the Small Business Regulatory Enforcement Fairness Act of 1996 (Pub. L. 104-121), we have offered to assist small entities in understanding this final rule so that they can better evaluate its effect on them and participate in the rulemaking. If the rule affects your small business, organization, or governmental jurisdiction and you have questions concerning its provisions or options for compliance, please contact Mr. Alston Colihan, Project Manager, Office of Boating Safety, by telephone at (202) 267-0984 or by e-mail at *acolihan@comdt.uscg.mil.*

Small businesses may also send comments on the actions of Federal employees who enforce, or otherwise determine compliance with Federal regulations to the Small Business and Agriculture Regulatory Enforcement Ombudsman and the Regional Small Business Regulatory Fairness Boards. The Ombudsman evaluates these actions annually and rates each agency's responsiveness to small business. If you wish to comment on actions by employees of the Coast Guard, call 1-888-REG-FAIR (1-888-734-3247).

Collection of Information

This final rule would call for no new collection of information under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501-3520).

Federalism

A rule has implications for federalism under Executive Order 13132, Federalism, if it has a substantial direct effect on State or local governments and would either preempt State law or impose a substantial direct cost of compliance on them. We have analyzed this final rule under that Order and have determined that it does not have implications for federalism.

Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1531-1538) requires Federal agencies to assess the effects of their discretionary regulatory actions. In particular, the Act addresses actions that may result in the expenditure by a State,

local, or tribal government, in the aggregate, or by the private sector of $100,000,000 or more in any one year. This final rule would not impose an unfunded mandate.

Taking of Private Property

This rule would not affect a taking of private property or otherwise have taking implications under Executive Order 12630, Governmental Actions and Interference with Constitutionally Protected Property Rights.

Civil Justice Reform

This final rule meets applicable standards in sections 3(a) and 3(b)(2) of Executive Order 12988, Civil Justice Reform, to minimize litigation, eliminate ambiguity, and reduce burden.

Protection of Children

We have analyzed this rule under Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This rule is not an economically significant rule and would not create an environmental risk to health or risk to safety that might disproportionately affect children.

Indian Tribal Governments

This rule does not have tribal implications under Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, because it would not have a substantial direct effect on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes.

Energy Effects

We have analyzed this rule under Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use. We have determined that it is not a "significant energy action" under that order because it is not a "significant regulatory action" under Executive Order 12866 and is not likely to have a significant adverse effect on the supply, distribution, or use of energy. The Administrator of the Office of Information and Regulatory Affairs has not designated it as a significant energy action. Therefore, it does not require a Statement of Energy Effects under Executive Order 13211.

Environment

We have analyzed this rule under Commandant Instruction M16475.lD, which guides the Coast Guard in complying with the National Environmental Policy Act of 1969 (NEPA)(42 U.S.C. 4321-4370f), and have concluded that there are no factors in this case that would limit the use of a categorical exclusion under section 2.B.2 of the Instruction. Therefore, this rule is categorically excluded, under figure 2-1, paragraph (34)(d), of the Instruction, from further environmental documentation. The proposed rule to remove the requirement to separate the 2-character country of origin code from the 12-character HIN by means of borders or on a separate label relates to the documentation of vessels and is not expected to have any environmental impact. An "Environmental Analysis Checklist" and a "Categorical Exclusion Determination" are available in the docket where indicated under **ADDRESSES.**

List of Subjects in 33 CFR Part 181

Labeling, Marine safety, Reporting and recordkeeping requirements

For the reasons set out in the preamble, the Coast Guard amends 33 CFR part 181 as follows:

PART 181 — MANUFACTURER REQUIREMENTS

■ 1. The authority citation for part 181 is revised to read as follows:

Authority: 46 U.S.C. 4302

■ 2. Revise § 181.27 to read as follows:

§ 181.27 Information displayed near hull identification number.

With the exception of the characters "US-", which constitute the country of origin code for the United States, if information is displayed on the boat within 2 inches of the 12-character hull identification number (HIN), that information must be separated from the HIN by means of borders or must be on a separate label, so that it will not be interpreted as part of the hull identification number.

Dated: May 10, 2004

David S. Belz,
Rear Admiral, U.S. Coast Guard, Director of Operations

[FR Doc. 04-13609 Filed 6-16-04; 8:45 am]

U.S. Department of Homeland Security
United States Coast Guard

March 2007

Boating Safety Circular 85

RECREATIONAL BOAT MANUFACTURERS SUBPART M - NAVIGATION LIGHTS

More than three years after the effective date of updated Coast Guard regulations requiring manufacturers of recreational boats who install navigation lights to install lights with third party certification, confusion continues. Although navigation lights were the topic of recent writings in the American Boat and Yacht Council (ABYC) Newsletter, and the subject of briefings at industry gatherings, Coast Guard and NMMA factory visits continue to identify numerous issues of navigation light fixtures and installations that do not comply with Federal regulations.

As of November 1, 2003, 33 CFR 183.810 requires recreational vessel manufacturers, distributors, and dealers installing navigation lights in new recreational vessels to meet the requirements for certification and markings. Coast Guard regulations require navigation lights to be certified to the applicable requirements of ABYC A-16 (or equivalent standard) by an independent laboratory listed by the Coast Guard. Lights meeting this requirement must carry labels indicating compliance. Specifically, the light must have a permanent and indelible label, that is visible without removing or disassembling the light containing the following information:

a. "USCG Approval 33 CFR 183.810;"

b. "Meets (insert standard – ABYC A-16, or equivalent)...;"

c. "Tested by (insert CG listed lab performing test)...;"

d. Name of manufacturer;

e. Model number;

f. Visibility of light in nautical miles;

g. Date on which light was type-tested; and

h. Identification and specification of bulb used in compliance test.

Many light fixtures used on recreational boats are not large enough to permit legible display of all of the above information. In that case, the required information may be placed in, or on the package containing the individual light, AND each light must be marked with "USCG" followed by the range of visibility; e.g. "USCG 2nm". This marking must be visible without removing the light, and must be permanent and indelible.

The Coast Guard Recreational Boating Product Assurance Division has received a variety of questions regarding the ABYC requirement that fixtures be marked with "A-16." According to ABYC A-16.8.9.3:

"the mark 'A-16'...shall indicate design conformance with this standard."

This is followed by an exception to A-16.8.9.3:

"Navigation lights that comply with the marking requirements of 33 CFR 183.810."

In other words, Coast Guard regulations require a compliant fixture to be marked with a minimum of "USCG **X**nm" and ABYC A-16.8.9.3 allows a fixture to be marked with the same minimum information (provided the other information is placed in or on the package containing the individual light fixture).

Another issue that causes many noncompliance citations is the "Manufacturer Certification of Compliance" label. Section 181.9 of 33 CFR 181, Subpart B, requires that:

"Each manufacturer of a boat ... to which Part 183 of this regulation applies shall affix a certification label ..."

Inside:

Manufacturer ID Codes 2
Boats vs. Bare Hulls 3
Kit Boat Manufacturers and CG Standards 4
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Since boat manufacturers who install navigation lights are now subject to Subpart M of 33 CFR 183, some boat manufacturers who previously were not required to affix a certification label to their boats now must do so as required by 33 CFR 181.9.

Aftermarket light fixture installations (those done by owners) are not affected by the above requirements. Some light fixture manufacturers have elected to market their navigation lights only for the aftermarket. Others manufacture some models that comply with the regulations for new boat installations, and others that do not. Some navigation light fixtures available in the marketplace are not suitable for installation on new boats by OEM boat manufacturers. Therefore boat manufacturers need to be sure to verify when sourcing lights for new installations that they comply with the navigation light regulations.

Another area that often causes problems is the installation of navigation light fixtures on boats. Both the Navigation Rules and ABYC A-16 state that navigation lights must be installed such that the light is visible within certain *horizontal and vertical sectors*. In many instances, especially when small light fixtures are mounted below the vessel's sheer, lights are not visible over the required horizontal and vertical sectors of visibility.

See Annex 1 of COLREGS, and Inland Rules for further technical information on sectors of visibility. Navigation rules 20 through 23 and rule 25 provide basic recreational boat navigation light requirements.

Practically speaking, the major installation issue causing non-compliant installations is failure to position lights in accordance with the fixture manufacturer's requirements with regard to the boats' centerline, and the vertical orientation of the fixture. In addition, in many other non-compliant installations, there is insufficient vertical separation between the sidelights, and the masthead or all-round light. A minimum of one meter is required.

Contact the Coast Guard Recreational Boating Product Assurance Division (202) 372-1077, or ABYC Technical Department (410) 990-4460 with questions regarding navigation light installations.

MANUFACTURER IDENTIFICATION CODES

ABC00001C607

The serial number above is a hull identification number (HIN). The first three characters in the HIN above are a Manufacturer Identification Code (MIC). The Coast Guard Recreational Boating Product Assurance Division will assign a MIC only to U.S. manufacturers and U.S. importers who are in the business of building or importing recreational boats for the purposes of sale to the public. Manufacturer Identification Codes and information about the companies to which they were assigned are entered into a computerized database at Coast Guard Headquarters.

See: http://www.uscgboating.org/recalls/mic_database.html

One part of the Recreational Boating Standards program consists of visits to recreational boat manufacturers and importers by *Compliance Associates* who are under contract with the Coast Guard. The purposes of the visits are: (1) to find boat builders who may be unaware about Coast Guard boating safety standards and regulations; (2) to educate manufacturers and importers about the various features of the Coast Guard Recreational Boating Product Assurance Division program; and (3) to ensure that boats under construction on the factory floor comply with applicable Coast Guard safety standards and regulations. The Compliance Associates plan their visits based upon manufacturer/importer name and address information in the Coast Guard Manufacturer Identification Code database.

According to Section 181.33(b) of the Hull Identification Number regulations:

"a manufacturer or importer who changes the business name or address must advise the Recreational Boating Product Assurance Division, 2100 Second Street SW, Washington, DC 20593-0001 of the change in writing."

This means if you are a boat manufacturer or importer with a Manufacturer Identification Code, you have a legal obligation to inform the Coast Guard if you change your business name or move your factory or place of business to another location. As a result, time and money aren't spent unnecessarily trying to determine whether you are still building boats for the purposes of sale to the public.

Incidentally, the Coast Guard has been assigning Manufacturer Identification Codes to boat manufacturers and importers since 1972. Typically there are about 3,500 active manufacturers and importers annually. This means there are limited numbers of three letter codes which can be assigned annually. Codes issued to companies which are out of business 10 or more years may be reassigned to new builders. If you are assigned a Manufacturer

Identification Code and suspend your boatbuilding operations, but intend to resume building boats in the future, you need to keep us informed concerning your business status, so your Manufacturer Identification Code isn't assigned to another company.

BOATS VS. BARE HULLS

When a boat leaves the place of manufacture or assembly for the purposes of sale, it must comply with applicable Coast Guard safety standards and regulations:

- All boats must bear two identical Hull Identification Numbers (HINs): (1) a primary HIN (usually affixed to the transom); and (2) a duplicate HIN (affixed to an unexposed location on the interior surface of the boat or beneath a fitting or item of hardware).
- If the boat is a monohull that is less than 20 feet in length, and is not a sailboat, canoe, kayak or inflatable, it must bear a U.S. Coast Guard Maximum Capacities label and contain flotation.
- If a boat is inboard powered and uses gasoline as fuel, it must comply with the Electrical, Fuel and Ventilation Standards.
- If a boat will be outboard powered with remote steering, shift controls must be designed for start-in-gear protection.
- If a boat is equipped with navigation lights, the lights must be certified.
- Finally, if the boat is subject to a Coast Guard safety standard, it must bear a certification label.

A bare hull is not a boat:

- A bare hull manufacturer has no way of knowing the eventual weight of the finished boat (necessary for determining safe loading information and any required volume of flotation material).
- A bare hull manufacturer has no way of knowing whether the finished boat will be powered by an outboard or an inboard and whether the fuel used will be gasoline or diesel.
- The bare hull manufacturer does not install navigation lights.
- If the finished boat is later recalled for failure to comply with an applicable Coast Guard safety standard or for a defect which creates a substantial risk of personal injury to the public, the bare hull manufacturer should not be legally responsible for defect notification and correction (unless, of course, such a defect involved complete hull failure).

Bare hull manufacturers are not boat manufacturers. There are no Coast Guard safety standards or regulations which apply to a bare hull. **Therefore, a bare hull manufacturer should not:**

(1) affix a HIN, because the Manufacturer Identification Code in an HIN affixed to a boat identifies the entity that is legally responsible for construction of the entire boat -- not just the hull;

(2) affix a certification label;

(3) affix a U.S. Coast Guard Maximum Capacities label; or

(4) install flotation.

The Flotation Standard is predicated on the assumption that a manufacturer has performed certain tests in accordance with the Safe Loading Standard. Since these tests are not performed on bare hulls, then logically, there is no regulation requiring a bare hull manufacturer to install flotation material.

Instead, the individual or company that buys a bare hull is subject to the regulations. The individual who buys a bare hull to complete for his or her own use would obtain a Hull Identification Number from the State where he or she resides.

A company engaged in the business of assembling a bare hull and an engine package would be the one that should apply for a MIC, assign the Hull Identification Number and, if necessary, build the boat to comply with applicable Coast Guard safety standards and regulations.

The Recreational Boating Product Assurance Division recognizes that there are boat manufacturers with Manufacturer Identification Codes who manufacture both finished boats and bare hulls. The finished boats must be built to comply with the regulations; however, the bare hulls they sell for completion by individuals or other companies should be free of HINs or other compliance labels.

KIT BOAT MANUFACTURERS AND COAST GUARD SAFETY STANDARDS AND REGULATIONS

At the end of Session 403 - Wooden Kit Boats - during the International Boat Builders' Exhibition and Conference (IBEX) in Miami Beach, Florida on November 2, 2006, many attendees were surprised to learn that kit boat manufacturers are subject to U.S. Coast Guard safety standards and regulations.

The term, "recreational vessel manufacturer" in section 2101 of Title 46, United States Code means:

"a person engaged in the manufacturing, construction, assembly or importation of recreational vessels, components [emphasis supplied], or associated equipment."

Further, §181.7 of Title 33, Code of Federal Regulations states, in part:

"Unless there is affixed to it a certification label that contains the information required by §181.15:

(a) No person who manufactures, constructs, or assembles a boat ... may deliver that boat ... for the purposes of sale."

Coast Guard safety standards and regulations in 33 CFR Parts 181 and 183 apply to manufacturers of recreational boats for the purposes of sale to the public. Just because a kit boat builder manufactures a set of components for eventual assembly by an individual for his or her personal use does not relieve the kit boat builder from the legal obligation to provide the purchaser with all components and instructions necessary to build the boat in compliance with the regulations.

All recreational boats manufactured for the purposes of sale to the public must have a primary and a duplicate hull identification number (HIN) affixed. Therefore, all kit boat manufacturers must obtain a Manufacturer Identification Code (MIC) and assign Hull Identification Numbers. If, due to the nature of the kit, a HIN cannot be affixed to a kit part, the kit boat manufacturer needs to provide purchasers with instructions which will result in the proper placement and attachment of the Hull Identification Numbers.

If the completed boat is a monohull boat less than 20 feet in length, that is not a sailboat, canoe, kayak, or inflatable, the kit boat manufacturer is subject to applicable Coast Guard safety standards in 33 CFR Part 183 (Display of Capacity Information, Safe Loading, Safe Powering and Flotation). If a U.S. Coast Guard Maximum Capacities label displaying maximum horsepower, maximum persons and maximum weight capacities cannot be pre-placed on a part, the kit manufacturer should provide instructions to explain the proper placement of the capacity label.

GRATINGS AND DECORATIVE COVERS ON VENTILATION SYSTEM OPENINGS

The design and installation of natural and powered ventilation systems on boats is a critical safety issue in the prevention of boat fires and explosions. Some builders are installing gratings and decorative covers on natural and powered ventilation system openings which reduce the effectiveness of their boats' ventilation systems.

Unless the compartment is open to the atmosphere, a **powered ventilation system** (exhaust blower) is required in each compartment in a boat that has a permanently installed gasoline engine with a cranking motor. The powered ventilation system must provide an air flow capacity (both for rated blower capacity and for system output) determined as a function of the net compartment volume.

Unless the compartment is open to the atmosphere, a **natural ventilation system** consisting of supply and exhaust openings is required in each compartment in a boat that:

(1) contains a permanently installed gasoline engine;

(2) has openings between it and a compartment that requires ventilation;

(3) contains a permanently installed fuel tank and an electrical component that is not ignition-protected in accordance with §183.410(a);

(4) contains a fuel tank that vents into that compartment; or

(5) contains a nonmetallic fuel tank with a permeability rate in excess of standards.

The cross-sectional area of the supply and exhaust openings in the natural ventilation system is based upon the net compartment volume.

The exhaust duct connected to an engine compartment blower is considered to be a part of the natural ventilation system, because the blower does not restrict the flow of air. The installation of gratings and decorative covers over ventilation system openings, however, does restrict air flow. Such gratings and decorative covers reduce the aggregate cross-sectional area for ventilation system openings and reduce the effectiveness of natural and powered ventilation systems.

For example, an engine compartment with a net compartment volume of 80 cubic feet would require a powered ventilation system with a blower capacity of 120 cubic feet per minute (and system output of 48 cubic feet per minute) and a natural ventilation system with supply and exhaust openings of 13.85 sq in each. A natural ventilation system consisting of two 3-inch diameter openings for both supply and exhaust would be acceptable (7.1 sq in x 2 = 14.2 sq in total). If, however, opening gratings/covers drop the open area to 10 sq in, the natural ventilation system would not be in compliance with the regulations. The output of the powered blower system would likewise be unacceptable if the tested output, due to the placement of the gratings/covers, dropped below 48 cfm.

Over-sizing of the ventilation system hull/deck openings to allow for the net decrease due to any gratings/covers – to still meet the aggregate natural

ventilation system opening size requirement (and powered system output) would result in an acceptable ventilation system design, with proper consideration for all design factors.

AFTER 31 DECEMBER 2006 BOATERS MUST NOT OPERATE 121.5/243 MHZ EPIRBs

WASHINGTON, DC - The Coast Guard reminds all boaters that beginning January 1, 2007, both 121.5 and 243 MHz Emergency Position Indicating Radio Beacons (EPIRBs) are prohibited from use in both commercial and recreational watercraft. Boaters wishing to have an emergency rescue beacon aboard their vessel must have a digital 406 MHz model.

The January 1, 2007, date to stop using 121.5 MHz EPIRBs is in preparation for February 1, 2009, when satellite processing of distress signals from all 121.5/243 MHz beacons will terminate. Following this termination date, only the 406 MHz beacons will be detected by the International Cospas-Sarsat Satellite System which provides distress alert and location data for search and rescue operations around the world.

The regulation applies to all Class A, B, and S 121.5/243 MHz EPIRBs. It does not affect 121.5/243 MHz man overboard devices which are designed to work directly with a base alerting unit only and not with the satellite system.

This change, in large part, was brought about by the unreliability of the 121.5/243 MHz beacons in an emergency situation. Data reveals that with a 121.5 MHz beacon, only one alert out of every 50 is a genuine distress situation. This has a significant effect on expending the limited resources of search and rescue personnel and platforms. With 406 MHz beacons, false alerts have been reduced significantly, and, when properly registered, can usually be resolved with a telephone call to the beacon owner. Consequently, real alerts can receive the attention they deserve.

When a 406 MHz beacon signal is received, search and rescue personnel can retrieve information from a registration database. This includes the beacon owner's contact information, emergency contact information, and vessel/aircraft identifying characteristics. Having this information allows the Coast Guard, or other rescue personnel, to respond appropriately.

In the U.S., users are required by law to directly register their beacon in the U.S. 406 MHz Beacon Registration Database at:

http://www.beaconregistration.noaa.gov/

or by calling 1-888-212-SAVE. Other users can register their beacon in their country's national beacon registration database or, if no national database is available, in the International Beacon Registration Database at:

https://www.406registration.com/

The United States Coast Guard is the lead agency for coordinating national maritime search and rescue policy and is responsible for providing search and rescue services on, under and over assigned international waters and waters subject to United States jurisdiction.

COMMERCIAL VS. RECREATIONAL

Sales of "commercial boats" to members of the public who will use them as recreational boats are prohibited by law. According to subparagraph 4307(a)(1)(A)(1) of Title 46 of the United States Code -- Prohibited Acts: "A person may not -- manufacture, construct, assemble, sell or offer for sale, introduce or deliver for introduction into interstate commerce, or import into the United States, a recreational vessel, unless -- it conforms with this chapter or a regulation prescribed under this chapter." The regulations and safety standards applicable to manufacturers of recreational boats in 33 CFR Parts 179, 181 and 183 were written under the authority of 46 U.S.C. Chapter 43.

A significant number of small boat manufacturers are designating their boats "For Commercial Use," and several State boating officials have observed these boats being used for general recreational purposes. These boats usually are not equipped or built to meet Federal safety standards and regulations, even though their manufacturers have produced recreational boats from the same molds. They may cost less than the same boat certified to meet Federal standards. Therefore, there is an incentive to sell the less expensive boat, the "For Commercial Use" boat, for recreational purposes. While the Coast Guard is concerned about the commercial fisherman who may occasionally use the boat for a family outing, of equal concern is the individual who buys a commercial boat for recreational purposes. Some purchasers mistakenly believe that a boat built "For Commercial Use" is more rugged and is therefore safer than the typical recreational boat.

The Coast Guard distinguishes between commercial boats and recreational boats by the manner in which they are advertised and labeled. If they are not equipped with the proper certification labels and there is further evidence, such as the absence of labels saying "For Commercial Use," indicating that the manufacturer did not intend to build them to meet the standards, the Coast Guard has the authority to initiate Civil Administrative Penalty procedures against the seller and the builder of the boat. The basis is a violation of 46 U.S.C. 4311(b)(1):

"A person violating section 4307(a) of this title is liable to the United States Government for a civil penalty of not more than $5,000, except that the maximum civil penalty may not be more than $250,000 for a related series of violations."

Finally, a manufacturer or dealer who knowingly sells a boat that does not comply with applicable safety standards and regulations for use as a recreational boat may suffer other serious financial penalties if the purchaser has an accident. Both the courts and juries are showing an increasing inclination to assess substantial penalties in product liability suits.

While the Coast Guard recognizes that operators such as commercial fishermen may legally use "commercial boats," the Coast Guard recommends that as a minimum they use boats that meet the Federal safety standards and regulations in 33 CFR Parts 181 and 183.

PAIN IN THE GAS

The following article was originally published in the August/September 2006 issue of *Professional BoatBuilder* magazine and is reprinted here with the permission of the authors and the editors of *Professional BoatBuilder.*

So a mechanic, a designer, and an insurance agent walk into a bar....No, seriously: A mechanic, a designer, and an insurance agent did in fact write in to *Professional BoatBuilder*, each concerned about the effects of recently reformulated gasoline on marine engines and fuel systems. Their views are presented here.

An Introduction to the Problem

by Aaron Porter

Tough to keep pace with today's volatile petroleum market in the United States—and all the attendant regulations. Ordinarily, it's safe to leave the sweating over details of energy and environmental policy to commodities traders, petroleum distributors, and the U.S. Environmental Protection Agency. But not this year. The widespread adoption of ethanol—an alcohol derived from fermented carbohydrates—as a gasoline additive may be good news for Midwestern farmers and fuel-filter manufacturers, but it's an expensive nuisance and even a danger to boat owners, builders, and repairers.

Ethanol's properties as a fuel additive are well-suited to North America's automotive fuel needs: it can be produced domestically; it performs as an effective oxygenate, reducing harmful emissions such as benzene; and, it doesn't contaminate groundwater the way methyl tertiary butyl ether (the ether-based oxygenate it is supplanting) can.

For the marine industry, though, the fit isn't so good. Ethanol is a solvent that doesn't mix well with the MTBE fuel lingering in some tanks; it scours fuel systems, overburdening filters; it breaks down fiberglass fuel tanks; and it rapidly absorbs water from atmospheric humidity, giving the fuel only a brief useful shelf life. Ethanol's adoption is changing the way gasoline-powered boats are maintained, serviced, used, and with regard to some components, constructed.

So why are petroleum refiners switching from MTBE to ethanol? Contrary to many reports, there is no federal ban on MTBE—although numerous states have enacted their own legislated prohibitions on the additive. Nor is the switch driven by the EPA requirement that gasoline be sold with 2.08% oxygenate content. (That rule, cited by the petroleum industry as a factor steering it to ethanol, was withdrawn by the EPA on May 5, 2006 in order to square with the provisions on reformulated fuels in the 2005 Federal Energy Policy Act.) The remaining federal regulation, which promotes the use of oxygenates without explicitly requiring them, is a limit on the harmful emissions that may come from gasoline when it's combusted. That means, while refiners are no longer required to blend an oxygenate with gasoline, incorporating one remains the most expedient way to meet emissions standards. Since

ALCOHOL CONTENT	
Max. % by Volume	
Ethanol	**10%**
Methanol	**0%**
Alcohol Cosolvent	**0%**

MTBE—ethanol's only presently viable alternative—has been banned in so many states, and since the threat of litigation for environmental damage from it looms, refiners are really left with ethanol as their lone workable oxygenate. Like it or not, ethanol-blended gasoline is what's coming down the pipeline.

Professional BoatBuilder has received a stream of warnings and concerns from the marine industry about the likely effects of this fuel reformulation. While some specific impacts of the change remain the subject of debate, there are precautions that can be taken now to protect boats as well as their owners, builders, and repairers from the potential hazards of the switch to ethanol. In this initial cautionary look at the problem, we include the most immediately relevant experiences and perspectives of a marine mechanic, a yacht designer, and a marine insurance provider. If their accounts of the pending risks and complications are any indicator, there'll be plenty more to read on this subject in coming issues of the magazine.

About the Author: *Aaron Porter, who assembled this article, is associate editor of* Professional BoatBuilder.

I. A Mechanic's Warnings

by Dan Crete

Due to federal laws requiring the use of oxygenates in densely populated, polluted "non-attainment areas," and state laws that forbid MTBE, the New York and Connecticut boating region got an early taste of the switch to 10% ethanol blend—also known as E10 gasoline—during the 2005 boating season. The area had previously been receiving MTBE gasoline. There was little warning about this changeover. As the 2005 season unfolded, reports of fuel-system problems began to surface. Complaints ranging from clogged fuel filters to engine failures became more common as the 2005 season progressed. Fortunately, we can draw on the experiences of boaters and boatyards in New York and Connecticut as we plan for the more widespread switch to ethanol.

One of the first things learned about this new gasoline is that it does not mix well with MTBE gasoline. When these two fuels are combined there are several complications: most prevalent is a tendency for the E10 to severely clog and even deteriorate in-line fuel filters. There were also reports of volatility problems, with varying mixtures of the two products in boat fuel tanks throwing off the vapor pressure of the fuel. That led to cold-start and even vapor-lock problems. In addition, isolated cases of severe corrosion of aluminum fuel-system parts have been documented and attributed to mixing of the two reformulated fuels.

To avoid blending the two fuels during the transition from MTBE to E10 it is recommended that fuel levels in tanks be run down to the lowest level safely possible before taking on any of the ethanol fuel. Remember, any fuel taken on last season outside of states with MTBE bans could be MTBE based. So far, this approach has allowed a seamless transition for people trying to avoid the problems resulting from the mixing of the two fuels.

Fuel suppliers are in transition, too. Boat owners who successfully navigate the initial switch need to be wary of where they take on fuel during the season as well. The key is to be sure to know which fuel each marina is dispensing. The determining factor will be just how much of last season's fuel a given retailer has left. The MTBE mix must be completely sold off before any E10 can be put into the storage tanks. Some fuel sellers who have just a few hundred gallons on site will make the transition almost immediately. But I'm aware of several yards and marinas that have thousands of gallons of MTBE fuel in their tanks. For them, the transition could take several weeks or even months as the season gets going.

Retail customers must avoid making the initial transition to E10 with their normal retailer, then going elsewhere and unknowingly taking on MTBE on top of the E10 already in their tank. This was a big problem last season for boaters taking on fuel in Connecticut, and then making a trip to Rhode Island and unwittingly filling up with MTBE again.

Boat owners who trailer their boats and fill up at roadside stations (which have been dispensing E10 since mid March 2006) must also be made aware of this situation, as they're likely to have MTBE in their boat tanks from last season.

Faith in Filters

Boatyards and marinas that retail fuel should take their own precautions with suppliers, and their own storage and dispensing equipment. Reputable fuel distributors in our region have given their customers ample warning about the steps to take with fuel storage tanks and dispensing equipment. Those include: cleaning gasoline storage tanks, being certain there is no water in the system; and upgrading fuel filters to 10-micron, ethanol-compatible, water-separating filters. Because ethanol is a solvent it is going to clean any dirt or contaminants both from dispensing and boat fuel systems. Ideally, these contaminants will be washed into solution in the gasoline and scrubbed out by the system's fuel filters. Yes, we are going to be changing a lot of fuel filters this summer. The reports from yards and boat owners are that filters clog often with the first loads of E10, but after burning through two or three tanks of fuel, the filters do take care of the dirt.

Carrying spare filters is going to be a must for boaters and retailers. Most filter manufactures are ramping up production of ethanol-compatible filters. If they're not already doing so, boatyards will need to stock a lot more filters than they have in the past. Boaters will need to have spares on board and the means to change them, including a way to safely store the old filter and the gasoline it contained while onboard. I would suggest an onboard kit with the proper tool and some sort of sealable container for storing old filters and gas. The industry standard seems to be 10-micron, water-separating filters. By all accounts they're doing a good job. Note: the 10-micron filters may pose a problem for some engine warranties. Consult the engine operator's manual, and talk to the dealer about what is best for that boat's application.

Water Hazards

Ethanol, being alcohol based, absorbs water very well. This is a bit of a double-edged sword for the marine industry. Marine fuel systems are very susceptible to water intrusion. E10 has the ability to absorb a certain amount of water into solution and simply allow it to be burned by the engine. As an improvement over MTBE gasoline, which can hold about 600 ppm in solution, E10 can hold 6,000 to 7,000 ppm in solution. Meaning, if you have a 100-gallon (378.5 l) tank it could hold up to .6 – .7 gallons (2.3–2.6 l) of water in solution. The problem for the ethanol alternative comes with "phase separation." That's what happens when the fuel is saturated beyond its capacity to hold water in solution. The water and gasoline actually separate, and the gasoline floats on top of the water. With MTBE you could simply pump the water out from under the gasoline, or let your filters remove the water, and burn any gasoline that remained. With E10, ethanol blends more easily with water than it does with gasoline. When phase separation occurs in E10, the ethanol is pulled out of the gas and stays with the water. This result is two solutions, neither of which is good for engine or fuel system. The gasoline left behind now has no oxygenate; it shouldn't be burned in the engine and must be disposed of. The water left behind now contains a high concentration of ethanol; this solution is highly corrosive and damaging to any materials it may be in contact with in the fuel system. The only solution to dealing with E10 that has phase separated is to dispose of the whole load of fuel, clean the tank, and start fresh with a new load of E10.

Every precaution must be taken to keep water out of fuel in storage tanks and on board. Checking fill caps and fittings for proper gaskets, and insuring that vent systems are up to spec, are two ways of being certain your fuel system is sound. In addition, retailers should stick their tanks with alcohol-compatible, water-finding paste daily and after each load of fuel is brought in by distributors. Check their tanks during delivery; if the fuel has water in it, refuse the load. Make it the distributor's problem if that company delivers bad fuel. As a retailer, you'll need to be able to ensure that your customers are getting a product of the highest quality. The damage that corrosion from phase separation can do to your own storage tanks is expensive if left unchecked.

E10's ability to absorb water has yet another drawback: it can absorb water directly from the atmosphere through the vent while simply sitting in the tank. In just 100 days at 70% humidity, E10 can absorb enough water to phase separate. The shelf life of E10 is only 60–90 days if left without treatment.

Gasoline "oxidizes" when exposed to air. That is, it loses its volatility over time. A good nonalcohol fuel stabilizer (we don't want to add even more alcohol to the mix) is highly recommended at all times in your fuel. There are several products on the market that will do a great job. But the key for any boatyard or boater is to not leave a boat for long periods of time with a large load of fuel aboard. If the yard or owner

knows there will be an extended delay between trips out, then leave the tank low and refill just before the next trip out. In general, the more the boat is used, the better off it will be.

When it comes to winter storage, a boatyard should run the tank down as low as possible at the end of the season and treat what is left for the winter. That of course goes against traditional thinking in terms of condensation, but: better a small amount of water from condensation than a tank full of bad gas.

About the Author: *Dan Crete is a mechanic and foreman at Burr Brothers Boatyard in Marion, Massachusetts, and an instructor at Massachusetts Maritime Academy.*

II. A Designer's Perspective

by Dave Gerr

In *Professional BoatBuilder* No. 84 (August/September 2003), in the second of two articles I wrote on fuel systems, I explained the advantages of fiberglass fuel tanks for both gasoline and diesel. The recent introduction of ethanol gasoline dramatically alters those recommendations.

State and federal regulatory changes that led to the replacement of MTBE with ethanol have revealed a largely unforeseen problem with fiberglass gasoline fuel tanks. Since the switch to E10 began, there's been a sudden rash of tank and fuel problems. After research and testing arranged by Boat/US and several marine surveyors dealing with odd fuel-system failures, these problems have been traced back to the alcohol in ethanol gasoline reacting with and dissolving the resin in the walls of fiberglass fuel tanks. The process is chemically similar to fiberglass osmotic blistering—but much more aggressive and more pervasive. In fact, it's been found that all standard fiberglass resins are attacked by ethanol. Tank walls have been seriously weakened, causing leaks, and styrene and related chemical by-products dissolved in or reacted with the ethanol have worked their way into the engine where they've created serious fouling problems.

The least-resistant resin has been found to be orthophthalic (orthopolyester), followed by isophthalic (isopolyester), which holds up somewhat better. Epoxy resins are better still. I know of no tests to date on vinylester. Regardless, every one of these resins suffered noticeable degradation in contact with ethanol.

Until the advent of ethanol, fiberglass fuel tanks for gasoline were one of the best options possible. There are many thousands of gasoline-powered boats in service with fiberglass fuel tanks. This includes vessels from top builders such as Bertram and Hatteras. Newly adopted ethanol changes that. All these tanks are now suspect, and you should not design or build gasoline tanks of fiberglass.

Resin vendors say there are resin formulations that can be used safely with ethanol. However, these are not widely known in the boating industry and currently are not readily available. Before you could design and build a fiberglass tank for gasoline also safe for ethanol, you would need to consult the resin vendor,

Precautions for the Switch to Ethanol

*** Do not mix MTBE with E10 gasoline.**

*** Avoid water intrusion into your fuel system.**

*** Run a nonalcohol fuel stabilizer in your boat's fuel system at all times. Recommended for equipment that sits for a lengthy period.**

*** The more use the boat gets, the less likely it is to have problems. Don't leave large loads of fuel aboard an idle boat.**

*** Install a good, water-separating fuel filter.**

*** Keep a stock of spare fuel filters handy, and the means for safely changing them.**

*** Replace older weather-faded plastic portable tanks with new tanks.**

*** Retailers should inform their customers about which fuel is being dispensed; customers need to ask which fuel they're purchasing during the transition to E10.**

*** Rubber fuel lines older than the mid-to late-1980s should be inspected and may need replacing.**

*** Some older carbureted engines may require special tuning. Consult the engine manufacturer for details.**

The formulation changes and the new risks they bring are not as bad as they sound at first. For retailers, if your fuel dispensing system has been well cared for, and is clean and free of water, then you shouldn't have any trouble. As for boaters—who are, let us never forget, our customers one and all—if they've had problems with water in their fuel systems in the past, then those problems will only worsen with the introduction of E10. Correct the water situation, and start fresh with E10 gasoline. —Dan Crete

select a suitable resin, make a sample test panel, expose it for a long period of time to ethanol (months at least), and then test the sample to ensure it suffered no degradation of any kind.

The process of developing fiberglass tanks safe for ethanol will probably be worked out over the next several years. Until then, avoid fiberglass gasoline tanks in new construction. You must also be aware of this potential problem in existing vessels. When surveying, retrofitting, repairing, or simply owning or operating an older gasoline-powered boat, be sure to determine its fuel tank material. If fiberglass, then the tank needs special attention to ensure there's been no degradation due to ethanol.

The Diesel Exception

Note that diesel tanks are unaffected by this new development. There's no alcohol equivalent of any type for diesel. Biodiesel—the vegetable-based renewable energy source that can be blended with, or even wholly replace, petroleum diesel—is an oil, not an alcohol. Biodiesel does not degrade fiberglass resins. Fiberglass diesel fuel tanks are still an excellent choice, with all the advantages of fiberglass tanks described in the original PBB article.

About the Author: *Dave Gerr is the director of Westlawn Institute of Marine Technology and maintains his longstanding design practice, Gerr Marine, based in New York City. He is the author of Propeller Handbook, The Elements of Boat Strength, and The Nature of Boats.*

III. Insuring the Ethanol Transition

by Jim Cassidy

Much has already been written about the problems that are arising (and will continue to escalate) due to the addition of ethanol to gasoline. Almost all such problems and potential problems occur in boats that have fiberglass or plastic-based fuel tanks and fuel system components that are not "ethanol-proof." The results range from minor to potentially catastrophic. Any of them can generate insurance claims, which will run the gamut from needing a tow, or stalling and foundering, to fire or explosion and property loss—or worse, personal injury or death. Given the facts as they are now known, the potential for disproportionately high loss-and-claim levels caused by ethanol-related problems is predictable.

Insurance is not intended to cover the predictable or the inevitable; rather, it exists to cover the unexpected. Therefore, the marine insurance industry must address the inevitable nature of ethanol-related losses. If marine insurers were to simply exclude coverage for any loss resulting from leaking or failed onboard fuel tanks or fuel-system components, then far too many boat owners who do not possess ethanol-vulnerable fuel tanks and systems would also be lacking coverage they should be able to have. Any fair and viable solution must be specific to those boats with ethanol-vulnerable systems.

Because my insurance company specializes in classic boats, which in most cases are older boats, we know we'll have a higher percentage than most insurance providers of clients whose fuel-system components are vulnerable to ethanol. This is a problem we've had to find a solution for. To provide the most comprehensive coverage without providing coverage for inevitable losses, we will add to all policies an endorsement that excludes coverage for ethanol-caused losses if the boat has vulnerable fuel tanks or system components. The precise wording of the endorsement is now being composed and should be in effect by the time you read this. By excluding claims resulting from only the failure of ethanol-vulnerable fuel system components we minimize the number of excluded claims conditions. For instance, should someone whose boat has a fiberglass fuel tank change to a new, nonethanol-vulnerable metal tank, then coverage for leaks from the new tank would automatically be provided starting from the time of replacement.

The entire matter of losses and claims resulting from ethanol-damaged fuel systems is not yet fully developed. Problems other than those already encountered may well come to light in the future. In the meantime, there's no doubt that, ultimately, all marine insurance companies will have to address the issue of ethanol and marine gasoline systems sooner rather than later.

About the Author: *Jim Cassidy is an owner and principal of Heritage Marine Insurance, based in Mystic, Connecticut.*

RECALL CAMPAIGNS

ALUMACRAFT BOAT COMPANY
(St. Peter, MN)(060008T)
Year: 2001 – 2003
Models: Fisherman 145, Yukon, Lunker, Navigator and Magnum
Units: 2,129
Problem: Hinge pin on seats produced by Geldert's LLC may come loose causing seat back to separate from seat bottom

AMERICAN SUZUKI MOTOR CORPORATION
(Brea, CA)(050052T)
Year: 2004
Models: 4-Stroke V6 outboards:
DF200T w/ serial nos.
20001F-421546 – 421911
DF200Z w/ serial nos.
20001Z-421114 – 421149
DF225T w/ serial nos.
22501F-421292 – 421690
DF225Z w/ serial nos.
22501Z-421084 – 421192
DF250T w/ serial nos.
25001F-422026 – 422417
DF250Z w/ serial nos.
25001Z-421296 — 421384
Units: 1,012
Problem: Incorrect flywheel casting composition could cause flywheels to come apart; possibility of injury to boat occupants

AMERICAN SUZUKI MOTOR CORP.
(Brea, CA)(060036T)
Year: 2004 – 2006
Models: DF200, DF225 & DF250 outboard engines
Units: 8,335
Problem: Malfunctioning electronic control module can cause hard starting leading to fuel accumulation in the intake port; this condition along with a misfire during starting can result in severe engine backfire which damages the engine's collector assembly (air intake); if the collector assembly breaks, the engine cover could come off unexpectedly

BAYLINER MARINE CORP.
(Everett, WA)(060045T)
Year: 2005 – 2006
Models: Bayliner 185 Bowrider with 4.3L Engine Option
Units: 1,971
Problem: Possible steering binding condition; possibility of loss of steering control

BAYLINER MARINE CORP.
(Everett, WA)(060088T)
Year: 2007
Models: 195 Discovery
Units: 97
Problem: Improper helm installation results in steering backwards; danger of collision

BAYLINER MARINE CORP.
MAXUM MARINE DIV.
(Everett, WA)(060050T)
Year: 2005 – 2006
Models: Maxum 1800SR with 4.3L Engine Option
Units: 48
Problem: Possible steering binding condition; possibility of loss of steering control

BENNINGTON MARINE CORP.
(Elkhart, IN)(050077T)
Year: 2004 – 2005
Models: Pontoons w/ serial nos. ending in 404, 405
& 505 with Mercruiser 4.3L, 5.0L, 5.7L, 350 MAG and 6.2L I/O engines
Units: 230
Problem: Failure in Mercruiser power steering pump hose may cause loss of steering control; possibility of collision

BENNINGTON MARINE CORP.
(Elkhart, IN)(060039T)
Year: 2006
Models: "I Series" pontoon boats with black 31 gallon fuel tanks
Units: 900
Problem: Fuel tank leaks; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS
(Benton, IL)(060093T)
Year: 2003 - 2007
Models: All Sea-Doo Sportster (2003 - 2006)
All Sea-Doo Speedster 200 (2004 - 2006)
All Islandia (2006)
All Utopia (2006)
2007 Speedster 200
2007 Speedster 150
2007 Islandia
2007 Utopia
Units: 4,702
Problem: On Sportboats equipped with Rotax naturally aspirated 155 horsepower 4-TEC engine internal airbox parts can detach and be drawn into throttle body; throttle plate may jam and prevent return of throttle to idle position; danger of collision

BOMBARDIER RECREATIONAL PRODUCTS EVINRUDE OUTBOARDS DIV.
(Waukegan, IL)(050039T)
Year: 2001, 2004 & 2005
Models: All 2001 200 – 250 HP DI models
2004 200 – 250 HP DI models w/ serial nos. 5050319 and later
2005 100 & 115 HP DI models w/ serial nos. All up to 5111879
2005 135 – 175 HP DI models w/ serial nos. All up to 5111879
2005 200 – 250 HP DI models w/ serial nos. All up to 5088447
Units: 5,922
Problem: Under certain operating conditions a fuel injector fastener could loosen and/or break; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS EVINRUDE MOTORS DIV.
(Sturtevant, WI)(060042S)
Year: 2006
Models: 40 horsepower outboards
Units: 204
Problem: Software switch in Engine Management Module allows engine to be started in gear

BOMBARDIER RECREATIONAL PRODUCTS EVINRUDE MOTORS DIV.
(Sturtevant, WI)(060052S)
Year: 2004 – 2007
Models: Evinrude E-TEC 40, 50, 60, 75 and 90 horsepower outboard engines
Units: 24,767
Problem: Fuel system pressurization during assembly may have damaged fuel filter; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS JOHNSON MOTORS DIV.
(Sturtevant, WI)(060034T)
Year: 2004 – 2006
Models: Johnson 200 & 255 outboard engines
Units: 746
Problem: Malfunctioning Electronic Control Module can cause hard starting leading to fuel accumulation in the intake port; this condition along with a misfire during starting can result in severe engine backfire which damages the engine's collector assembly (air intake); if the collector assembly breaks, the engine cover could come off unexpectedly

BOMBARDIER RECREATIONAL PRODUCTS JOHNSON OUTBOARDS DIV.
(Sturtevant, WI))(050042T)
Year: 2004
Models: 200 HP 4 Stroke outboards
Units: 237
Problem: Incorrect flywheel casting composition could cause flywheels to come apart; possibility of injury to boat occupants

CARAVELLE POWERBOATS, INC.
(Americus, GA)(06R1292S)
Year: 2006
Models: 237 LS Bow Rider
Units: 49
Problem: Insufficiently sized openings in natural ventilation system

CARVER BOAT CORP.
(Pulaski, WI)(060049S)
Year: 1997 – 2007
Models: Mariner 350 and 360
Units: 914
Problem: Isolation bulkhead forward of engine compartment not completely sealed; possibility non-ignition-protected components could be exposed to fuel vapors

CORRECT CRAFT, INC.
(Orlando, FL)(050019T)
Year: 2005
Models: SV211 w/ serial nos.: 59109 - 59384 & 59388 - 59395
Units: 285
Problem: Ventilation; inadvertently mixed intake and exhaust ducts in the same plenum

DORAL INTERNATIONAL
(Grand Mere, QC)(050072T)
Year: 2003 – 2005
Models: Elegante 330SE w/ HINs:
CA-QJAD3182D303 –
CA-QJAD5226C505
Boca Grande 360SE w/ HINs:
CA-QJAE3092K203 –
CA-QJAE5189B505
equipped with Volvo 8.1 or Mercruiser 8.1 inboard engines
Units: 34
Problem: Missing "L" shaped support brackets could allow metal and semi-rigid rubber exhaust hoses to disconnect from each other sending raw cooling water and carbon monoxide into engine room

FOUNTAIN POWERBOATS
(Washington, NC)(06R1320S)
Year: 1993 – 2007
Models: 42 Lightning and 42 Executioner
Units: 361
Problem: Fuel lines from saddle tanks lack anti-siphon protection

FINELINE INDUSTRIES
(Merced, CA)(060058T)
Year: 2006 - 2007
Models: Centurion
Units: 293
Problem: Left and right tower Heim bolt on Evolution Towers may pull out causing tower to fall into cockpit; possible injury to operator and/or passengers

G3 BOATS
(Lebanon, MO)(060035S)
Year: 2006
Models: 1860WOFJ
Units: 29
Problem: Level Flotation

GEM PRODUCTS, INC.
(Orange Park, FL)

The plastic portion of vented fuel fills (99800, 99820, 99840, 99860 series) manufactured by Gem Products, Inc. may crack during fueling; possible fuel discharge into bilges; possible fire/ explosion if ignition source present. The letters "PAT. PEND" are visible on the flange of recalled products. The following companies are involved:

CHAPARRAL BOATS, INC.
(Nashville, GA)(060065T)
Year: 2006 - 2007
Models: 190 SSI, 204 SSI, 210 SSI, 215 SSI, 220 SSI, 235 SSI, 236 SSI, 246 SSI, 255 SSI, 256 SSI, 260 SSI, 265 SSI, 275 SSI, 276 SSI, 280 SSI, 285 SSI, 236 SSX, 256 SSX, 276 SSX, 240 Signature, 270 Signature, 276 Signature, 280 Signature, 290 Signature, 310 Signature, 330 Signature, 350 Signature, 214 Sunesta, 216 Sunesta, 232 Sunesta, 234 Sunesta, 236 Sunesta, 252 Sunesta, 254 Sunesta, 274 Sunesta,
Units: 2,869

CHRIS CRAFT BOATS
(Sarasota, FL)(060067T)
Year: 2006 - 2007
Models: Speedster, Launch 22, Launch 25, Corsair 25, Launch 28, Corsair 28
Units: 189

KENCRAFT MANUFACTURING, INC.
(Wilson, NC)(060070T)
Year: 2006 - 2007
Models: 2060, 2260, 2460
Units: 59

KENNER BOATS
(Knoxville, AR)(060081T)
Year: Mako 2201CC & 2201CCT boats built
Models: between 020306 - 090606;
Mako 1801CC boats built between 020306 - 090606;
Mako 1901CCV2, M1901CCT, & M1901CC boats built between 020306 - 090606;
Mako 2101CCV2 & 2101CC boats built between 020306 - 090606;

GEM PRODUCTS, INC. (cont'd)
(Orange Park, FL)

The plastic portion of vented fuel fills (99800, 99820, 99840, 99860 series) manufactured by Gem Products, Inc. may crack during fueling; possible fuel discharge into bilges; possible fire/ explosion if ignition source present. The letters "PAT. PEND" are visible on the flange of recalled products. The following companies are involved:

KENNER BOATS (cont'd)
(Knoxville, AR)(060081T)

Tahoe 195O, 196O, 215O & 215OCC boats built between 020306 - 090606; Kenner V2102 & V2102T boats built between 020306 AND 090606; Kenner 2103 & 2103T boats built between 020306 & 090606; Kenner 1800 & 1800T boats built between 020306 & 090606; Kenner V1902 & V1902T boats built between 020306 AND 090606
Units: 654

MAKO MARINE INTERNATIONAL, INC.
(Forest City, NC)(060071T)
Year: 2007
Models: M184CC, M204CC
Units: 21

MONTEREY BOATS
(Williston, FL)(060074T)
Year: 2006 - 2007
Models: 234 FSX
Units: 43

NAUTIC STAR BOATS
(Amory, MS)(060075T)
Year: 2007
Models: 1800 Nautic Bay, 1900 Nautic Bay, 2110 Nautic Bay, 2200 Nautic Bay, 2000 Offshore, 205DC Sportdeck, 206 I/O Sportdeck, 210DC Sportdeck, 200SC Sportdeck, 210 Sportdeck, 230 Sportdeck, 2110 Tunnel, 2000 OS DC, 206 I/O Sportdeck, 210 I/O Sport, 210DC I/O Sportr, 230SL I/O Sport
Units: 202

OCEAN MASTER MARINE
(West Palm Beach, FL)(060076T)
Year: 2006 - 2007
Models: Ocean Skiff & Center Console
Units: 34

PARKS MANUFACTURING, INC.
(Seminole, OK)(060063T)
Year: 2007
Models: 2200 Pure Bay & 220 V-BAY LC
Units: 84

ROBALO BOATS LLC
(Nashville, GA)(060066T)
Year: 2006 - 2007
Models: R200, R220, R227, R240, R245, R260, R265, R295, R300, R305
Units: 225

SEA HUNT BOAT MANUFACTURING
(Lexington, SC)(060077T)
Year: 2007
Models: 240 CC
Units: 12

SUNDANCE BOATS, INC.
(Blackshear, GA)(060079T)
Year: 2005 - 2007
Models: Skiff
Units: 147

TIDEWATER BOATS
(Irmo, SC)(060080T)
Year: 2006 - 2007
Models: 18, 19 & 21 Bay; 216 CC
Units: 153

GLASTRON BOATS
(Little Falls, MN)(050027T)
Year: 2005
Models: DS 215
Units: 72
Problem: Possible puncture in fuel tank during installation of changing room drain; possible fire/ explosion if ignition source present

HUNTER MARINE
(Alachua, FL)(060053T)
Models: H240 w/ HINs:
HUN24462F203 – HUN24516C404
H260 w/ HINs:
HUNF0027A202 – HUNF0140B404
H270 w/ HINs:
HUNK0162F102 – HUNK0173D304
H27 w/ HINs:
HUN27101G405 – HUN27105J405
H306 w/ HINs:
HUN30465F102 – HUN30568C404
H326 w/ HINs:
HUN32255F102 – HUN32362I304
H33 w/ HINs:
HUN33101I304 – HUN33258J405
H356 w/ HINs:
HUN35101F102 – HUN35421F304
H36 w/ HINs:
HUN36101F304 – HUN36231J405
H38 w/ HINs:
HUN38101C405 – HUN38145J405
H386 w/ HINs:
HUN38718E102 – HUN38836C405
H410 w/ HINs:
HUN41332K102 – HUN41357H203
H41 w/ HINs:
HUN41101J102 – HUN41218J405
P420 w/ HINs:
HUN42189J102 – HUN42230J304
H426/44 aft cockpit w/ HINs:
HUN4A101G203 – HUN4A155J405
H426/44 deck salon w/ HINs:
HUN40101D203 – HUN4D196J405
P450/456 w/ HINs:
HUN45272J102 – HUN45315I405
P460/466/46 w/ HINs:
HUN46270G203 – HUN46337J405
Units: 1,650
Problem: On ball valves manufactured by Marine Hardware (with blue handles), ball valve stem corrodes prematurely making it impossible to close the valve; possible water leakage

INDMAR PRODUCTS COMPANY, INC.
(Millington, TN)(060086T)
Year: 2005 - 2006
Models: GM 8.1L engine
Units: 998
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/explosion if ignition source present

IMAR GROUP
(Fargo, ND)(06R1393S)
Year: 2006
Models: Gekko Revo 6.7
Units: 24
Problem: Display of capacity information; various electrical, fuel and ventilation system noncompliances

KAWASAKI MOTORS CORPORATION
(Santa Ana, CA)(050045T)
Year: 2004 – 2005
Models: JT900, JT1200 & JT1500
Units: 13,493
Problem: Hose from freshwater flush fitting to the engine may have a loose connection filling engine compartment with water

KAWASAKI MOTORS CORPORATION
(Santa Ana, CA)(050046T)
Year: 2005
Models: JT900-E2 w/ HINs:
US-KAW60001I405 - KAW61899E505
JT1200-C2 w/ HINs:
US-KAW30001I405 - KAW30253B505
JT1200-D1 w/HINs:
US-KAW40001J405 - KAW43217E505
JT1500-A2 w/HINs:
US-KAW50001E505 - KAW53531E505
Units: 6,718
Problem: Seat may not latch securely and might come off unexpectedly

KEVCON CORP.
(Fort Dodge, IA)(050023S)
Year: 1996 – 2004
Models: Stealth 145C, 1237 Jon & 1437 Jon sold under Brand Name Misty Harbor
Units: Stealth 145C – 147 boats w/ HINs:
KEIS0118C000 – KEIS0575F405
1237 Jon – 124 boats w/HINs:
KEIE0124K203 – KEIE0628K203
1437 Jon — 141 boats w/HINs:
KEIE0109E697 – KEIE0672G405
Units: 412
Problem: Level Flotation

KODIAK MARINE
(Tualatin, OR)(060085T)
Year: 2005 - 2006
Models: GM 8.1L engine
Units: 57
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/explosion

LARSON BOATS
(Little Falls, MN)(060111T)
Year: 2007
Models: SEi-180 I/O & Escape 204
Units: 115
Problem: Dash fuse panel supply wire is undersized allowing for greater than three percent minimum voltage drop to critical components; possible tripping of the engine circuit breaker leaving ignition system with no power

LUHRS CORP.
(St. Augustine, FL)(060032T)
Year: 2006
Models: 28 Open
Units: 50
Problem: Bilge pump thru-hull placement lacks anti-siphon protection

MALIBU BOATS, INC.
(Merced, CA)(060087T)
Year: 2007
Models: Wakesetter 21.5 XTi
Wakesetter 21.5 VLX
Wakesetter 23 LSV
Wakesetter 247 LSV
Wakesetter VTX
Anniversary Response
Anniversary Wakesetter
Sunscape 21.5 LSV
Sunscape 23 LSV
Sunscape 247 LSV
vRide
Response LXi
Units: 353
Problem: Possible fuel leak around mounting area of in-tank fuel pump; possible fire/explosion if ignition source present

MASTERCRAFT BOAT COMPANY
(Vonore, TN)(050037T)
Year: 2005
Models: Maristar & X-30
Units: 84
Problem: Fuel tank may come in contact with transmission coupler abrading outside of tank; possibility of fuel leakage and possible fire/explosion if ignition source present

MERCURY MARINE
(Fond du Lac, WI)(050005T)
Year: 2003 – 2005
Models: 225 V-6 EFI 4-Stroke outboards w/ serial nos: 0T653945 - 1B055871
Units: 3,685
Problem: Throttle may stick preventing operator from shifting into neutral

MERCURY MARINE
(Fond du Lac, WI)(060090T)
Year: 2005 – 2006
Models: GM 8.1L engine
Units: 11,183
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/explosion if ignition source present

MERCURY MARINE
(Fond du Lac, WI)(050014T)
Models: Bravo X I/II/III Drives w/ serial nos. 0W250000 thru 0W266345
Bravo XR I/III Drives w/ serial nos. 0W240000 thru 0W240652
Units: 2,655
Problem: Shift link bar may become disengaged from shift lever resulting in loss of shift control; possibility of collision

MERCURY MARINE
(Fond du Lac, WI)(060097T)
Year: 2006
Models: 25/30 EFI 4-Stroke outboards w/ serial nos.: 0R125005 - 0R145228
Units: 2,430
Problem: Throttle may not return to neutral after running at elevated rpms resulting in loss of shift control; possibility of collision

MERIDIAN YACHTS
(Everett, WA)(050024T)
Year: 2005
Models: 341, 368, 381, 408, 411, 459, 490
Units: 53
Problem: Stainless rudder bearings seize on rudder shaft; possibility of collision

MERIDIAN YACHTS
(Everett, WA)(050055T)
Year: 2004 – 2006
Models: 408, 411 & 459
Units: 172
Problem: Shore power plug ends on Glendenning Cable Master may have been installed incorrectly; possible fire/explosion if fuel or vapor source present

PANTHER AIRBOAT CORP.
(Cocoa, FL)(060095T)
Models: Airboats equipped with GM 8.1L engine
Units: 50
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/explosion if ignition source present

PLEASURECRAFT ENGINE GROUP
(Little Mountain, SC)(060083T)
Year: 2005 - 2006
Models: GM 8.1L engine
Units: 1,005
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/explosion if ignition source present

RANGER BOATS
(Flippin, AR)(060102T)
Year: 2006 - 2007
Models: 175VS, 178VS, 180 RE, 185 VSI, 188 IN, 188VS, 190 RE , 195'V, 1750R, 1760', 1850 R, 1860VS, 2000', 618VS, 619VS, 519VX, Z19'0
Units: 273
Problem: Main battery cable routed incorrectly and could interfere with outboard engine flywheel on boats rigged with Bombardier 115, 150, 175 or 200 HP engines; possible short circuit; possible fire/ explosion if fuel or vapor source present

REGAL MARINE INDUSTRIES
(Orlando, FL)(06R1557S)
Year: 2007
Models: Regal 2700
Units: 60
Problem: Continuously energized ungrounded terminals on battery switch not protected from accidental short circuiting; all-round navigation light obstructed by bimini top

S2 YACHTS, INC.
(Holland, MI)(060019S)
Year: 2004 – 2006
Models: 3200 Open
Units: 86
Problem: Engine compartment blowers insufficient size

SEA BOSS BOATS
(Newberry, SC)(050029T)
Year: 2003 – 2004
Models: 180CC w/ HINs:
GHQCW001A303 - GHQCW298E404
190CC w/ HINs:
GHQJR001A303 - GHQJR210E404
210CC w/ HINs:
GHQTT001L202 - GHQTT174E404
210WA w/ HINs:
GHQKL001L203 - GHQKL121E404
235CCF w/ HINs:
GHQJR001G304 - GHQJD024C404
235WAF w/ HINs:
GHQLF001G304 - GHQLF017C404
19 BAY w/ HINs:
GHQ FC001A303 - GHQFC060H304
19 BAY w/ HINs:
GHQFN001G304 - GHQFN054E404
21 BAY w/ HINs:
GHQKB001G304 - GHQKB085E404
Units: 1,054
Problem: ABS thru-hull fitting manufactured by T-H Marine Supplies reacts with PVC hose causing fitting to fail; possibility of sinking

SEA PRO BOATS
(Newberry, SC)(050067S)
Year: 1999 – 2006
Models: S195FS w/ HINs:
PIOFS101K899 – PIOFS713F506
S195FS w/ HINs:
PIOFS001G506 – PIOFS022J506
Units: 620
Problem: Level Flotation

SEA PRO BOATS
(Newberry, SC)(050068S)
Year: 2002 – 2006
Models: SV1500C w/ HINs:
PIONG001G102 – PIONG180F506
Units: 180
Problem: Level Flotation

SEA RAY BOATS
(Knoxville, TN)(060110T)
Year: 2007
Models: 2150 & 270 SLX
Units: 313
Problem: AC & DC Electrical Systems do not have common ground as required by ABYC E-11. If a short occurs in the shore power system, possibility of stray current into the water around the boat

SMOKER CRAFT
(New Paris, IN)(050007T)
Year: 2000 – 2004
Models: Various
Units: 5,314
Problem: Ignition switch defective and could short; possible fire/explosion if fuel or vapor source present

SMOKER CRAFT, INC.
(New Paris, IN)(050016S)
Year: 2004 – 2005
Models: 20-foot Deck Boat
Units: 115
Problem: Decorative grills on natural ventilation supply and exhaust openings reduce cross-sectional area below minimum requirements

STARCRAFT MARINE
(Topeka, IN)(05R0466S)
Year: 2005
Models: Aurora 2000 I/O
Units 556
Problem: Decorative grills on natural ventilation supply and exhaust openings reduce cross-sectional area below minimum requirements

SUNSATION PERFORMANCE BOATS
(Algonac, MI)(06R1738S)
Year: 2007
Models: 32-foot inboard
Units: 102
Problem: Missing manually reset, trip-free circuit breaker or fuse on some ungrounded current carrying conductors

TELEFLEX CANADA
(Richmond BC)(050028T)
Year: 2005
Models: Seastar Tubing w/ lot nos.:
71335 to 71336
Baystar Tubing w/ lot nos.:
71335 to 71336
Units: 19,000 Seastar & 1,096 Baystar
Problem: Tubing may burst prematurely; potential loss of steering control

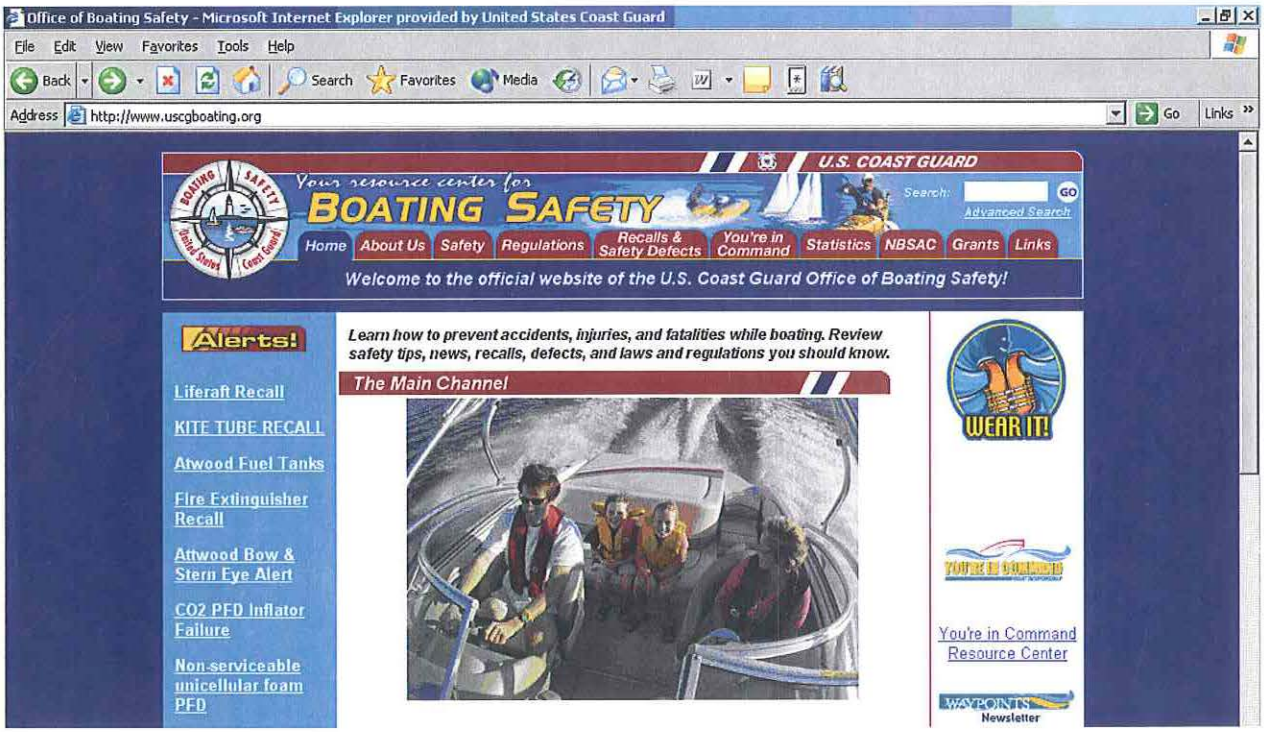
VOLVO PENTA OF THE AMERICAS, INC.
(Chesapeake, VA)(060084T)
Year: 2005 - 2006
Models: GM 8.1L engine
Units: 1,749
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/explosion if ignition source present

WESTERBEKE CORPORATION
(Taunton, MA)(050026S)
Year: 2003 - 2005
Models: Generators – 5.0 BCG, 5.0 BCGA, 7.0 BCGC, 7.0 BCGD, 8.0 BEG, 10.0 BEG, 12.5 BEG, 15.0 BEG, 20.0 BEG, 20.0 BEGA, 25.0 BEG, & 25.0 BEGA
Units: 2,166
Problem: "On" toggle switch fails ignition protection test; possible fire/explosion if fuel or vapor source present

YAMAHA MOTOR CORPORATION
(Cypress, CA)(050010T)
Year: 2004 – 2005
Models: FX1100 WaveRunner
Units: 12,000
Problem: Parts of throttle body assembly, including the link lever may become corroded during storage if exposed to salt water; corrosion could prevent throttle return springs from returning linkage to the idle position; engine may be prevented from starting; or if engine is already running, throttle may stick open; possibility of collision

YAMAHA MOTOR CORPORATION
(Cypress, CA)(050051T)
Year: 2005
Models: VX1100 & VX1100A
Units: 10,000
Problem: Corrosion on connector terminals of the rectifier and regulator assembly can cause excessive electrical resistance which can cause severe overheating of the wire harness coupler that connects to the rectifier and regulator assembly – risk of fire; corrosion on certain parts of the accelerator position sensor assembly might prevent throttle return springs from returning accelerator cam to idle position

YAMAHA MOTOR CORPORATION
(Cypress, CA)(070002T)
Year: 2005
Models: 90TLR Outboard motors
Units: 300
Problem: Possibility of oil pump mounting bolts to be loose; throttle link rod might catch on loose bolts causing throttle valve to stick in open position; possible loss of control and danger of collision



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The **Boating Safety Circular** is published by the U.S. Coast Guard Office of Boating Safety for free distribution to manufacturers, dealers, distributors, marinas, yacht clubs and other boating safety organizations. Questions or comments concerning the material found in this circular may be addressed to: Commandant (CG-3PCB-3), U.S. Coast Guard, 2100 Second Street SW, Washington, DC 20593-0001.

U.S. Department of Homeland Security

United States Coast Guard

August 2008

Boating Safety Circular 86

BOATING AND CARBON MONOXIDE POISONING A DANGEROUS COMBINATION

Just because you're boating, doesn't mean you don't need to be vigilant about the dangers of carbon monoxide (CO) poisoning. Carbon monoxide is a toxic, odorless, colorless, tasteless gas produced by the burning of carbon-based fuels, such as gasoline, charcoal and propane. On boats, CO gas is emitted by engines, gas generators, cooking ranges and heaters. The build-up of CO inside boat cabins, partially enclosed cockpits, beneath swim platforms or other enclosed areas is potentially deadly. Carbon monoxide in high concentrations can be fatal in a matter of minutes. Unless the symptoms are severe, carbon monoxide poisoning is often misdiagnosed as seasickness; however, lower concentrations must not be ignored because the effects of exposure to carbon monoxide are cumulative and can be just as lethal.

Let's face it. Boating and carbon monoxide poisoning are a dangerous combination. Here are some typical accident scenarios to give you an idea as to the extent of the problem:

. . . about 9 a.m., water patrol officers were called to help a woman who was screaming for help. Officers found her husband unconscious on the boat. He apparently passed out because of a carbon monoxide leak aboard the boat. The boat's carbon monoxide detectors were not working.

Nowadays many boats are equipped with carbon monoxide (CO) detectors, but the CO detectors on many older boats are susceptible to false alarms and might have been disconnected; other CO detectors may appear to work when in fact they may not sound an alarm in the presence of medium to high levels of CO gases. The Coast Guard advises the owners of all inboard and sterndrive powered boats built prior to 1998 to inspect their CO detectors. If the CO detector on your boat has been disconnected, or if the exterior cover of the device does not bear the word "marine," the Coast Guard urges immediate replacement with newer CO detection technology.

Improvements in technology and reliability of carbon monoxide gas detectors have reached the point that their installation in accommodation spaces should be considered by all safety conscious recreational boaters. American Boat and Yacht Council ABYC Standard A-24 recommends CO detectors on any boat with accommodation spaces and gasoline powered engines or generators.

Detectors are available as single and multi station systems, fully integrated systems and self-contained units with internal batteries. The major drawback to the units with internal batteries is, should the battery go dead, the detector is incapable of indicating the presence of carbon monoxide. The newer CO detectors have fault circuit checks and other features that were not available in the older models and are considered more reliable with fewer false alarms.

On older CO detector models, detector sensitivity (susceptibility to false alarms) increases with the unit's age; however, owners should learn to react to every alarm as a situation which

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requires immediate action. If your CO detector sounds an alarm, and neither your engine nor a generator are running, do not assume a false alarm. A boat next to you might be the source of the CO and the reason for the alarm. Boat owners should replace their CO detectors as recommended by the device manufacturer.

Follow this link to a list of marine type CO detectors at the Office of Boating Safety website: http://www.uscgboating.org/articles/

. . . three people who had been running a generator to power an air conditioner aboard a houseboat were sent to the hospital after complaining of carbon monoxide poisoning symptoms. The boat was in a canyon and the children were sleeping in the rear of the boat next to an open window, while a generator there was running to power the air conditioning. Their symptoms were headache, nausea and vomiting.

The common practice of running gasoline-powered generators to power air conditioning, entertainment centers and galley appliances while anchored or moored creates another situation in which carbon monoxide can accumulate in dangerous concentrations, particularly if an air conditioner is located near the exhaust port for a generator.

Gasoline powered **portable** generator sets also produce carbon monoxide. Some marine surveyors have reported seeing small generators on boats that have been mounted in the bilge to do nothing more than power high-wattage stereos. The generators were installed by the same businesses that sold the stereos. Currently, no portable generators meet the Coast Guard Electrical and Fuel System Standards. The fuel tank is usually on top of the generator directly above electrical components that are not ignition-protected. The exhaust system on a portable generator is usually constructed of nonmarine alloys that can rust through after brief exposure to a salt water environment. The hot exhaust is typically run to the transom by a dry (non water-cooled) rubber hose. Once the exhaust hose on a portable generator fails, it doesn't take long to fill the engine compartment and eventually the cabin with dangterous levels of carbon monoxide.

. . . a child who vomited and who appeared to be having a seizure were a family's first clue something was wrong. Before the ordeal ended, 21 people aboard the boat were treated for carbon monoxide poisoning in what one person called the largest case of carbon monoxide poisoning he had seen. It was the third such poisoning in the area in less than a week, and the cases have spurred authorities to again warn boaters about dangers posed by the colorless, odorless gas.

Some houseboat transom designs consist of a recessed area amidships forward of the swim platform creating a cavity for engine and generator exhaust ports. When the generator is running the carbon monoxide gas buildup in this cavity, on or near the swim platform, and near the rear deck space is so high, that there is an imminent danger of death for anyone in or near the cavity for even a very short period of time. For that reason, all owners and operators of boats equipped with swim platforms and gasoline-powered generators with exhaust ports on the transom are advised to turn off their generators when their boats are at anchor or moored and passengers are on or near the swim platform or swimmers are in the water. Keep passengers, particularly unsupervised children, off the back deck or a swim platform while gasoline engine(s) or a generator are running.

CO can accumulate anywhere in or around your boat, including on back decks, swim platforms, or on the water around generator exhausts. CO can remain in or around your boat at dangerous levels even if your engine or another boat's engine is no longer running! Don't run engine(s) or auxiliary generator(s) on boats with enclosed accommodation spaces unless the boat is equipped with a functioning marine carbon monoxide detector that complies with ABYC A-24 - Carbon Monoxide Detection Systems on Boats.

. . .authorities said one person died and three others are out of the hospital after suffering carbon monoxide poisoning while aboard a boat moored at a marina. . . . when medical officials arrived on the scene, they found all four victims unconscious. A survivor said one of the engines started to lose power, and the victim went below to open the hatch leading to the engineroom. The victim complained of not feeling well and

eventually collapsed. Authorities said they were looking at both engines and the generator as a possible cause of the carbon monoxide leak.

New propulsion engines and generator sets with catalytic converters produce reduced quantities of carbon monoxide; but what about the CO produced on the large numbers of used-boats?

What to Inspect on Your propulsion Engine or Generator Set:

* Inspect and confirm that the engine(s) and generator(s) are properly tuned, and well maintained.
* Inspect each water pump impeller and the water pump housing; consider replacement if worn.
* Inspect and confirm that cooling system(s) are in working condition.
* Inspect and confirm that all hose clamps are in good condition and securely tightened.
* Inspect and confirm that there are no leaks around the cylinder head gaskets, exhaust manifold gaskets, water inject exhaust elbows, pipe nipples between water injected elbows and exhaust manifolds, and exhaust pipes, hoses and fittings.
* Inspect and check the generator temperature sensor (if installed) to ensure that it has not been damaged by exposure to excessive exhaust temperature and that the sensor is still working properly.
* Inspect and confirm proper operation of the generator cooling water anti-siphon valve (if equipped).

What to look for includes:

* Exhaust leaks
* Cracks in hoses, pipes and components
* Black streaking (this can mean loose parts are allowing exhaust to escape)
* Corrosion in hoses, pipes and components
* Corroded pipe nipple on exhaust elbow (move the elbow to check for looseness)
* Change in exhaust sound
* Change in exhaust smell in the engine room or boat interior (CO is odorless, but may be mixed with other exhaust gases)
* Check for pitting, pinholes, and cracks or loose rust at the ends of pipe nipples and thread roots
* Replace any component that is cracked, charred, or deteriorated.

. . . two women suffered carbon monoxide poisoning while swimming among a number of boats that were afloat in a cove at the far northern end of a lake. Boaters often gather there and leave engines and generators running, creating the potential for CO poisoning. The women were pulled from the water by off-duty firefighters. The women were breathing on their own but in an "altered stage of consciousness" because of the CO poisoning.

Large numbers of powerboaters often gather for manufacturer-sponsored regattas or as spectator boats at poker runs and other boat racing activities. Unfortunately, when large numbers of boats gather together they create significantly larger and more concentrated amounts of carbon monoxide. Individuals, particularly children, should avoid swimming near large numbers of boats adrift or at anchor with engines or generators running.

The National Institute for Occupational Safety and Health (NIOSH) conducted a series of studies of CO exposure on houseboats and express cruisers and found high levels of CO gas at or near the swim platform when the boats were either stationary or underway. When a boat is stationary and the engine(s) and/or generator set are running, the CO buildup at the transom of the boat, on the swim platform, and around the rear deck space may be so high that it creates an imminent danger for anyone who remains in these areas for even a short period of time.

The use of hand-held showers at or near the swim platform when gasoline fueled engine(s) and/or a generator set are running is hazardous to your health. As recently as a year ago, a website provided skiboat owners with instructions for installing an aftermarket hand-held hot water shower system at the swim platform.Unfortunately, instead of a hot water heater, the system required the engine to be running to heat the shower water. The Coast Guard informed the author about the lethally high levels of CO that may be found around the swim platform during engine operation, and the website promptly removed the article. The Coast Guard recommends that any owner of a gasoline powered boat who has installed a hand-held shower

connected to the engine's raw water open cooling system, to disconnect the shower immediately.

. . . officials say three people were found dead this afternoon on a cabin cruiser. Officials say they were apparently killed by carbon monoxide poisoning. Around 1:00 pm, authorities responded to reports of unconscious individuals and found two women and one man dead inside the 30-foot cabin cruiser. Carbon monoxide meters showed the level of the deadly gas at 30 parts per million; levels that high always require an evacuation of the area.

Treat symptoms of seasickness as possible CO poisoning, unless you can be sure it's not carbon monoxide.

Other CO Sources

Do not use any flame producing device in an unventilated area. Any heater, stove or lantern that produces an open flame uses oxygen. The argument that these devices do not produce carbon monoxide does not apply when they are used in enclosed spaces. Alcohol heaters and stoves, propane heaters and stoves, catalytic heaters, oil lamps, gasoline lanterns, even charcoal stoves consume oxygen. When the amount of oxygen in the air gets below a certain level, these devices produce carbon monoxide because of incomplete combustion of their fuel. Ventilation must be provided whenever any device producing an open flame is used in a boat cabin.

Carbon Monoxide (CO) Checklist

The Coast Guard recommends that new owners be provided with a printed copy of the following carbon monoxide checklist to show them how to conduct appropriate system checks.

Each Time You Go On a Boat Trip

* Educate all passengers about where exhaust outlets are located on your vessel, the symptoms of CO poisoning, and where CO may accumulate.
* When docked, or rafted with another boat, be aware of exhaust emissions from the other boat.
* Confirm that water flows from the exhaust outlet when the engines and generator are started.
* Listen for any change in exhaust sound, which could indicate an exhaust component failure.
* Test the operation of each CO alarm by pressing the test button.

Once a Month

* Make sure all exhaust system clamps are in place and secure.
* Look for potential sources of leakage from exhaust system components. Signs include rust and/or black streaking, water leaks, or corroded or cracked fittings.
* Inspect rubber exhaust hoses for burned, cracked, or deteriorated sections. All rubber hoses should be pliable and free of kinks.

US Coast Guard Brochure -
Carbon Monoxide Poisoning –
What You Can't See...Can Harm You

A comprehensive and easy-to-understand brochure about the dangers of carbon monoxide, how it accumulates, and ways to prevent carbon monoxide poisoning can be downloaded and printed from the Office of Boating Safety website:

http://www.uscgboating.org/command/co/tools.htm

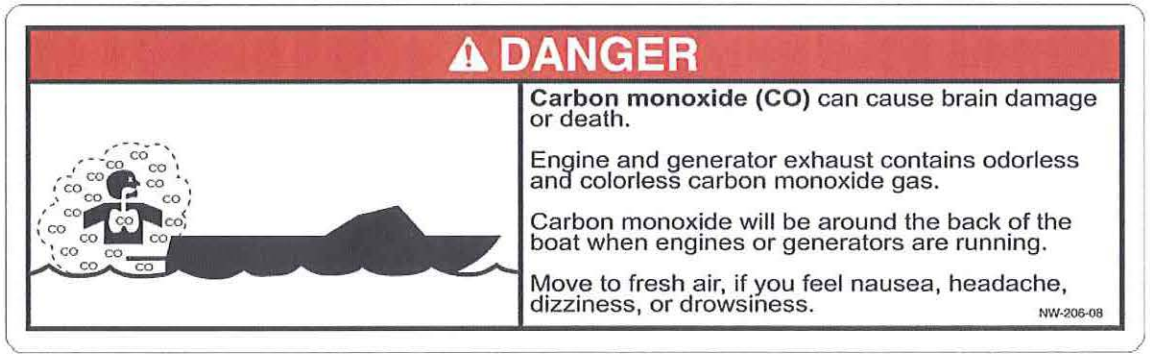
Copies of the brochure are available by calling (202) 372-1067 or from your local Guard Auxiliary Flotilla.

ABYC AND NMMA CARBON MONOXIDE WARNING DECALS

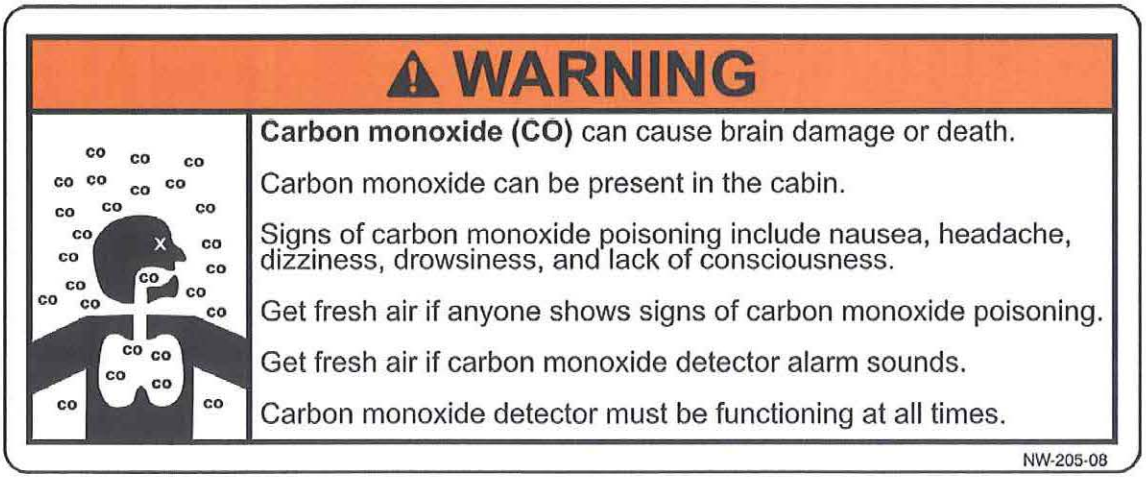
The American Boat & Yacht Council (ABYC) and the National Marine Manufacturers Association developed three standard CO decals for display on recreational boats. Order these CO decals directly from NMMA (see below) or download a printable version at the Office of Boating Safety website: www.uscgboating.org/command/co/tools.htm and print them onto paper with an adhesive backing to create your own CO decals. Since the decals are not displayed on most used boats, the Coast Guard urges all owners to obtain copies of the labels and to place them on their boats as indicated to inform others of the hazards of CO poisoning.

To order CO Decals from NMMA go to http://www.nmma.org/certification/publications/decals.asp or contact the NMMA Order Desk at 1-888-558-2272 or email: orderdesk@nmma.org.

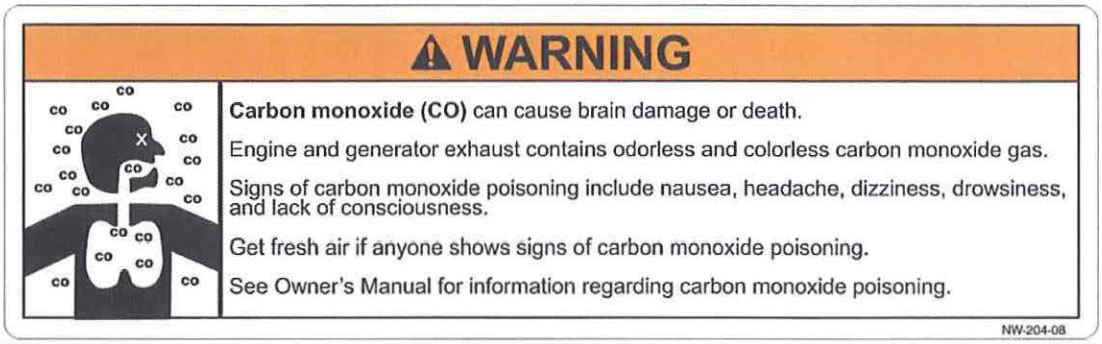
CO TRANSOM LABEL
(NW 206-08) This label is required on all boats sold in the State of California in accordance with AB2222.
[Order from NMMA $75.00/250 plus S&H]



CO CABIN LABEL
(NW 205-08)
[Order from NMMA $62.50/250 plus S&H]



CO HELM LABEL
(NW 204-08) This label is required on all boats sold in the State of California in accordance with AB2222. [Order from NMMA $75.00/250 plus S&H]



KNOW MORE ABOUT IT BROCHURES

The National Marine Manufacturers Association has published a series of "Know More About It" brochures. The brochures are a great addition to owners manuals and information packages for the boat owner. They have been developed by marine professionals and are widely used throughout the industry. Each of the brochures offers important contact information and where to go to get additional information about each of the topics:

Propeller Safety

This brochure explains the dangers of propeller strikes and lists safety checks and measures to ensure propeller safety while boating. $15.00/100 plus S&H.

Carbon Monoxide Poisoning

This brochure outlines the dangers of carbon monoxide gases that are emitted from gasoline engines. It advises how to avoid CO poisoning and identifies measures a boat owner can take to avoid the effects of CO. $15.00/100 plus S&H.

Electrical Shock

This brochure outlines problems associated with dockside power on a boat. It explains proper handling of electrical cable and practices in and around the dock electrical hookup. $15.00/100 plus S&H.

Marine Fuel Systems Safety

This brochure offers information on the inspection and maintenance of gasoline fuel systems onboard boats. Also included are tips on hazard avoidance, a checklist for each time the boat is operated and annual inspection guidelines. $15.00/100 plus S&H.

Water Skiing Safety

This brochure outlines proper water skiing etiquette, proper signals, and safe boat handling while towing water skiers. $15.00/100 plus S&H.

To order any of the brochures, download an order form from http://www.nmma.org/certification/publications/order.asp or contact the NMMA order desk at 1-888-588-2272 or email orderdesk@nmma.org.

NEWS from CPSC

U.S. Consumer Product Safety Commission

Office of Information and Public Affairs Washington, DC 20207

FOR IMMEDIATE RELEASE
November 2, 2007
Release #08-062

CPSC Hotline: (800) 638-2772
CPSC Media Contact: (301) 504-7908

When Changing Clocks Back to Standard Time, Check Batteries and Age of Alarms

CPSC Recommends Replacing Older Alarms

WASHINGTON, D.C.- Since 1992, the U.S. Consumer Product Safety Commission (CPSC) has reminded consumers to check smoke alarms and change batteries when they change their clocks, but in that time, many alarms have lost their effectiveness. This year, CPSC wants to remind consumers to replace smoke alarms every ten years and replace carbon monoxide (CO) alarms every five years.

In a national telephone survey of households conducted by the CPSC, 97 percent of homes had at least one smoke alarm. That's good news, but without fresh batteries, alarms will not work when needed. And the sensors in alarms will degrade and lose effectiveness over time because of environmental contamination and age.

According to National Fire Protection Association (NFPA) reports, there were more than 1.6 million fires reported in the United States in 2005. These fires caused about 3,700 civilian deaths and 18,000 injuries. Additionally, from 2002-2004, CPSC estimated a yearly average of 166 deaths from unintentional, non-fire related CO exposure.

"Millions of Americans are without adequate protection from fire and CO because the alarm's battery is dead or the alarm is too old," said CPSC Acting Chairman Nancy Nord. "Alarms don't last forever, and old ones need to be replaced."

Consumers need to remain vigilant against carbon monoxide poisoning and fires. CPSC recommends three simple tips to protect your life, your loved ones, and your home:

1. Make sure your home is protected with both smoke and CO alarms. Combination smoke/CO alarms are available in the marketplace.
2. Test alarms monthly to make sure they are working.
3. Once a year, change batteries when you change your clocks.

COAST GUARD MANUFACTURER IDENTIFICATION CODE DATABASE

The Coast Guard requests your help in keeping our Manufacturer Identification Code database current. Accordingly, we ask each recreational boat manufacturer to visit www.uscgboating.org/recalls/mic_database annually to confirm your company data.

Coast Guard regulations require that a manufacturer or importer who changes the business name and/or address must advise the Recreational Boating Product Assurance Branch of the change in writing. Print any changes to the database on a copy of your company's letterhead or stationery or enclose a business card and mail it to:

Commandant (CG-54223)
U.S. Coast Guard
2100 Second Street SW
Washington DC 20593-0001

U.S. COAST GUARD INFOLINE/HOTLINE 800-NUMBER — NO LONGER IN SERVICE

The U. S. Coast Guard Infoline (a toll-free phone number formerly referred to as the Boating Safety Hotline) was discontinued October 1, 2006 due to budget shortfalls. At that time, the Coast Guard requested our partner organizations to remove the 800 number from active websites and customer assistance phone services, and to discontinue the use of the number in all printed material.

It has recently come to the Coast Guard's attention that the CG Infoline 800 number (800-368-5647) has been privately reactivated and now leads to a secondary 800 number that is unrelated to boating safety when dialed. All Coast Guard field units have been directed to obliterate this number from all forms and publications where it appears. All replacement stock of these forms and publications will no longer carry the CG Infoline number.

RECALL CAMPAIGNS

ALUMACRAFT BOAT COMPANY
(St. Peter, MN)(060008T)
Year: 2001 – 2003
Models: Fisherman 145, Yukon, Lunker, Navigator and Magnum
Units: 2,129
Problem: Hinge pin on seats produced by Geldert's LLC may come loose causing seat back to separate from seat bottom

AMERICAN HONDA MOTOR CORP.
(Torrance, CA)(070050T)
Year: 2003 - 2007
Models: BF15D & BF20D outboard motors w/ serial nos:
BALJ1000001 - 1402293
BAMJ1000001 - 1403159
Units: 19,454
Problem: Possibility fuel chamber may crack and leak fuel; possible fire/explosion from starting and running engine

BAYLINER MARINE CORP.
MAXUM MARINE DIV.
(Everett, WA)(060050T)
Year: 2005 – 2006
Models: Maxum 1800SR with 4.3L Engine Option
Units: 48
Problem: Possible steering binding condition; possibility of loss of steering control

BAYLINER MARINE CORP.
(Everett, WA)(060045T)
Year: 2005 – 2006
Models: Bayliner 185 Bowrider with 4.3L Engine Option
Units: 1,971
Problem: Possible steering binding condition; possibility of loss of steering control

BAYLINER MARINE CORP.
(Everett, WA)(060088T)
Year: 2007
Models: 195 Discovery
Units: 97
Problem: Improper helm installation results in steering backwards; danger of collision

BENNINGTON MARINE CORP.
(Elkhart, IN)(07R2594S)
Year: 2007
Models: AZ240
Units: 55
Problem: Insufficiently sized openings in natural ventilation system

BENNINGTON MARINE CORP.
(Elkhart, IN)(050077T)
Year: 2004 – 2005
Models: Pontoons w/ serial nos. ending in 404, 405 & 505 with Mercruiser 4.3L, 5.0L, 5.7L, 350 MAG and 6.2L I/O engines
Units: 230
Problem: Failure in Mercruiser power steering pump hose may cause loss of steering control; possibility of collision

BOMBARDIER RECREATIONAL PRODUCTS
JOHNSON MOTORS DIV.
(Sturtevant, WI)(060034T)
Year: 2004 – 2006
Models: Johnson 200 & 255 outboard engines
Units: 746
Problem: Malfunctioning Electronic Control Module can cause hard starting leading to fuel accumulation in the intake port; this condition along with a misfire during starting can result in severe engine backfire which damages the engine's collector assembly (air intake); if the collector assembly breaks, the engine cover could come off unexpectedly

BOMBARDIER RECREATIONAL PRODUCTS
EVINRUDE MOTORS DIV.
(Sturtevant, WI)(060052T)
Year: 2004 – 2007
Models: Evinrude E-TEC 40, 50, 60, 75 and 90
horsepower outboard engines
Units: 24,767
Problem: Fuel system pressurization during assembly may have damaged fuel filter; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS
(Quebec, Canada)(080022T)
Year: 2008
Models: RXP-X 255
Units: 3,170
Problem: Abrasion of fuel vent hose by steering stem arm may cause fuel and/or vapor leakage; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS
(Benton, IL)(060093T)
Year: 2003 - 2007
Models: All Sea-Doo Sportster (2003 - 2006)
All Sea-Doo Speedster 200 (2004 - 2006)
All Islandia (2006)
All Utopia (2006)
2007 Speedster 200
2007 Speedster 150
2007 Islandia
2007 Utopia
Units: 4,702
Problem: On Sportboats equipped with Rotax naturally aspirated 155 horsepower 4-TEC engine internal airbox parts can detach and be drawn into throttle body; throttle plate may jam and prevent return of throttle to idle position; danger of collision

BOMBARDIER RECREATIONAL PRODUCTS
EVINRUDE OUTBOARDS DIV.
(Waukegan, IL)(050039T)
Year: 2001, 2004 & 2005
Models: All 2001 200 – 250 HP DI models
2004 200 – 250 HP DI models
w/ serial nos. 5050319 and later
2005 100 & 115 HP DI models
w/ serial nos. All up to 5111879
2005 135 – 175 HP DI models
w/ serial nos. All up to 5111879
2005 200 – 250 HP DI models
w/ serial nos. All up to 5088447
Units: 5,922
Problem: Under certain operating conditions a fuel injector fastener could loosen and/or break; possible fire/explosion if ignition source present

BOMBARDIER RECREATIONAL PRODUCTS
EVINRUDE MOTORS DIV.
(Sturtevant, WI)(060042S)
Year: 2006
Models: 40 horsepower outboards
Units: 204
Problem: Engine Management Module allows engine to be started in gear

BOMBARDIER RECREATIONAL PRODUCTS
JOHNSON OUTBOARDS DIV.
(Sturtevant, WI))(050042T)
Year: 2004
Models: 200 HP 4 Stroke outboards
Units: 237
Problem: Incorrect flywheel casting composition could cause flywheels to come apart; possibility of injury to boat occupants

CARAVELLE POWERBOATS, INC.
(Americus, GA)(06R1292S)
Year: 2006
Models: 237 LS Bow Rider
Units: 49
Problem: Insufficiently sized openings in natural ventilation system

CARVER BOAT CORP.
(Pulaski, WI)(070042T)
Year: 2000-2003
Models: 396, 410 & 444
Units: 396
Problem: Muffler bonding material may fail; danger of carbon monoxide poisoning

CARVER BOAT CORP.
(Pulaski, WI)(060049S)
Year: 1997 – 2007
Models: Mariner 350 and 360
Units: 914
Problem: Isolation bulkhead forward of engine compartment not completely sealed; possibility non-ignition-protected components could be exposed to fuel vapors

DORAL INTERNATIONAL
(Grand Mere, QC)(050072T)
Year: 2003 – 2005
Models: Elegante 330SE w/ HINs:
CA-QJAD3182D303 –
CA-QJAD5226C505
Boca Grande 360SE w/ HINs:
CA-QJAE3092K203 –
CA-QJAE5189B505
equipped with Volvo 8.1 or Mercruiser 8.1 inboard engines
Units: 34
Problem: Missing "L" shaped support brackets could allow metal and semi-rigid rubber exhaust hoses to disconnect from each other sending raw cooling water and carbon monoxide into engine room

FOUNTAIN POWERBOATS
(Washington, NC)(06R1320S)
Year: 1993 – 2007
Models: 42 Lightning and 42 Executioner
Units: 361
Problem: Fuel lines from saddle tanks lack anti-siphon protection

FINELINE INDUSTRIES
(Merced, CA)(060058T)
Year: 2006 - 2007
Models: Centurion
Units: 293
Problem: Left and right tower Heim bolt on Evolution Towers may pull out causing tower to fall into cockpit; possible injury to operator and/ or passengers

GODFREY MARINE
(Elkhart, IN)(07R2593S)
Year: 2007
Models: SD2400
Units: 43
Problem: Insufficiently sized openings in natural ventilation system

HARRIS KAYOT MARINE, LL
(Fort Wayne, IN)(08R2736S)
Year: 2007 - 2008
Models: V220
Units: 134
Problem: Insufficiently sized openings in natural ventilation system

HUNTER MARINE
(Alachua, FL)(060053T)
Models: H240 w/ HINs:
HUN24462F203 – HUN24516C404
H260 w/ HINs:
HUNF0027A202 – HUNF0140B404
H270 w/ HINs:
HUNK0162F102 – HUNK0173D304
H27 w/ HINs:
HUN27101G405 – HUN27105J405
H306 w/ HINs:
HUN30465F102 – HUN30568C404
H326 w/ HINs:
HUN32255F102 – HUN32362I304
H33 w/ HINs:
HUN33101I304 – HUN33258J405
H356 w/ HINs:
HUN35101F102 – HUN35421F304
H36 w/ HINs:
HUN36101F304 – HUN36231J405
H38 w/ HINs:

HUNTER MARINE
(Alachua, FL)(060053T)
Models: HUN38101C405 – HUN38145J405
H386 w/ HINs:
HUN38718E102 – HUN38836C405
H410 w/ HINs:
HUN41332K102 – HUN41357H203
H41 w/ HINs:
HUN41101J102 – HUN41218J405
P420 w/ HINs:
HUN42189J102 – HUN42230J304
H426/44 aft cockpit w/ HINs:
HUN4A101G203 – HUN4A155J405
H426/44 deck salon w/ HINs:
HUN40101D203 – HUN4D196J405
P450/456 w/ HINs:
HUN45272J102 – HUN45315I405
P460/466/46 w/ HINs:
HUN46270G203 – HUN46337J405
Units: 1,650
Problem: On ball valves manufactured by Marine Hardware (with blue handles), ball valve stem corrodes prematurely making it impossible to close the valve; possible water leakage

INDMAR PRODUCTS COMPANY, INC.
(Millington, TN)(060086T)
Year: 2005 - 2006
Models: GM 8.1L engine
Units: 998
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/ explosion if ignition source present

IMAR GROUP
(Fargo, ND)(06R1393S)
Year: 2006
Models: Gekko Revo 6.7
Units: 24
Problem: Display of capacity information; various electrical, fuel and ventilation system noncompliances

GEM PRODUCTS, INC.
(Orange Park, FL)

The plastic portion of vented fuel fills (99800, 99820, 99840, 99860 series) manufactured by Gem Products, Inc. may crack during fueling; possible fuel discharge into bilges; possible fire/explosion if ignition source present. The letters "PAT. PEND" are visible on the flange of recalled products. The following companies are involved:

CHAPARRAL BOATS, INC.
(Nashville, GA)(060065T)
Year: 2006 - 2007
Models: SSI: 190, 204, 210, 215, 220, 235, 236, 246, 255, 256, 260, 265, 275, 276, 280, 285
SSX: 236, 256, 276
Signature: 240, 270, 276, 280, 290, 310, 330, 350
Sunesta: 214, 216, 232, 234, 236, 252, 254, 274
Units: 2,869

CHRIS CRAFT BOATS
(Sarasota, FL)(060067T)
Year: 2006 - 2007
Models: Speedster; Launch 22, 25 & 28; Corsair 25 & 28
Units: 189

KENNER BOATS
(Knoxville, AR)(060081T)
Year: Boats built between 020306 - 090606
Models: Mako 2201CC, 2201CCT, 1801CC, 1901CCV2, M1901CCT, M1901CC, 2101CCV2, 2101CC;
Tahoe 195O, 196O, 215O & 215OCC;
Kenner V2102, V2102T, 2103, 2103T,1800, 1800T, V1902 & V1902T
Units: 654

NAUTIC STAR BOATS
(Amory, MS)(060075T)
Year: 2007
Models: Nautic Bay 1800, 1900, 2110, 220; Offshore 2000; Sportdeck 205DC, 206 I/O, 210DC, 200SC, 210, 230; Tunnel 2110, 2000 OS DC; Sport 210 I/O, 210DC I/O, 230SL I/O
Units: 202

PARKS MANUFACTURING, INC.
(Seminole, OK)(060063T)
Year: 2007
Models: 2200 Pure Bay & 220 V-BAY LC
Units: 84

ROBALO BOATS LLC
(Nashville, GA)(060066T)
Year: 2006 - 2007
Models: R200, R220, R227, R240, R245, R260, R265, R295, R300, R305
Units: 225

TIDEWATER BOATS
(Irmo, SC)(060080T)
Year: 2006 - 2007
Models: 18, 19 & 21 Bay; 216 CC
Units: 153

KAWASAKI MOTORS CORP.
(Santa Ana, CA)(070053T)
Year: 2007-2008
Models: JT1500
Units: 9,763
Problem: Position of throttle lever housing can change during operation allowing handlebar to prevent full closure of throttle

KAWASAKI MOTORS CORP.
(Santa Ana, CA)(070038T)
Year: 2007
Models: Ultra 250X (JT1500B7F) w/ HINS: KAW30002K607-KAW30734A707, KAW30736A707-KAW30845A707, KAW30847A707-KAW35244D707, KAW35246D707-KAW35314D707, KAW35316D707-KAW35320D707, KAW35322D707-KAW43165E707, Ultra LX (JT1500C7F) w/ HINS: KAW40001K607-KAW41950B707, KAW41952B707-KAW42802D707, KAW42804D707-KAW43037E707, KAW43039E707-KAW43040E707, KAW43044E707-KAW43075E707, KAW43077E707-KAW43142E707, KAW43144E707-KAW43158E707, KAW43160E707-KAW43162E707, KAW43164E707-KAW43165E707
Units: 8,919
Problem: Fuel hose may not be properly connected to fuel injection system fuel rail causing fuel leakage; possible fire/explosion if ignition source present

KEVCON CORP.
(Fort Dodge, IA)(050023S)
Year: 1996 – 2004
Models: Stealth 145C, 1237 Jon & 1437 Jon sold under brand name Misty Harbor
Units: Stealth 145C – 147 boats w/ HINs: KEIS0118C000 – KEIS0575F405
1237 Jon – 124 boats w/HINs: KEIE0124K203 – KEIE0628K203
1437 Jon — 141 boats w/HINs: KEIE0109E697 – KEIE0672G405
Units: 412
Problem: Level Flotation

KODIAK MARINE
(Tualatin, OR)(060085T)
Year: 2005 - 2006
Models: GM 8.1L engine
Units: 57
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/ explosion

LARSON BOATS
(Little Falls, MN)(060111T)
Year: 2007
Models: SEi-180 I/O & Escape 204
Units: 115
Problem: Dash fuse panel supply wire is undersized allowing for greater than three percent minimum voltage drop to critical components; possible tripping of the engine circuit breaker leaving ignition system with no power

MALIBU BOATS, INC.
(Merced, CA)(060087T)
Year: 2007
Models: Wakesetter 21.5 XTi
Wakesetter 21.5 VLX
Wakesetter 23 LSV
Wakesetter 247 LSV
Wakesetter VTX
Anniversary Response
Anniversary Wakesetter
Sunscape 21.5 LSV
Sunscape 23 LSV
Sunscape 247 LSV
vRide
Response LXi
Units: 353
Problem: Possible fuel leak around mounting area of in-tank fuel pump; possible fire/ explosion if ignition source present

MALLARD MARINE
(Portland, OR)(07V163S)
Year: 2006 - 2007
Models: Marsh Rat
Units: 178
Problem: Maximum persons and maximum weight capacities overrated; insufficient flotation

MASTERCRAFT BOAT COMPANY
(Vonore, TN)(080001T)
Year: 2005 - 2007
Models: Maristar 245 & X-45
Units: 410
Problem: Possible hydraulic steering system failure; danger of collision

MERCURY MARINE
(Fond du Lac, WI)(080007T)
Year: 2006
Models: 25/30 HP EFI Four Stroke outboards
Units: 22,167
Problem: Possibility upper motor mount retaining nuts can come loose; loose nuts will not cause loss of motor or loss of control

MERCURY MARINE
(Fond du Lac, WI)(060090T)
Year: 2005 – 2006
Models: GM 8.1L engine
Units: 11,183
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/ explosion if ignition source present

MERCURY MARINE
(Fond du Lac, WI)(050014T)
Models: Bravo X I/II/III Drives w/ serial nos. 0W250000 thru 0W266345
Bravo XR I/III Drives w/ serial nos. 0W240000 thru 0W240652
Units: 2,655
Problem: Shift link bar may become disengaged from shift lever resulting in loss of shift control; possibility of collision

MERCURY MARINE
(Fond du Lac, WI)(060097T)
Year: 2006
Models: 25/30 EFI 4-Stroke outboards w/ serial nos.: 0R125005-0R145228
Units: 2,430
Problem: Throttle may not return to neutral after running at elevated rpms resulting in loss of shift control; possibility of collision

MERIDIAN YACHTS
(Everett, WA)(050024T)
Year: 2005
Models: 341, 368, 381, 408, 411, 459, 490
Units: 53
Problem: Stainless rudder bearings seize on rudder shaft; possibility of collision

MINN KOTA MOTORS
(Racine, WI) (070030T)
Year: 2006
Models: Maxxum 101 (36V)
Units: 1,233
Problem: 48 circuit boards in the 1,233 36-volt Maxxum 101 motors produced between 7/11/06 and 11/9/06 have failed. Of these, 48 resulted in the non-primary propulsion electric trolling motor ceasing to operate. In two isolated instances the circuit board failure resulted in the trolling motor overheating to the point of combustion

PANTHER AIRBOAT CORP.
(Cocoa, FL)(060095T)
Models: Airboats equipped with GM 8.1L engine
Units: 50
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/ explosion if ignition source present

RANGER BOATS
(Flippin, AR)(080014T)
Year: 2006 - 2007
Models: Z19, Z20, Z21, Z21I, Z22, Z520, 198VX, 519VX, 520VX
Units: 1,216
Problem: Possible fuel leakage at fuel selector valve fitting; possible fire/explosion if ignition source present

RANGER BOATS
(Flippin, AR)(060102T)
Year: 2006 - 2007
Models: 175VS, 178VS, 180 RE, 185 VSI, 188 IN, 188VS, 190 RE , 195'V, 1750R, 1760',1850 R, 1860VS, 2000', 618VS, 619VS, 519VX, Z19'0
Units: 273
Problem: Main battery cable routed incorrectly and could interfere with outboard engine flywheel on boats rigged with Bombardier 115, 150, 175 or 200 HP engines; possible short circuit; possible fire/explosion if fuel or vapor source present

REGAL MARINE INDUSTRIES
(Orlando, FL)(06R1557S)
Year: 2007
Models: Regal 2700
Units: 60
Problem: Continuously energized ungrounded terminals on battery switch not protected from accidental short circuiting; all-round navigation light obstructed by bimini top

SEA BOSS BOATS
(Newberry, SC)(050029T)
Year: 2003 – 2004
Models: 180CC w/ HINs:
GHQCW001A303-GHQCW298E404
190CC w/ HINs:
GHQJR001A303-GHQJR210E404
210CC w/ HINs:
GHQTT001L202-GHQTT174E404
210WA w/ HINs:
GHQKL001L203-GHQKL121E404

SEA BOSS BOATS
(Newberry, SC)(050029T)
Year: 2003 – 2004
Models: 235CCF w/ HINs:
GHQJR001G304-GHQJD024C404
235WAF w/ HINs:
GHQLF001G304-GHQLF017C404
19 BAY w/ HINs:
GHQ FC001A304-GHQFC060H304
19 BAY w/ HINs:
GHQFN001G304-GHQFN054E404
21 BAY w/ HINs:
GHQKB001G304-GHQKB085E404
Units: 1,054
Problem: ABS thru-hull fitting manufactured by T-H Marine Supplies reacts with PVC hose causing fitting to fail; possibility of sinking

SEA PRO BOATS
(Newberry, SC)(050067S)
Year: 1999 – 2006
Models: S195FS w/ HINs:
PIOFS101K899 – PIOFS713F506
S195FS w/ HINs:
PIOFS001G506 – PIOFS022J506
Units: 620
Problem: Level Flotation

SEA RAY BOATS
(Knoxville, TN)(060110T)
Year: 2007
Models: 2150 & 270 SLX
Units: 313
Problem: AC & DC Electrical Systems do not have common ground as required by ABYC E-11. If a short occurs in the shore power system, possibility of stray current into the water around the boat

STARCRAFT MARINE
(Topeka, IN)(07R2031S)
Year: 2007
Models: Starstep 200
Units: 34
Problem: Insufficiently sized openings in natural ventilation system

SUNSATION PERFORMANCE BOATS
(Algonac, MI)(06R1738S)
Year: 2007
Models: 32-foot inboard
Units: 102
Problem: Missing manually reset, trip-free circuit breaker or fuse on some ungrounded current carrying conductors

TOHATSU AMERICA CORP.
(Farmers Branch, TX)(080023T)
Year: 2002 - 2007
Models: 70HP & 90HP TLDI
Units: 1,644
Problem: Possible abrasion of high pressure fuel filter may result in fuel leakage; possible fire/explosion if ignition source present

TRACKER MARINE GROUP
(Springfield, MO)(080002S)
Year: 2007 - 2008
Models: Tahoe 215I w/ HINs:
BUJ40307A707 - BUJ41378D707
BUJ41898D708 - BUJ43563I708
Tahoe 216I w/ HINs:
BUJ40308A707 - BUJ41381D707
BUJ41901D708 - BUJ43534I708
Units 726
Problem: Adapter harness failure; possibility of engine start without input from key switch

TRACKER MARINE GROUP
(Springfield, MO)(080002S)
Year: 2007 - 2008
Models: Tundra 18 & Tundra 20
Units 81
Problem: Insufficient flotation

U.S. MARINE
(Everett, WA)(070033T)
Year: 2004 – 2008
Models: 185BR w/HINs:
BBBC19CSJ304 – BBB91CSG708
Units: 2,270
Problem: Seat base pedestal improperly installed

VOLVO PENTA OF THE AMERICAS INC.
(Chesapeake, VA)(070027T)
Year: 2004 – 2007
Models: 12 volt CT600 & CT900 bow thrusters
12 volt SP600 & SP900 stern thrusters
Units: 233
Problem: 12 V CT600/CT900 bow thrusters & 12 V SP600 & SP900 stern thrusters (QL label) overheat during operation due to deviations from installation instructions; one incident resulted in an electrical fire

VOLVO PENTA OF THE AMERICAS, INC.
(Chesapeake, VA)(070045T)
Year: 2005 - 2006
Models: 3.0L, 4.3L & 5.0L gasoline engines
Units: 7,630
Problem: Holley carburetor corrosion may result in fuel leakage; possible fire/explosion if ignition source present

VOLVO PENTA OF THE AMERICAS, INC.
(Chesapeake, VA)(060084T)
Year: 2005 - 2006
Models: GM 8.1L engine
Units: 1,749
Problem: Retainer clip for fuel rail damper not properly heat treated and may fracture; possibility of fuel leakage; possible fire/ explosion if ignition source present

WEBER AUTOMOTIVE
(Markdorf, Germany)(070052S)
Year: 2006 - 2008
Models: Williams Performance Tenders Turbojets sold by Novurania (101) and Sugar Sand Sting (25)
Units: 126
Problem: Fuel system quick connect fitting

does not comply with 33 CFR 183.590

WESTERBEKE CORPORATION
(Taunton, MA)(050026S)
Year: 2003 - 2005
Models: Generators – 5.0 BCG, 5.0 BCGA, 7.0 BCGC, 7.0 BCGD, 8.0 BEG, 10.0 BEG, 12.5 BEG, 15.0 BEG, 20.0 BEG, 20.0 BEGA, 25.0 BEG, & 25.0 BEGA
Units: 2,166
Problem: "On" toggle switch fails ignition protection test; possible fire/explosion if fuel or vapor source present

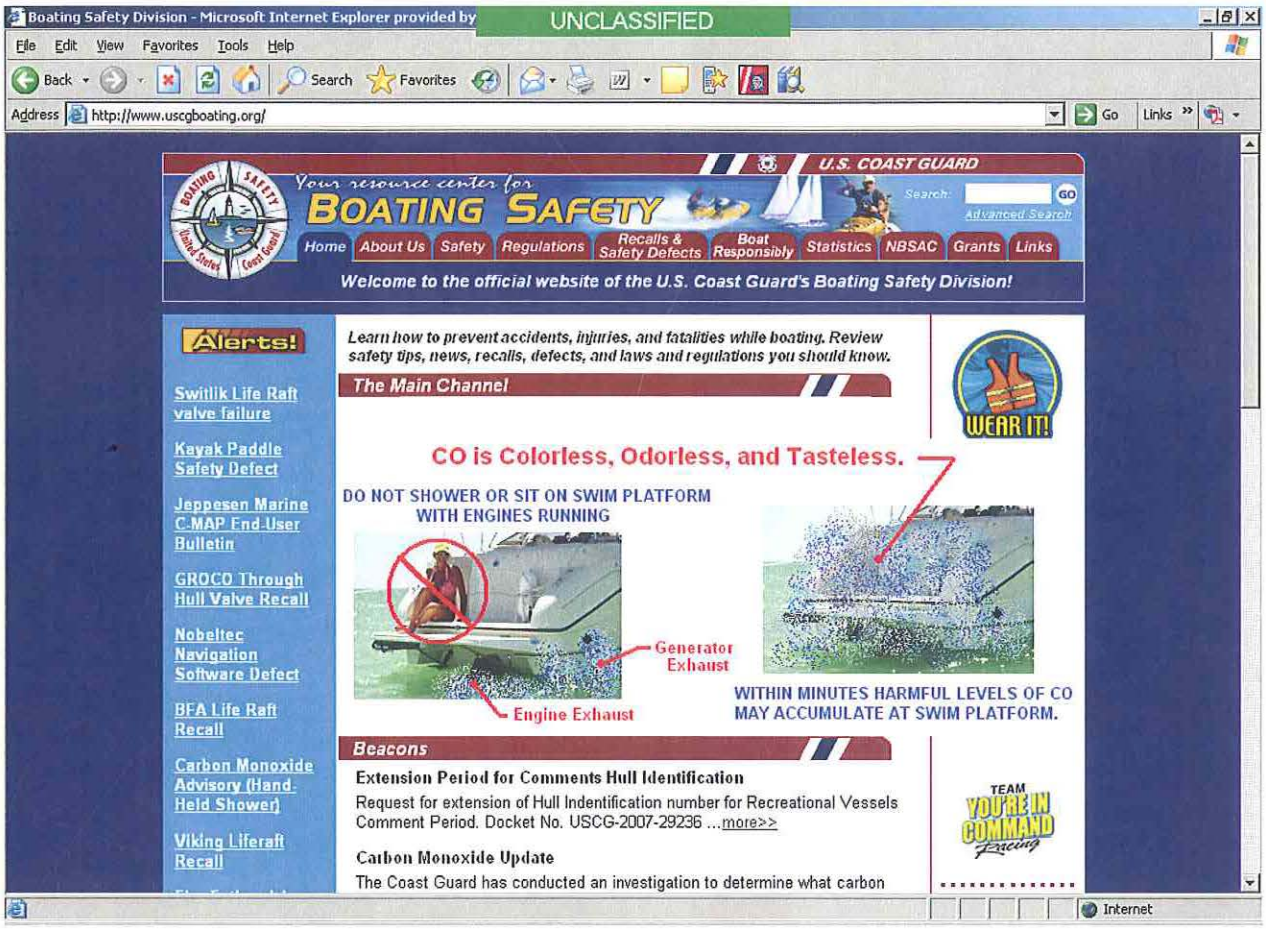
YAMAHA MOTOR CORPORATION
(Cypress, CA)(080019T)
Year: 2007 - 2008
Models: AR210, SR210, & SX210 (FRT1100) AR230 HO, SR230 HO & SX230 HO (SXT1100) Sport Boats
Units: 3,954
Problem: Fuel tank filler hose may not be installed correctly; possible fuel leakage and possible fire/explosion if ignition source present

YAMAHA MOTOR CORPORATION
(Cypress, CA)(080020T)
Year: 2007 - 2008
Models: AR230 HO, SR230 HO & SX230 HO (SXT1100) Sport Boats
Units: 2,716
Problem: One or more bolts may have fallen into air box near throttle body; possible inte3rference with throttle linkage

YAMAHA MOTOR CORPORATION
(Cypress, CA)(080017T)
Models: 2005 - 2008 XV1100 WaveRunner
2003 - 2008 GP1300 WaveRunner
Units: 64,634
Problem: Outer throttle cable could corrode and become cracked or kinked; possibility throttle movement impairment or failure to return to idle position; danger of collision

YAMAHA MOTOR CORPORATION
(Cypress, CA)(070002T)
Year: 2005
Models: 90TLR Outboard motors
Units: 300
Problem: Possibility of oil pump mounting bolts to be loose; throttle link rod might catch on loose bolts causing throttle valve to stick in open position; possible loss of control and danger of collision

BFA MARINE DIV.
ZODIAC INTERNATIONAL
(Issy Les Moulineaux France)(070031T)
Year: 1997 – 2006
Models: Atlantic w/ five digit serial nos. 10001 – 50180 (1997 – 2006)
Pacific w/ five digit serial nos. 10001 – 50180 (1997 – 2006)
Baltic w/ five digit serial nos. 10001 – 50180 (1997 – 2002)
XM Offshore w/ five digit serial nos. 10001 – 50180 (1997 – 2001)
Any 2002 – 2006 leisure life raft w/12-character HIN beginning with XDC
Units: 7,500 worldwide (500 USA)
Problem: Dysfunctional overpressure valve; in the event both overpressurization valves of the two independent compartments happen to fail, the life raft will not function as a lifesaving device, but will sink. See http://www.bfa-marine.com/work/us/



This is the last time the **Boating Safety Circular** will be printed in hard copy and mailed to subscribers. All future issues will be web-based and posted to the Coast Guard Office of Boating Safety website (see above).

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The **Boating Safety Circular** is published by the U.S. Coast Guard Office of Boating Safety. Questions or comments concerning the material found in this circular may be addressed to: Commandant (CG-54223), U.S. Coast Guard, 2100 Second Street SW, Washington, DC 20593-0001.

SWITLIK

PARACHUTE COMPANY

Established 1920

Sub: **SAFETY ALERT** and RECALL
Ref: Service Information Bulletin No. SIB-08144

IF YOU ARE THE OWNER OF A MARINE LIFE RAFT MANUFACTURED BY SWITLIK PARACHUTE COMPANY,

IT MAY HAVE A POTENTIAL PROBLEM WITH THE INFLATION SYSTEM.

THIS IS NOT OBVIOUS AND COULD CAUSE FALSE RELIANCE ON A LIFE RAFT THAT, IF NEEDED, MAY NOT INFLATE AND FUNCTION AS A LIFE SAVING DEVICE.

We have had reports recently from two Life Raft Service Stations of Switlik Life Raft inflation valves failing to operate properly and discharge the gas from the CO_2 cylinder into the life raft. These malfunctions occurred during performance of annual service and standard 5-year operational and inflation testing.

Inspection of these valves indicated clear signs of changes in the consistency of the lubricant and a degradation of the piston O-ring material. This resulted in the O-rings adhering to the pistons and valve bodies, causing the inflation valves to malfunction.

We are implementing a corrective action that mandates replacement of the inflation valve with a valve that does not utilize this O-ring material and lubricant combination. While the instances and percentages of improper inflation system operation are relatively small, this issue directly affects whether or not a life raft will properly inflate in case of an emergency. **We feel that this valve replacement should occur at your earliest practical opportunity.**

To facilitate the inflation valve Service Bulletin in the safest and most expeditious manner for you, we will be replacing, at no charge to you, the existing S-2630 inflation valve/s on your life raft. (You are responsible for complying with any normal recommended service procedures and transportation of the Life Raft to and from the service facility.)

YOUR SAFETY is of the utmost importance to us! Please contact Switlik Parachute Company at (609) 587-3300 or go to our web site, (www.switlik.com), for a listing of our Service Stations to schedule the servicing of your life raft and replacement of the inflation valve. We regret this occurrence and the inconvenience it causes you. Although the probability that your life raft will not work as designed is small, we are addressing this issue by erring on the side of safety.

We thank you for your patience while we work to make your time on the water safer.

SWITLIK PARACHUTE COMPANY
1325 East State Street Trenton, N.J. 08609
Phone: (609)-587-3300 Fax: (609)-586-6647
E-Mail: info@switlik.com Web Site: www.switlik.com

APPENDIX I

GEI EMERGENCY PROCEDURES PLAN

Emergency Event Procedures for

GEI Personnel

(Fulton Former Manufactured

Gas Plant Site)

Emergency Plan Procedures

The following emergency plan was developed to address what actions will be taken in the event of an emergency including natural disasters, infrastructure failure (e.g. gas leaks, transformer explosion, etc), potential or actual terrorist event in New York City. Although infrequent and random, it is important to have a plan of action and response in the event of one of these events. This plan is a supplement to the project specific health and safety plan (HASP) that is prepared and utilized at New York City job sites.

If an emergency event has occurred, GEI personnel will take the following actions. The actions are broken down into a two tiered approach for an event at or near a job site and an event in NYC not immediately near or affecting the job site:

For an Emergency Event at or in close proximity to the Job Site:

- In spite of the pending emergency try to stay calm. While it is easy for panic to set in, you will be safer if you can try to control your emotions and get yourself to safety.
- If present, follow the instructions of emergency personnel.
- Follow the site Health and Safety plan procedures.
- If you are in the immediate vicinity of the emergency or terrorist event, move away from the scene. Be cautious that you avoid becoming part of a crowd. Sometimes panic can set a crowd into frenzy and more injuries may result.
- Do not put yourself in danger. Do not enter or go near a building that has been damaged by an explosion, fire or smoke.
- If you feel you can help someone else without endangering yourself, this is fine. However, it's a bad idea to risk hurting yourself to help others.
- If the jobsite is evacuated go the designated gathering point [See attached Evacuation Plan].
- Evacuation of an area impacted by a terrorist event will likely be on foot, if you are far enough away from the event immediately get into your vehicle and follow the evacuation routes and actions established in the next section.
- If you cannot get to your vehicle locate the closest public transportation such as the subway. See the next section for the nearest subway location.
- If a visible vapor/gas or dust cloud is present stay upwind of the material if possible. Check wind direction by looking at the tops of trees or by movement of plants or shrubs.
- If you cannot move away from the vapor/gas or dust cloud quickly enough, you may consider using your GEI full-face respirator to protect your respiratory system & putting on a Tyvek® suit for skin protection if indicators of a biological, chemical, or radiological agent are present. Evacuate the area as quickly as possible.

- Once evacuation to a safe place has occurred follow the procedures for communications and getting information.
    - Stay tuned to local new stations (television and radio) to evaluate the extent of the emergency. If you are in your vehicle tune into AM 880 or AM 1010 on the radio for news updates and traffic updates. Follow the advice of local emergency officials.
    - Stay tuned to local media for information about road and bridge closures. New York City's 311 or 212-504-4115 can help you monitor evacuation routes. (For the metropolitan New York City area, 511 NY also will provide information about northern New Jersey and southwestern Connecticut.) Information can also be accessed through the internet at NYC DOT (http://nyctmc.org/).
    - Notify your immediate supervisor and project of the emergency and where you are going (see attached Communication Procedures). Once you have evacuated the area notify your immediate supervisor, project manager, office, and family members of your condition and location.
- Make a determination if evacuation from the City is feasible and appropriate.

For An Event in the Greater NYC not impacting the Site and does not have the potential to impact site operations

- Stay tuned to local new stations (television and radio) to evaluate the extent of the emergency. If you are in your vehicle tune into AM 880 or AM 1010 on the radio for news updates and traffic updates. Follow the advice of local emergency officials.
- Stay tuned to local media for information about road and bridge closures. New York City's 311 or 212-504-4115 can help you monitor evacuation routes. (For the metropolitan New York City area, 511 NY also will provide information about northern New Jersey and southwestern Connecticut.) Information can also be accessed through the internet at NYC DOT (http://nyctmc.org/).
- Notify your immediate supervisor and project of the emergency and where you are going (see attached Communication Procedures). Once you have evacuated the area notify your immediate supervisor, project manager, office, and family members of your condition and location.
- Make a determination if evacuation from the City is feasible and appropriate.

Evacuation Procedures and Routes

The following are potential evacuation routes from the Site including main roads for vehicle traffic and use of the public transportation system (i.e. subway/ trains). Keep in mind that these routes may not be accessible and you may have to walk out of the area nearest the emergency. It is a good idea to know where you will go and how you will get there and alternate routes. If the Site is evacuated notify the GEI Project Manager who in turn will notify the Grid Project Manager of this action.

Gathering Point

If GEI employees need to evacuate the Site the primary off-site meeting place is eastern corner of the Thomas Green Park (intersection of Douglass Street and 3rd Avenue. Once all GEI employees are accounted for, decisions of possible of evacuation from the City will be decided by the GEI Project Manager and Site Safety Officer (SSO). If the primary gathering point is compromised by the emergency evacuate to the secondary gathering point in the parking lot of the Holiday Inn Express at 625 Union Street.

If Roadways and Bridges are intact:

Vehicle Evacuation Routes for CT personnel

Three main bridges lead out of the Brooklyn: Whitestone (I-678), Triborough Bridge (a.k.a. Robert F. Kennedy Bridge) (I-278), or the Throgs Neck Bridge (I-295), respectively. If the bridges have been the focus of event, then do not take the bridges. The preferred route from the site is traveling to the I-278 East/Brooklyn Queens Expressway to I-495 East to I-678 North (over the Whitestone Bridge) and follow CT 15 (Hutchinson River Parkway North) or I-95 North to I-91 North to Route 3. The main route map is attached with the alternate routes over the Triborough Bridge and the Throgs Neck Bridge.

An alternate route could include using the Port Jefferson ferry to Bridgeport, CT. You will need to merge onto I-278 East to I-495 East then onto I-495 East/Eastern Long Island/Riverhead to Exit 40E onto NY 25 East. Follow NY 25 East into Port Jefferson then follow the signs to the ferry.

Evacuation through Manhattan is unlikely in a terrorist event, but if the event is not in Manhattan the evacuation routes can include going through the Brooklyn Battery Tunnel on I-278 or across the Brooklyn Bridge.

Vehicle Evacuation Routes for LI personnel

Long Island personnel should return to the Huntington Station office if the jobsite has been evacuated. You will need to merge onto I-278 East to I-495 East then onto I-495 East/Eastern

Long Island/Riverhead to Exit 40E onto NY 25 East. Follow NY 25 East to Walt Whitman Road and the office.

Vehicle Evacuation Routes for Montclair personnel

New Jersey personnel should return to their offices via I-278 West across the Verrazano-Narrows Bridge to exit 9 to merge onto NY-440 North toward Dr. M. L. King Jr Expressway/Bayonne Bridge Take the exit toward I-78/I-95 and merge onto Port Jersey Blvd, take the slight right at Avenue E. Merge onto I-78 W via the ramp to Turnpike North-South/Newark. Take exit 52 for Garden State Parkway South; keep left at the fork and follow signs for Garden State Parkway North. Merge onto Garden State Parkway North then take exit 150 for Hoover Avenue toward Belleville/Bloomfield. Then follow regular route to the office.

If Roadways and Bridges are not intact:

Subway/ Trains

If city evacuation is ordered or the GEI SSO orders an evacuation of the job site, the attached NYC subway map has been included for reference. The subway/ train is only a viable alternative if the subway system is operational and has not been the target of an attack. If the subway/ public transit has been the focus of an attack then the subway system will be avoided.

The closest subway station to the Fulton MGP Site is the Union Street Station located at the intersection of 4th Avenue and Union Street. The entrances to the subway are located on the southeast and southwest sides of 4th Avenue. The route from the site to the Union Street Station is 0.3 miles. You would go southwest on Nevins Street to the second left (364 feet) which is Union Street. Go 0.3 miles to the station entrance. You will pass 3 bus stops along the way which may be a possible transportation option if you can't get to the subway station. The M and R subway lines run out of this station. Both lines run through Manhattan to Queens. The local lines can be taken to either Grand Central Station to Metro North or to Penn Station to the Amtrak trains.

Communication Plan

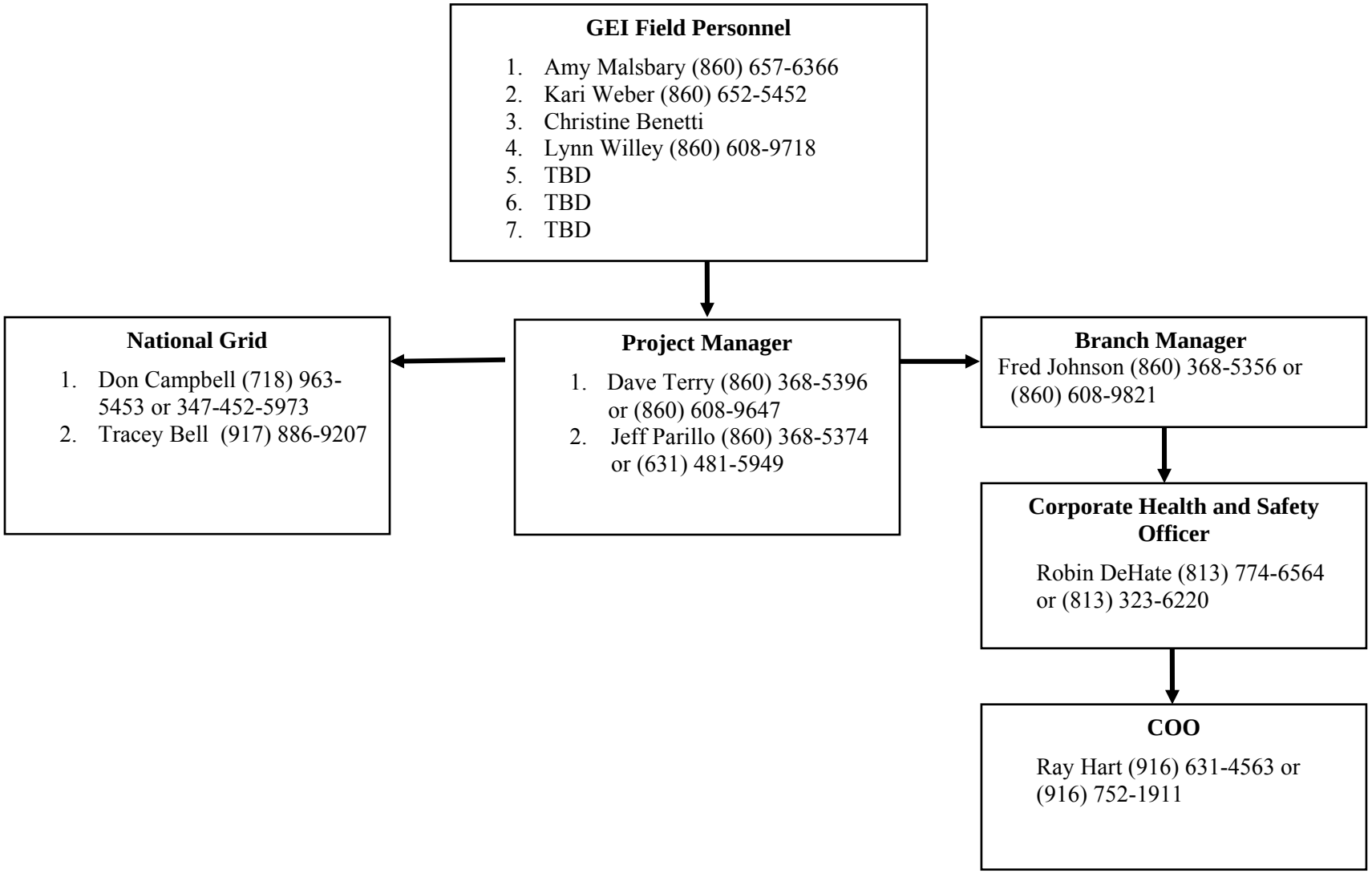
Communication services may be interrupted or you may not have access to others. Consider a few different communication alternatives:

- An email or text message back to the office may be easier than a telephone call.
- Also a long distance phone may be easier to make than a local call.
- Call or email (or text if your phone has this option) from a safe location.
- If the GEI cell phone does not work find a land-line as cellular telephone service may be overwhelmed or not in service.

Panicked family, co-workers, and friends may become more panicked if they can't contact you (or, vice versa should some incident happen where your family lives). It's also a good idea to keep in close touch with your co-workers and supervisor. At a minimum your supervisor and project manager should be contacted by you at the end of each work day if you are out in the field. Let people know where you're going and when you'll be back. This way, if someone does need to find you, they will know where to start looking.

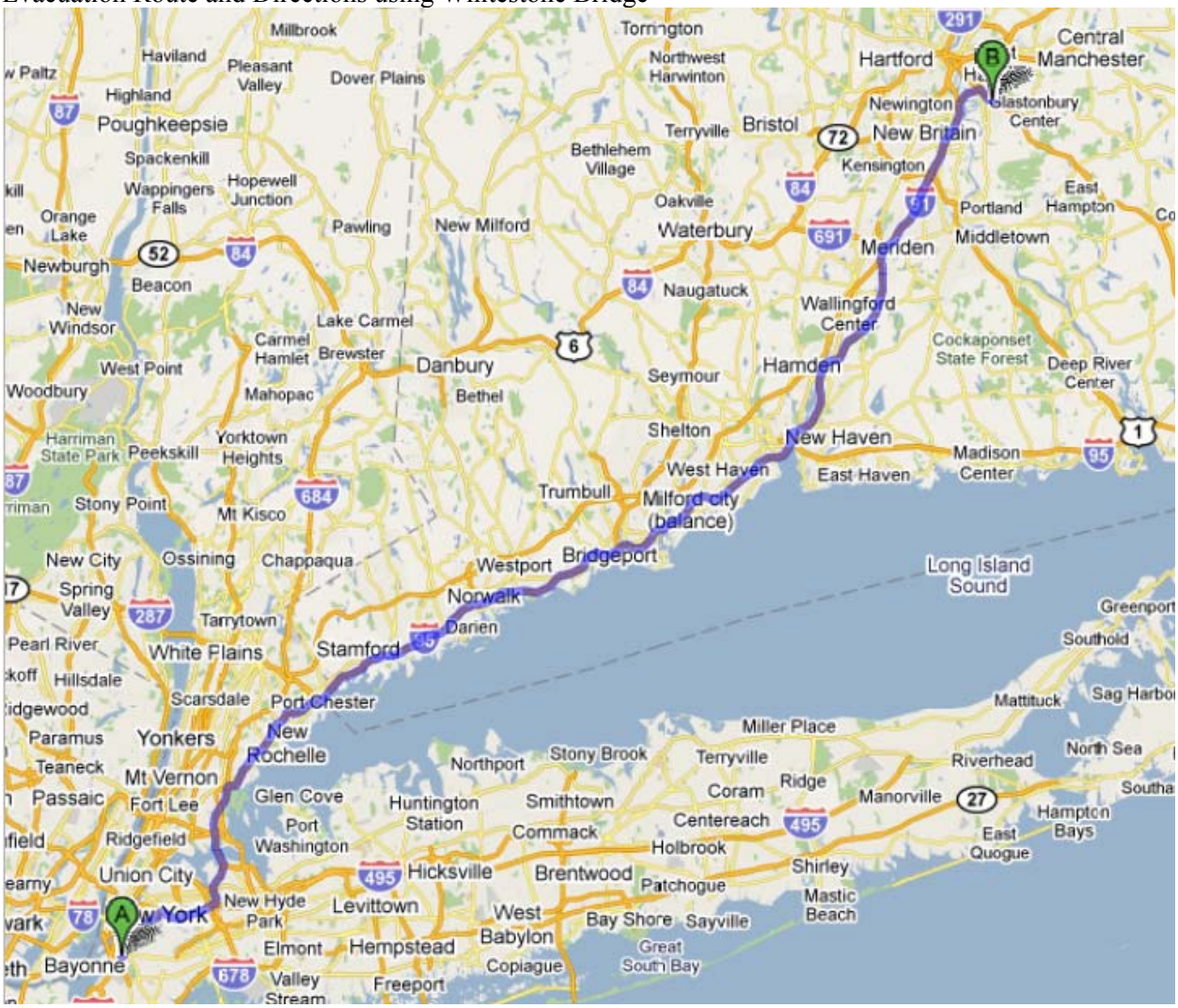
In the event of an emergency GEI personnel will contact via telephone, email, or texting David Terry as the Project Manager or Lynn Willey as the Task Manager. The Project Manager will notify the Branch Manager. The Branch Manager will notify the Corporate Health and Safety Manager who in turn will inform the COO of the emergency and the actions taken by GEI personnel. The Project Manager or the Task Manager will be responsible for notifying the National Grid Project Manager of the situation.

Communication Flowchart - Fulton Former MGP Site



Evacuation Routes for CT Personnel

Evacuation Route and Directions using Whitestone Bridge

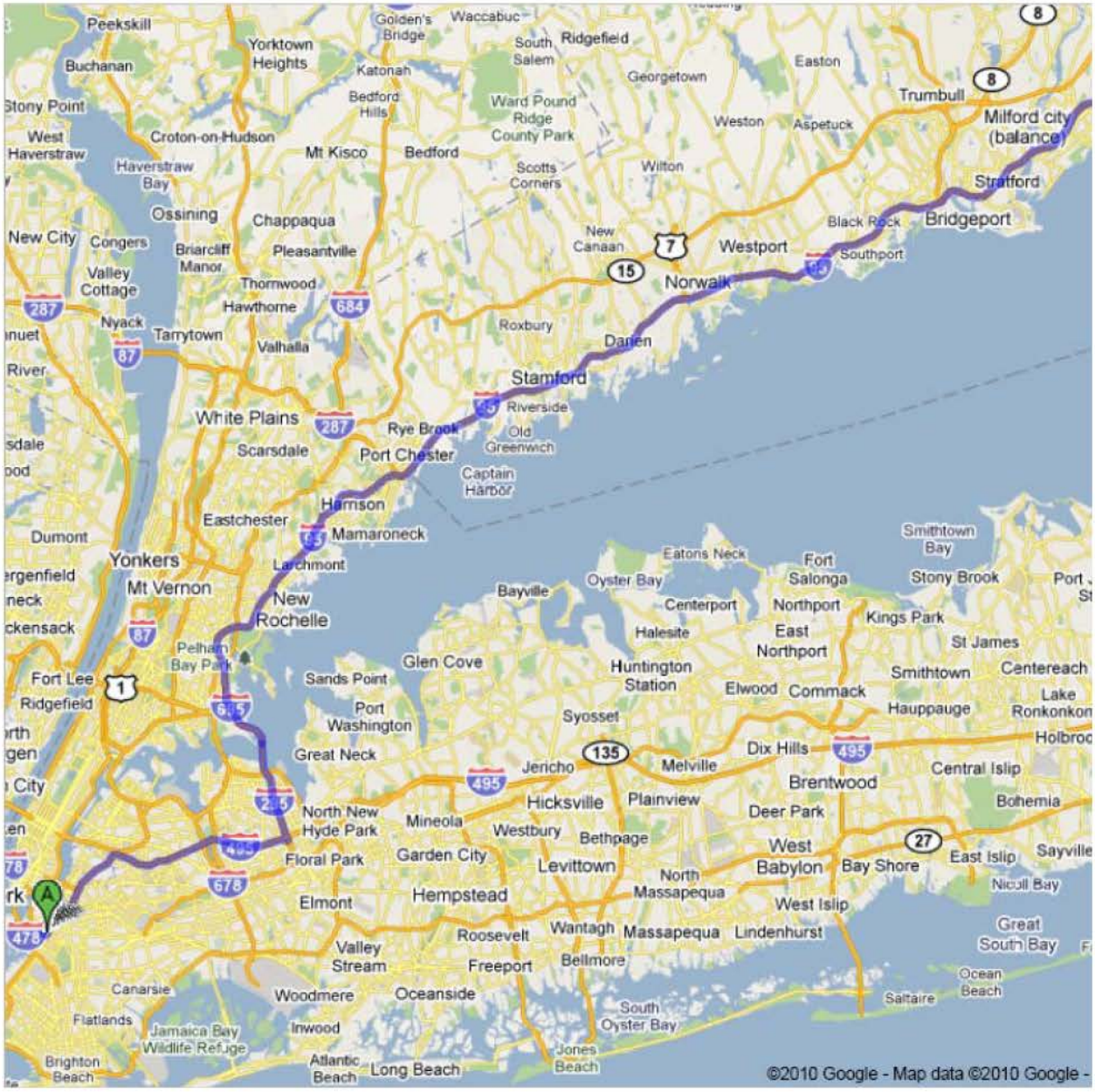


	1. Head **southwest** on **Nevins St** toward **Sackett St**	go 184 ft total 184 ft
↰	2. Take the 1st **left** onto **Sackett St**	go 0.1 mi total 0.2 mi
↰	3. Take the 1st **left** onto **3rd Ave** About 2 mins	go 0.6 mi total 0.7 mi
↱	4. Turn **right** at **Lafayette Ave**	go 141 ft total 0.8 mi
↰	5. Take the 1st **left** onto **Flatbush Ave** About 1 min	go 0.2 mi total 0.9 mi
	6. Continue onto **Flatbush Avenue Ext** About 2 mins	go 0.5 mi total 1.5 mi
↱	7. Turn **right** at **Tillary St**	go 0.1 mi total 1.6 mi
↖	8. Take the **I-278 E/Bklyn-QNS Expy** ramp on the **left** to **Triboro BR**	go 0.1 mi total 1.7 mi
278	9. Merge onto **I-278 E** About 4 mins	go 4.2 mi total 5.9 mi
↗	10. Take exit **35** toward **I-495 E/48 St**	go 0.2 mi total 6.1 mi
	11. Take exit **35E** toward **I-495 E/Eastern Long Is/Riverhead**	go 0.1 mi total 6.2 mi
	12. Merge onto **Q Mid Expressway Lwr Deck En** About 1 min	go 0.5 mi total 6.7 mi
495	13. Merge onto **I-495 E** via the ramp to **Eastern Long Is** About 4 mins	go 3.4 mi total 10.1 mi
↗	14. Take exit **22A-E** toward **Van Wyck Expy**	go 0.6 mi total 10.7 mi
	15. Continue toward **I-678 N/Van Wyck Expy**	go 210 ft total 10.7 mi
678	16. Keep **right** at the fork, follow signs for **I-678 N/Van Wyck Expy/Whitestone Bridge** and merge onto **I-678 N/Van Wyck Expy** Continue to follow I-678 N Partial toll road About 8 mins	go 6.4 mi total 17.1 mi
	17. Continue onto **Hutchinson River Pkwy N** About 6 mins	go 4.4 mi total 21.5 mi
95	18. Take exit **6** to merge onto **I-95 N** toward **New Haven** Partial toll road Entering Connecticut About 1 hour 13 mins	go 59.7 mi total 81.3 mi
91	19. Take exit **48** on the **left** to merge onto **I-91 N** toward **Hartford** About 34 mins	go 33.5 mi total 115 mi
3	20. Take exit **25** to merge onto **CT-3 N** toward **Glastonbury** About 2 mins	go 2.3 mi total 117 mi

	21. Take the exit onto **CT-2 E** toward **Norwich** About 1 min	go 1.0 mi total 118 mi
↗	22. Take exit **8** for **CT-94/Hebron Ave**	go 0.2 mi total 118 mi
94	23. Turn **left** at **CT-94 E/Hebron Ave** About 2 mins	go 0.4 mi total 119 mi
↰	24. Turn **left** at **Oak St**	go 49 ft total 119 mi
	25. Continue onto **Western Blvd** About 2 mins	go 0.2 mi total 119 mi
↰	26. Turn **left** at **Winding Brook Dr** Destination will be on the right	go 397 ft total 119 mi

B 455 Winding Brook Dr, Glastonbury, CT 06033

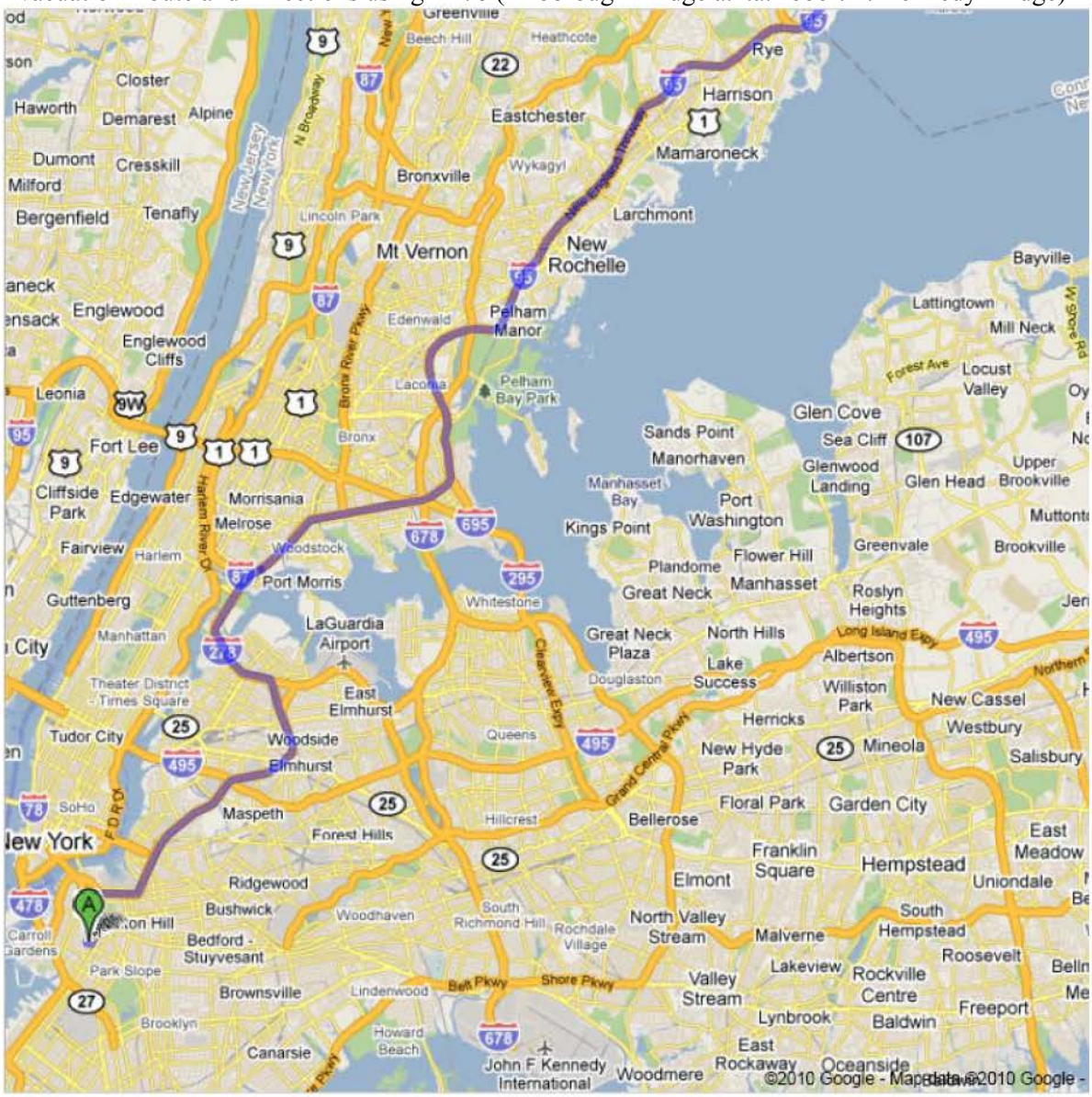
Evacuation Route and Directions using Throgs Neck Bridge



	1. Head **southwest** on **Nevins St** toward **Sackett St**	go 184 ft total 184 ft
↰	2. Take the 1st **left** onto **Sackett St**	go 0.1 mi total 0.2 mi
↰	3. Take the 1st **left** onto **3rd Ave** About 2 mins	go 0.6 mi total 0.7 mi
↱	4. Turn **right** at **Lafayette Ave**	go 141 ft total 0.8 mi
↰	5. Take the 1st **left** onto **Flatbush Ave** About 1 min	go 0.2 mi total 0.9 mi
	6. Continue onto **Flatbush Avenue Ext** About 2 mins	go 0.5 mi total 1.5 mi
↱	7. Turn **right** at **Tillary St**	go 0.1 mi total 1.6 mi
↖	8. Take the **I-278 E/Bklyn-QNS Expy** ramp on the **left** to **Triboro BR**	go 0.1 mi total 1.7 mi
278	9. Merge onto **I-278 E** About 4 mins	go 4.2 mi total 5.9 mi
↗	10. Take exit **35** toward **I-495 E/48 St**	go 0.2 mi total 6.1 mi
	11. Take exit **35E** toward **I-495 E/Eastern Long Is/Riverhead**	go 0.1 mi total 6.2 mi
	12. Merge onto **Q Mid Expressway Lwr Deck En** About 1 min	go 0.5 mi total 6.7 mi
495	13. Merge onto **I-495 E** via the ramp to **Eastern Long Is** About 7 mins	go 7.5 mi total 14.2 mi
295	14. Take exit **27 N** to merge onto **I-295 N/Clearview Expy** toward **Bronx** Continue to follow I-295 N Partial toll road About 8 mins	go 6.5 mi total 20.7 mi
695	15. Slight **right** at **I-695 N** (signs for **I-95 N/New Haven**) About 2 mins	go 1.8 mi total 22.5 mi
95	16. Merge onto **I-95 N** Partial toll road Entering Connecticut About 1 hour 18 mins	go 63.3 mi total 85.8 mi
91	17. Take exit **48** on the **left** to merge onto **I-91 N** toward **Hartford** About 34 mins	go 33.5 mi total 119 mi
3	18. Take exit **25** to merge onto **CT-3 N** toward **Glastonbury** About 2 mins	go 2.3 mi total 122 mi
2	19. Take the exit onto **CT-2 E** toward **Norwich** About 1 min	go 1.0 mi total 123 mi
↗	20. Take exit **8** for **CT-94/Hebron Ave**	go 0.2 mi total 123 mi
94	21. Turn **left** at **CT-94 E/Hebron Ave**	go 0.4 mi
↰	22. Turn **left** at **Oak St**	go 49 ft total 123 mi
	23. Continue onto **Western Blvd** About 2 mins	go 0.2 mi total 124 mi
↰	24. Turn **left** at **Winding Brook Dr** Destination will be on the right	go 397 ft total 124 mi

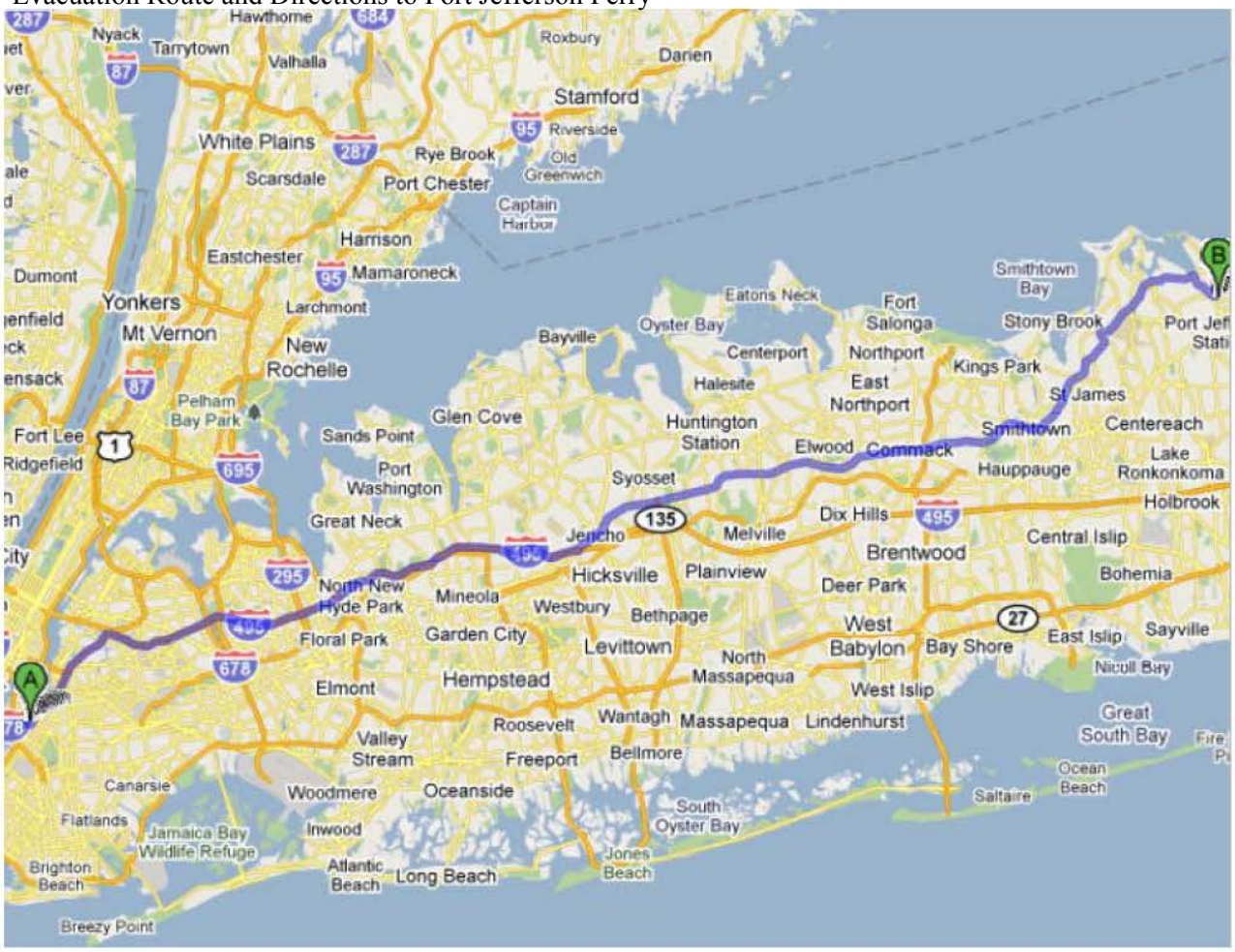
B 455 Winding Brook Dr, Glastonbury, CT 06033

Evacuation Route and Directions using I-278 (Triborough Bridge a.k.a.Robert F. Kennedy Bridge)



	1. Head **southwest** on **Nevins St** toward **Sackett St**	go 184 ft total 184 ft
	2. Take the 1st **left** onto **Sackett St**	go 0.1 mi total 0.2 mi
	3. Take the 1st **left** onto **3rd Ave** About 2 mins	go 0.6 mi total 0.7 mi
	4. Turn **right** at **Lafayette Ave**	go 141 ft total 0.8 mi
	5. Take the 1st **left** onto **Flatbush Ave** About 1 min	go 0.2 mi total 0.9 mi
	6. Continue onto **Flatbush Avenue Ext** About 2 mins	go 0.5 mi total 1.5 mi
	7. Turn **right** at **Tillary St**	go 0.1 mi total 1.6 mi
	8. Take the **I-278 E/Bklyn-QNS Expy** ramp on the **left** to **Triboro BR**	go 0.1 mi total 1.7 mi
278	9. Merge onto **I-278 E** About 10 mins	go 7.7 mi total 9.4 mi
278	10. Take the exit onto **I-278 E** toward **Triboro Bridge** Partial toll road About 13 mins	go 8.1 mi total 17.6 mi
95	11. Merge onto **I-95 N** Partial toll road Entering Connecticut About 1 hour 20 mins	go 64.6 mi total 82.1 mi
91	12. Take exit **48** on the **left** to merge onto **I-91 N** toward **Hartford** About 34 mins	go 33.5 mi total 116 mi
3	13. Take exit **25** to merge onto **CT-3 N** toward **Glastonbury** About 2 mins	go 2.3 mi total 118 mi
2	14. Take the exit onto **CT-2 E** toward **Norwich** About 1 min	go 1.0 mi total 119 mi
	15. Take exit **8** for **CT-94/Hebron Ave**	go 0.2 mi total 119 mi
94	16. Turn **left** at **CT-94 E/Hebron Ave** About 2 mins	go 0.4 mi total 120 mi
	17. Turn **left** at **Oak St**	go 49 ft total 120 mi
	18. Continue onto **Western Blvd** About 2 mins	go 0.2 mi total 120 mi
	19. Turn **left** at **Winding Brook Dr** Destination will be on the right	go 397 ft total 120 mi

Evacuation Route and Directions to Port Jefferson Ferry



	1. Head **southwest** on **Nevins St** toward **Sackett St**	go 184 ft total 184 ft
↰	2. Take the 1st **left** onto **Sackett St**	go 0.1 mi total 0.2 mi
↰	3. Take the 1st **left** onto **3rd Ave** About 2 mins	go 0.6 mi total 0.7 mi
↱	4. Turn **right** at **Lafayette Ave**	go 141 ft total 0.8 mi
↰	5. Take the 1st **left** onto **Flatbush Ave** About 1 min	go 0.2 mi total 0.9 mi
	6. Continue onto **Flatbush Avenue Ext** About 2 mins	go 0.5 mi total 1.5 mi
↱	7. Turn **right** at **Tillary St**	go 0.1 mi total 1.6 mi
↖	8. Take the **I-278 E/Bklyn-QNS Expy** ramp on the **left** to **Triboro BR**	go 0.1 mi total 1.7 mi
278	9. Merge onto **I-278 E** About 4 mins	go 4.2 mi total 5.9 mi
↗	10. Take exit **35** toward **I-495 E/48 St**	go 0.2 mi total 6.1 mi
	11. Take exit **35E** toward **I-495 E/Eastern Long Is/Riverhead**	go 0.1 mi total 6.2 mi
	12. Merge onto **Q Mid Expressway Lwr Deck En** About 1 min	go 0.5 mi total 6.7 mi
495	13. Merge onto **I-495 E** via the ramp to **Eastern Long Is** About 23 mins	go 20.1 mi total 26.8 mi
25	14. Take exit **40E** to merge onto **NY-25 E/Jericho Turnpike** toward **Syosset** Continue to follow NY-25 E About 27 mins	go 21.2 mi total 48.0 mi
↰	15. Turn **left** at **New York 25A E/Nissequogue River Rd/River Rd** Continue to follow New York 25A E About 7 mins	go 5.0 mi total 53.0 mi
↱	16. Turn **right** at **N Country Rd/New York 25A E** Continue to follow New York 25A E Destination will be on the left About 6 mins	go 5.0 mi total 58.0 mi

Bridgeport & Port Jefferson Ferry
102 West Broadway, Port Jefferson, NY 11777 - (631) 473-0286

Evacuation Routes for Long Island Personnel

Evacuation Route and Directions to Long Island office

	1. Head **southwest** on **Nevins St** toward **Sackett St**	go 184 ft total 184 ft
	2. Take the **1st left** onto **Sackett St**	go 0.1 mi total 0.2 mi
	3. Take the **1st left** onto **3rd Ave** About 2 mins	go 0.6 mi total 0.7 mi
	4. Turn **right** at **Lafayette Ave**	go 141 ft total 0.8 mi
	5. Take the **1st left** onto **Flatbush Ave** About 1 min	go 0.2 mi total 0.9 mi
	6. Continue onto **Flatbush Avenue Ext** About 2 mins	go 0.5 mi total 1.5 mi
	7. Turn **right** at **Tillary St**	go 0.1 mi total 1.6 mi
	8. Take the **I-278 E/Bklyn-QNS Expy** ramp on the **left** to **Triboro BR**	go 0.1 mi total 1.7 mi
278	9. Merge onto **I-278 E** About 4 mins	go 4.2 mi total 5.9 mi
	10. Take exit **35** toward **I-495 E/48 St**	go 0.2 mi total 6.1 mi
	11. Take exit **35E** toward **I-495 E/Eastern Long Is/Riverhead**	go 0.1 mi total 6.2 mi
	12. Merge onto **Q Mid Expressway Lwr Deck En** About 1 min	go 0.5 mi total 6.7 mi
495	13. Merge onto **I-495 E** via the ramp to **Eastern Long Is** About 23 mins	go 20.1 mi total 26.8 mi
25	14. Take exit **40E** to merge onto **NY-25 E/Jericho Turnpike** toward **Syosset** About 10 mins	go 8.8 mi total 35.7 mi
	15. Turn **right** at **New York Ave**	go 446 ft total 35.8 mi
	16. Take the **2nd right** onto **Detroit Rd**	go 0.2 mi total 35.9 mi
	17. Turn **right** at **Walt Whitman Rd** Destination will be on the right	go 417 ft total 36.0 mi

Evacuation Routes for Montclair Personnel

Evacuation Route and Directions to Montclair office

	1. Head **southwest** on **Nevins St** toward **Sackett St**	go 446 ft total 446 ft
↰	2. Take the 2nd **left** onto **Union St**	go 0.1 mi total 0.2 mi
↱	3. Take the 1st **right** onto **3rd Ave** About 3 mins	go 0.9 mi total 1.1 mi
	4. Continue onto **Hamilton Ave** About 1 min	go 0.1 mi total 1.3 mi
↖	5. Slight **left** at **3rd Ave** About 6 mins	go 2.1 mi total 3.4 mi
278	6. Take the ramp on the **left** onto **I-278 W** Partial toll road About 10 mins	go 7.8 mi total 11.1 mi
↗	7. Take exit **11** toward **Bradley Ave**	go 0.2 mi total 11.3 mi
	8. Merge onto **N Gannon Ave** About 2 mins	go 0.5 mi total 11.9 mi
↰	9. Turn **left** at **Woolley Ave** About 1 min	go 0.2 mi total 12.0 mi
↱	10. Turn **right** at the 2nd cross street onto **Westwood Ave** About 1 min	go 0.4 mi total 12.4 mi
↱	11. Turn **right** at **Willowbrook Rd**	go 253 ft total 12.4 mi
↰	12. Take the 1st **left** onto **Dreyer Ave** About 1 min	go 0.3 mi total 12.7 mi

13.	**Dreyer Ave** turns **right** and becomes **Canterbury Ave**	go 0.1 mi total 12.8 mi
14.	Turn **left** at **Victory Blvd**	go 85 ft total 12.8 mi
15.	Take the **1st right** onto **Dr Martin Luther King Jr Expy**	go 0.2 mi total 13.0 mi
16.	Continue onto **NY-440 N** Entering New Jersey About 2 mins	go 2.3 mi total 15.3 mi
17.	Continue onto **NJ-440 N** About 4 mins	go 3.9 mi total 19.2 mi
18.	Take the exit toward **I-78/I-95**	go 0.3 mi total 19.5 mi
19.	Merge onto **Port Jersey Blvd** Partial toll road	go 0.3 mi total 19.8 mi
20.	Slight **right** at **Avenue E** Toll road	go 446 ft total 19.9 mi
21.	Merge onto **I-78 W** via the ramp to **Turnpike North-South/Newark** Partial toll road About 9 mins	go 9.0 mi total 28.9 mi
22.	Take exit **52** for **Garden State Pkwy S**	go 0.3 mi total 29.2 mi
23.	Keep **left** at the fork, follow signs for **Garden State Pkwy N** and merge onto **Garden State Pkwy N** Partial toll road About 10 mins	go 8.1 mi total 37.3 mi
24.	Take exit **150** for **Hoover Ave** toward **Belleville/Bloomfield**	go 0.2 mi total 37.5 mi
25.	Turn **left** at **Hoover Ave** About 2 mins	go 0.5 mi total 38.0 mi
26.	Turn **right** at **Bay Ave** About 2 mins	go 0.9 mi total 38.8 mi
27.	Slight **left** at **Claremont Ave** About 1 min	go 0.4 mi total 39.2 mi
28.	Turn **left** at **Greenwood Ave** Destination will be on the left About 1 min	go 0.2 mi total 39.4 mi

APPENDIX J

INCIDENT REPORTING

Supervisor's Report of Accident

Supervisor's Name: _____

Basic Rules for Accident Investigation

- Find the cause to prevent future accidents - Use an unbiased approach during investigation.
- Interview witnesses & injured employees at the scene - conduct a walkthrough of the accident.
- Conduct interviews in private - Interview one witness at a time.
- Get signed statements from all involved.
- Take photos or make a sketch of the accident scene.
- What hazards are present - what unsafe acts contributed to accident?
- Ensure hazardous conditions are corrected immediately.

Date & Time		**Location**	
Tasks performed		**Witnesses**	
Resulted in	**__ Injury __ Fatality** **__ Property Damage**	**Property Damage**	
Injured		**Injured**	
Describe Accident Facts & Events			

Supervisor's Root Cause Analysis	*Check ALL that apply to this accident*		
Unsafe Acts		**Unsafe Conditions**	
Improper work technique		Poor Workstation design	
Safety rule violation		Unsafe Operation Method	
Improper PPE or PPE not used		Improper Maintenance	
Operating without authority		Lack of direct supervision	
Failure to warn or secure		Insufficient Training	
Operating at improper speeds		Lack of experience	
By-passing safety devices		Insufficient knowledge of job	
Protective equipment not in use		Slippery conditions	
Improper loading or placement		Excessive noise	

Improper lifting		Inadequate guarding of hazards	
Servicing machinery in motion		Defective tools/equipment	
Horseplay		Poor housekeeping	
Drug or alcohol use		Insufficient lighting	
Unsafe Acts require a written warning and re-training <u>before</u> the Employee resumes work			
Date		**Date**	
Re-Training Assigned		Unsafe Condition Guarded	
Re-Training Completed		Unsafe Condition Corrected	
Supervisor Signature		**Supervisor Signature**	

Accident Report Review

Supervisor _____ Date _____

Department Superintendent _____ Date _____

Safety Manager _____ Date _____

Plant Manager _____ Date _____

Appendix B

Quality Assurance Project Plan (electronic only)

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Quality Assurance Project Plan

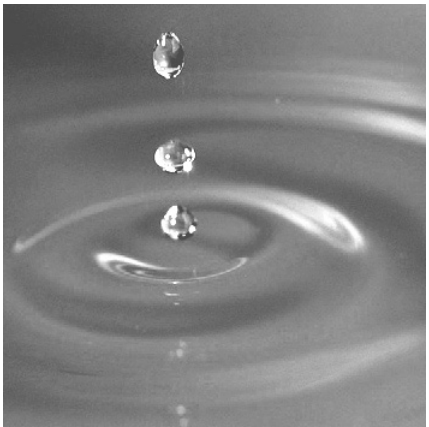
Fulton Municipal Works
Former Manufactured Gas Plant Site

Brooklyn, New York
AOC Index No. A2-0552-0606
Site #: 224051

Submitted to:
National Grid Corporation
1 MetroTech Center
Brooklyn, NY 11201

Submitted by:
GEI Consultants, Inc.
455 Winding Brook Drive
Glastonbury, CT 06033
860-368-5300

March 2012
093020-2-1202



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Appendix

A Laboratory Quality Manual

Abbreviations and Acronyms

ASP	Analytical Service Protocols
CAS	Chemical Abstract Service
CMS	Chip Measurement System
CLP	Contract Laboratory Protocol
COC	Chain Of Custody
CPT	Cone Penetrometer Testing
DQO	Data Quality Objective
DO	Dissolved Oxygen
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc.
KeySpan	KeySpan Corporation
LCS	Labortory Control Sample
LEL	Lower Explosive Limit
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAPL	Non-aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PDI	Pre-Design Investigation
PID	Photoionization Detector
PM	Project Manager
PQL	Practical Quantification Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
%R	Percent Recovery
RCRA	Resource Conservation Recovery Act
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation

SD	Standard Deviation
SOP	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compounds
TOX	Total Organic Halides
TPH	Total Petroleum Hydrocarbons
USDOT	United States Department of Transporation
VOC	Volatile Organic Compound

Quality Assurance Glossary

"Analytical Services Protocol" or "ASP" means the New York State Department of Environmental Conservation (NYSDEC's) compendium of approved United States Environmental Protection Agency (EPA) and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

"Confirmatory Sample" means a sample taken after remedial action is expected to be complete to verify that the cleanup requirements have been met. This term has the same meaning as "post remediation sample."

"Contract laboratory program" or "CLP" means a program of chemical analytical services developed by the EPA to support the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

"Data Usability Summary Report, (DUSR)" is a document that provides a thorough evaluation of the analytical data to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and use.

"Effective solubility" means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate phase mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure phase solubility.

"Environmental Laboratory Accreditation Program" or "ELAP" means a program conducted by the New York State Department of Health (NYSDOH), which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing.

"Intermediate Sample" means a sample taken during the investigation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

"Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

"Non-targeted compound" means a compound detected in a sample using a specific analytical method that is not a targeted compound, a surrogate compound, a system monitoring compound or an internal standard compound.

"Practical quantitation level" or "PQL" means the lowest quantitation level of a given analyte that can be reliably achieved among laboratories within the specified limits of precision and accuracy of a given analytical method during routine laboratory operating conditions.

"PAH" means polycyclic aromatic hydrocarbon as defined by United States Environmental Protection Agency (USEPA) Method 8270.

"Quality assurance" or "QA" means the total integrated program for assuring the reliability of monitoring and measurement data, which includes a system for integrating the quality planning, quality assessment and quality improvement efforts to meet data end-use requirements.

"Quality assurance project plan" or "QAPP" means a document, which presents in specific terms the policies, organization, objectives, functional activities, and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of a specific project or operation.

"Quality control" or "QC" means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

"Semi volatile organic compound" or "SVOC" means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semi volatiles are those target compound list compounds identified in the statement of work in the current version of the EPA Contract Laboratory Program.

"Target analyte list" or "TAL" means the list of inorganic compounds/elements designated for analysis as contained in the version of the EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, and Multi-Concentration in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/ elements.

"Targeted compound," means a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

"Target compound list plus 30" or "TCL+30" means the list of organic compounds designated for analysis (TCL) as contained in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis, and up to 30 non-targeted organic compounds (plus 30) as detected by gas chromatography/mass spectroscopy (GC/MS) analysis. For the purposes of this chapter, a Target Compound List+30 scan means the analysis of a sample for Target Compound List compounds and up to 10 non-targeted volatile organic compounds and up to 20 non-targeted semi volatile organic compounds using GC/MS analytical methods. Non-targeted compound criteria should be pursuant to the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, and Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"Tentatively identified compound" or "TIC" means a non-targeted compound detected in a sample using a GC/MS analytical method, which has been tentatively, identified using a mass spectral library search. An estimated concentration of the TIC is also determined.

"Unknown compound" means a non-targeted compound, which cannot be tentatively identified. Based on the analytical method used, the estimated concentration of the unknown compound may or may not be determined.

"Volatile organics" means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of volatile organics means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 624 or those target compounds identified as volatiles in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"**Waste oil"** means used and/or reprocessed engine lubricating oil and/or any other used oil, including but not limited to: fuel oil, engine oil, gear oil, cutting oil, transmission fluid, oil storage tank residue, animal oil and vegetable oil, which has not subsequently been refined.

1. Purpose

GEI Consultants, Inc. (GEI) has prepared this Quality Assurance Project Plan (QAPP) to address the Pre-Design Investigation (PDI) of the Fulton Former Manufactured Gas Plant (MGP) site located in Brooklyn, New York. The QAPP is a companion document to the *Fulton Municipal Works Former MGP Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan* dated March 2012 (Final PDI Work Plan) and the Field Sampling Plan (FSP) dated March 2012. The project location is shown in Figure 1 of the Final PDI Work Plan. The QAPP presents the project scope and goals, organization, objectives, sample handling procedures and specific Quality Assurance/Quality Control (QA/QC) procedures associated with the Fulton Former MGP.

Furthermore, this QAPP identifies project responsibilities, prescribes guidance and specifications to make certain that:

- Samples are identified and controlled through sample tracking systems and chain-of-custody (COC) protocols
- Field and laboratory analytical results are valid and usable by adherence to established protocols and procedures
- Laboratory data are validated so they can be applied to developing a conceptual understanding of the nature and extent of contamination of soils, soil vapor and groundwaters at the Fulton Former MGP site (geotechnical laboratory data will not be validated)
- All aspects of the investigation, from field to laboratory are documented to provide data that are technically sound and legally defensible

The requirements of this QAPP apply to all contractor activities as appropriate for their respective tasks.

This QAPP was prepared based upon guidance provided by the New York Stated Department of Environmental Conservation (NYSDEC):

- *DER-10, Technical Guidance for Site Investigation and Remediation.* New York State Department of Environmental Conservation. May 2010.

2. Project Goals and Objectives

National Grid is conducting a PDI at the Fulton former MGP site (Site) in Brooklyn, New York. This PDI was prepared to investigate the extent of impacts at the Site from the operation of the Fulton Former MGP that was used to store manufactured and natural gas from 1879 until prior to 1938.

The scope of the PDI is presented in the *Fulton Municipal Works Former MGP Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan* dated March 2012. The PDI includes, but is not limited to the following tasks:

- PDI Activities
- Environmental and Geotechnical Investigation
- Groundwater Model
- Background Noise and Vibration Investigation
- Utility Survey and Subsurface Infrastructure Investigation
- Structural Survey of Adjacent Buildings
- Non-aqueous phase liquid (NAPL) Delineation and Future Recovery

The PDI scope of work described in the Final PDI Work Plan is intended to collect sufficient data to design a remedy for the Fulton Municipal Works MGP site.

3. Project Organization and Responsibility

GEI is responsible for the implementation of the Final PDI Work Plan scope of work, including the supervision of contractors, field activities, and the evaluation and interpretation of data. The Consultant will direct the sampling activities and coordinate submittal of samples to testing laboratories. The project organization and key personnel for GEI are listed below:

Program Manager:	David Terry
Project Manager (PM):	Jeff Parillo
Field Team Leader:	Amy Malsbary
Quality Assurance Officer:	Jaimie Wargo
Corporate Health & Safety Officer:	Robin DeHate
Data Validator:	Lorie MacKinnon and Lisa McDonagh
Data Manager:	Julie Sorensen

The primary responsibilities of each of these personnel are described in the following table.

Key Project Personnel and Responsibilities		
Position	**GEI Personnel**	**Areas of Responsibilities**
Program Manager	David Terry	▪ Overall program oversight ▪ Project management ▪ Project schedule ▪ Client contact regarding project related issues ▪ Personnel and resource management ▪ Review of project submittals ▪ Budgeting
Project Manager	Jeff Parillo	▪ Client contact regarding project-related issues ▪ Coordination of contractors ▪ Technical development and implementation of Work Plan and Field Sampling Plan ▪ Personnel and resource management ▪ Preparation and review of project submittals ▪ Preparation of project submittals ▪ Budgeting
Field Team Leader	Amy Malsbary	▪ Client contact regarding project related issues on day to day basis as part of field operations ▪ Coordination of contractors ▪ Implementation of Work Plan and Field Sampling Plan ▪ Personnel and resource management ▪ Preparation of project submittals
Quality Assurance	Jaimie Wargo	▪ QA/QC for sampling and laboratory

Key Project Personnel and Responsibilities		
Position	**GEI Personnel**	**Areas of Responsibilities**
Officer		performance
Data Validator	Lorie MacKinnon Lisa McDonagh	▪ Perform data validation activities ▪ Prepare data usability summary reports ▪ Evaluate data with regards to quality objectives
Data Managers	Julie Sorensen	▪ Manage raw data from the laboratory

A New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) approved laboratory will be utilized to perform standard analytical chemistry parameters for surface soils, subsurface soil, and groundwater samples including:

- Volatile Organic Compounds (VOCs) according to United States Environmental Protection Agency (EPA) Method 8260B
- Semi volatile Organic Compounds (SVOCs) according to EPA Method 8270C
- Target Analyte List (TAL) Metals according to EPA Method 6000/7000 series
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082
- Pesticides by EPA Method 8081
- Herbicides by EPA Method 8151A
- Total Cyanide by EPA Method 9012 *(Cyanide speciation will be completed if detected above the clean-up objective)
- Disposal Parameters (total metals, Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311, Resource Conservation Recovery Act (RCRA) 8 metals by EPA 6000/7000 series, TCLP pesticides EPA 8081A, TCLP herbicides by 8151A, TCLP VOC by EPA 8260B, TCLP SVOC by EPA 8270C, paint filter test, ignitability by EPA 1030 (soils)/EPA 1010 (water), corrosivity by EPA 9040 (water)/ 9045 (soils), reactivity [cyanide by EPA 7.3.3.2 and sulfide by EPA 7.3.4.2] by, total petroleum hydrocarbons (TPH) by EPA 8015B/418.1, total PCBs by EPA 8082, flashpoint, total organic halides (TOX) by EPA 450.1, and % solids)

Test America's relevant certifications are summarized in the following table:

Test America Certifications		
Location	**Responsible Agency**	**Certification**
New York	NYSDOH	ELAP for potable water/non-potable water, solid and hazardous waste) Contract Laboratory Program (CLP)
	NYSDEC	Analytical Service Protocol (ASP)
United States	EPA	CLP-Lab: 10602 [VOCs/SVOCs/Inorganics]

TerraSense's relevant certifications are summarized in the following table:

TerraSense Certifications		
Location	**Responsible Agency**	**Certification**
United States	United States Army Corps of Engineers	ER 1110-1-261 Validated Laboratories
	American Association of State Highway and Transportation Officials	Materials Reference Laboratory – Quality Systems and Soil
	United States Department of Agriculture	Permitted for Soil Importation

Table 1 provides a summary of surface soil, subsurface soil and soil vapor analyses and **Table 2** provides a summary of groundwater analyses. **Table 3** provides a summary of soil vapor analyses. **Table 4** provides a summary of quality assurance samples, holding times and analysis for each media.

Other contractors will be identified once the work plan is approved.

4. Quality Assurance Objectives

This section establishes the QA objectives for measurements that are critical to the project. The QA objectives are developed for relevant data quality indicators. These indicators include the method detection limit, reporting limit, precision, accuracy, completeness, representativeness, and comparability. The data quality objectives (DQOs) are based on project requirements and ensure: (1) that the data generated during the project are of known quality and (2) that the quality is acceptable to achieve the project's technical objectives provided in the Final PDI Work Plan. All analytical data will be provided by the laboratory using the New York State ASP Category B deliverable format.

Quantitation Limits are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness. The analytical methods to be used at this site will provide a level of data quality and can be used to evaluate potential impacts to soil and groundwater from the former MGP operation, compared to NYSDEC Part 375 soil cleanup objectives and New York State Ambient Groundwater Standards, Criteria and Guidance values, and for purposes of risk assessment.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of the QAPP.

The data quality indicators are presented in subsections 4.1 through 4.6. Procedures to assess the data quality indicators are given below in Section 13.

4.1 Required Quantification Limit

The required quantification limit is the quantitative analytical level for individual analytes needed to make decisions relative to the objectives of the project. Quantitative limits may be expressed as the method detection limit (MDL) or some quantitative level defined in terms relative to the program. It should be noted that there is some ambiguity in the definitions and use of terms that define quantification limits. The MDL presented herein is a well-defined and accepted entity, although attainable only under ideal laboratory conditions.

Method Detection Limit: The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDL is determined from analysis of a sample in a given matrix type containing the analyte.

Practical Quantitation Limit: The PQL [also referred to as the reporting limit (RL)] is the concentration in the sample that corresponds to the lowest concentration standard of the calibration curve.

Laboratory MDLs and PQLs for soils, groundwater, soil vapor and ambient air are located on **Tables 5** through **7**, respectively.

4.2 Accuracy

Accuracy is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., sample liners, drilling shoe, or stainless–steel sampling implements).

The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards," materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds in matrix spikes (MSs), matrix spike duplicates (MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. The laboratory accuracy will be evaluated in accordance with laboratory quality assurance plan and standard operating procedures located in **Appendix A**.

4.3 Precision

Precision is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. In environmental sampling, precision is the result of field sampling and analytical factors. Precision in the laboratory is easier to measure and control than precision in the field. Replicate laboratory analyses of the same sample provide information on

analytical precision; replicate field samples provide data on overall measurement precision. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision.

Precision in the field is assessed through the collection and measurement of field duplicates. Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter, with the exception of the waste characterization parameters. Precision will be measured through the calculation of relative percent differences (RPDs) as described below in subsection 13.2. The resulting information will be used to assess sampling and analytical variability. Field duplicate RPDs must be less than 50% for soil samples and less than 30% for aqueous samples. These criteria apply only if the sample and/or duplicate results are >5x the quantitation limit; if both results are <5x the quantitation limit, the criterion will be doubled. Duplicate samples are described in below in subsection 5.1.5. **Table 4** summarizes the number of duplicates per media sampled.

Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicate pairs and field duplicate pairs. MS/MSD samples or matrix duplicate pairs will be performed at a frequency of one per twenty primary samples per matrix. Duplicate samples are described below in subsection 5.1.5. **Table 4** summarizes the number of duplicates per media sampled.

4.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. “Normal conditions” are defined as the conditions expected if the sampling plan was implemented as planned. The objective for completeness is a sufficient amount of valid data to achieve a predetermined statistical level of confidence. Critical samples must be identified and plans must be formulated to secure requisite valid data for these samples.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project, and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

To ensure that these percentages are met, materials for crucial parameters will be retained if re-sampling is required and strict adherence to holding times will be required.

4.5 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represents either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Final PDI Work Plan and FSP are followed and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample-holding times. These are provided in **Table 4** and within **Appendix A**.

4.6 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Final PDI Work Plan and FSP are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. To facilitate data comparison, the data-reporting format as presented below will be used:

- Conventions (units reported as): for solids (weight/unit weight [i.e., mg/kg]); for liquids (weight/unit volume [i.e., mg/L]); for air (weight/unit volume [i.e., mg/m^3]).
- Use common chemical name with corresponding chemical abstract system (CAS) code.
- Report all data for soils on a dry-weight basis.

5. Sampling Plan

Environmental sampling will include subsurface soil, surface soil, soil vapor, ambient air, groundwater and waste characterization sampling. Subsurface soil borings and monitoring wells will be installed utilizing drilling methods presented in the FSP. Groundwater samples will be collected utilizing low-flow sampling methods, peristaltic pumps, bailers, whale pumps, or bladder pumps. Performing grab or composite sampling by appropriate hand-held sampling equipment will be the preferred method for waste characterization sampling. Analytical samples and analysis methods are described in the Final PDI Work Plan. Sampling methods and procedures are described in the FSP.

5.1 Sample Type, Location, and Frequency

5.1.1 Subsurface Borings Soil Sampling

Thirty-five soil boring locations will be sampled utilizing drilling methods listed in the FSP. Two of the borings will be completed as permanent monitoring wells and three of the borings will be completed using the Cone Penetrometer Testing (CPT) method. The locations are shown in Figure 3 of the Final PDI Work Plan. Twenty-three of the borings will be completed to an elevation of approximately -60 ft NAVD88, while the other 12 will be drilled to an elevation of approximately -40 ft NAVD88 and at least 10 feet below observed NAPL saturated zones. The actual number of subsurface soil samples and their location may be modified based upon subsurface utilities and property access. The number and location of samples will vary based upon access and subsurface obstructions. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in accordance with the Final PDI Work Plan and the FSP. Monitoring wells will be installed in accordance with the Final PDI Work Plan and FSP. A summary of subsurface soil samples and analysis are located in **Table 1**. Analytical samples are not planned for this PDI investigation, only geotechnical samples. Geotechnical samples tested in accordance with the FSP and any applicable ASTM standards. QA/QC samples will not be collected nor will validation be performed on the geotechnical samples.

5.1.2 Test Pit Sampling

Test pits are not proposed for the PDI. However, if test pits are deemed necessary, they will be excavated utilizing a backhoe or other excavation equipment. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in general accordance with

the Final PDI Work Plan and the FSP. A summary of subsurface soil samples and analysis are located in **Table 1**.

5.1.3 Surface Soil Samples

Surface soil samples are not proposed as a part of this PDI. If they are deemed necessary, sample locations will be sampled using hand tools. The samples will be collected from 0 to 2 inches below vegetative cover. The actual number of surface soil samples and their location may be modified based upon field conditions. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in general accordance with the Final PDI Work Plan and the FSP. A summary of surface soil samples and analysis are located in **Table 1**.

5.1.4 Groundwater samples

The four proposed PDI monitoring wells will be gauged once during a site-wide groundwater elevation gauging event where the existing monitoring well network will also be gauged. These four proposed will not be sampled during the PDI. Temporary groundwater monitoring points are not proposed as a part of this PDI, but if groundwater samples are collected from temporary groundwater monitoring points, the points will be screened across the water table or targeted intervals at the proposed sample locations. If groundwater samples from any of the monitoring wells are required, they will be collected and submitted for laboratory analysis in accordance with the FSP and the Final PDI Work Plan. Water quality parameters including temperature, pH, turbidity, salinity, dissolved oxygen (DO), and specific conductance, will be collected prior to laboratory analysis in general accordance with the Final PDI Work Plan and the FSP. A summary of groundwater samples and analysis are located in **Table 2.**

5.1.5 Soil Vapor Samples

Soil vapor samples are not proposed for the PDI. However, if samples are deemed necessary, they will be installed and samples will be collected in general accordance with the *New York State Department of Health's "Guidance for Evaluating Soil Vapor Intrusion in the State of New York"* and KeySpan Corporation's (KeySpan) *"Draft Standard Operating Procedure - Soil Vapor Intrusion for MGP Sites in New York.* Within buildings, sub-slab soil vapor points will be installed to evaluate the soil vapor conditions. For exterior soil vapor locations, the soil vapor samples will be collected from temporary soil vapor probes, which will be installed, to a depth of approximately 5 feet below grade. Soil vapor samples will be collected in certified clean SUMMA® canisters and submitted for laboratory analysis in general accordance with the FSP and the Final PDI Work Plan. A summary of soil vapor samples and analysis are located in **Table 3**.

5.1.6 Ambient Air Samples

Indoor air or ambient air samples are not proposed as a part of the PDI. If indoor or ambient air samples are determined to be necessary, the proposed ambient air samples will be collected from the approximate breathing height (approximately 3 to 5 feet aboveground). The indoor air and outdoor air samples will be collected utilizing an individually certified 6-Liter SUMMA® canister with a laboratory-supplied flow controller that is calibrated to an 8-hour period. The regulator flow rate will not exceed 0.2 liters per minute. Each SUMMA® canister will be shipped to an approved NYSDOH ELAP-registered laboratory for analysis. The samples will be analyzed for VOCs and naphthalene by the modified EPA Method TO-15. QA/QC samples will include one blind duplicate ambient air sample (indoor or outdoor air sample) and will be collected during each sampling event. The ambient air sampling will target the winter heating season between November 15 and March 30 in accordance with NYSDOH Soil Vapor Guidance.

Property information will also be collected in general accordance with the NYSDOH Center of Environmental Health's Indoor Air Quality Questionnaire and Building Form that is provided as Appendix B of the NYSDOH soil vapor guidance and KeySpan's *Draft Standard Operating Procedures for Soil Vapor Intrusion for MGP Sites in New York* which is located in the FSP.

5.1.7 Investigation-Derived Waste Sample Collection

Waste classification sampling will be conducted for soils and liquid wastes. The purpose of characterizing a waste is for its proper off-site disposal. Composite samples will be collected from the on-site waste storage vessels (drums or roll-off) for parameters required by the approved disposal facility. Soil samples will be collected utilizing stainless steel sampling tools, shovel, or auger that had been decontaminated. Liquid samples will be collected utilizing disposable bailer, peristaltic pump, a pump with tubing, or other similar methods. These samples will be handled in general accordance with sample handling procedures presented in the FSP. Investigation-derived waste samples will be analyzed for parameters listed in Section 3 or other analyses that are required by the National Grid-approved facility.

5.1.8 Field QC Sample Collection

Field QC samples are used to monitor the reproducibility and representativeness of field sampling activities. The field QC samples are handled transported and analyzed in the same manner as the associated field samples. Field QC samples will include equipment blanks, trip blanks, field duplicates and MS/MSDs. The quantity, field QC sample type and analysis is detailed in **Table 4**.

Equipment Blank Samples are used to monitor the adequacy of decontamination procedures and possible sources of contamination such as potential laboratory methodologies. Equipment blanks will consist of laboratory-supplied, distilled or de-ionized water and will be used to check for potential contamination of the equipment, which may cause sample contamination. Equipment blanks will be collected by routing the distilled water through decontaminated piece of sampling equipment or disposable sampling equipment into laboratory supplied bottles. Non-dedicated field equipment will be decontaminated as specified below in subsection 5.3. Equipment blanks will be submitted to the laboratory at a frequency of one per 20 samples per matrix per type of equipment being used per parameter. Equipment blanks will not be completed for waste characterization sampling activities.

Trip Blank Samples will consist of analyte-free water and will be prepared by the laboratory. (Trip blanks are used to assess the potential for VOC contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the project location unopened, stored with the site characterization samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler, which contains samples submitted for VOC analysis.

Field Duplicate Samples, also referred as blind duplicate samples, are two samples that are submitted from the same interval using the same sample procedures. Field duplicates will be used to assess the sampling and analytical reproducibility. Both samples are collected utilizing the same methods and are submitted for the same laboratory analysis; however, different sample identification numbers are used. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters. Field duplicates will not be completed for waste characterization sampling activities.

MS/MSD Samples are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for organic and inorganic parameters. MS/MSDs will not be completed for waste characterization sampling activities.

Refer to **Table 4** for a summary of QC sample preservation and container requirements.

5.2 Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest United States EPA's Specifications and Guidance for Contaminant-Free Sample Containers. Certificates of analysis are provided with each bottle lot and

maintained on file to document conformance to EPA specifications. The containers will be pre-preserved, where appropriate (**Table 3**).

5.3 Equipment Decontamination

All non-dedicated sampling equipment shall be cleaned between each use in the following manner:

- Wash/scrub with a biodegradable degreaser ("Simple Green") if there is oily residue on equipment surface
- Tap water rinse
- Wash and scrub with Alconox (or non-phosphate soap) and water mixture
- Tap water rinse
- All equipment used to collect samples for VOCs and SVOC analysis will then receive a methanol rinse followed by a de-ionized water rinse.
- All equipment used to collect samples for metals analysis will then receive a 10% nitric acid solution rinse followed by a de-ionized water rinse.
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

The drilling and excavation equipment will be decontaminated in general accordance with methods described in the FSP.

Groundwater sampling pumps will be cleaned by washing and scrubbing with an Alconox/water solution, rinsing with tap water and irrigating with de-ionized water.

Decontamination fluids will be containerized into United States Department of Transportation (USDOT)/UN-approved 55-gallon drums or containment vessels and will be characterized and disposed of by National Grid at an approved disposal facility.

6. Documentation and COC

6.1 Sample Collection Documentation

6.1.1 Field Notes

Field notes documenting field activities will be maintained in a field notebook in general accordance with subsection 2.2 of the FSP. Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. Each page of the logbook will be signed in permanent ink and dated. No erasures or obliterations of field notes will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field logbooks will be reviewed at regular intervals by the field team leader, site manager and PM for completeness and representativeness. Logbooks will be supported by daily activity reports as described in subsection 2.3 of the FSP.

6.1.2 COC Records

Sample custody is discussed in detail below in subsection 6.2. COC records are initiated by the samplers in the field. The field portion of the custody documentation should include:

- The project name
- Signature(s) of sampler (s) responsible for sample custody
- Sample ID number
- Date and time of collection
- Whether the sample is grab or composite
- Names of individuals involved in sampling
- Air bill or other shipping number (if applicable)

On a regular basis (daily or on such a basis that all holding times will be met), samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service. Sample packaging and shipping procedures, and field COC procedures are described below in subsection 6.2.1 of this Plan. Sample receipt and log-in procedures at the laboratory are described below in subsection 6.2.2 of this Plan.

6.1.3 Sample Labeling

Each sample will be labeled with a pre-printed adhesive label using indelible ink. The label should include the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identification. The following identification scheme will be used:

PRIMARY SAMPLES TYPES	QA/QC SAMPLE TYPES
SOIL SAMPLES	**FIELD BLANKS**
Surface Soil-ID (SAMPLE DEPTH-FEET)	SAMPLE-ID – [DATE]
FW-SS-XX (0-0.2)	FW-SS-FB-033107
Boring -ID (SAMPLE DEPTH-FEET)	FW-SB-FB-033107
FW-SB-101 (X-X)	FW-MW-FB-033107
GROUNDWATER SAMPLES	FW-GW-FB-033107
Monitoring Well-ID	**MATRIX SPIKE/DUP**
FW-MW-24	SAMPLE [ID] [DEPTH] [EITHER MS OR MSD]
Temporary Groundwater Monitoring Point-ID	FW-SS-01 (10-15) MS/MSD
(SAMPLE DEPTH-FEET)	FW-SB-01 (10-15) MS/MSD
FW-GW-XX (X-X)	FW-MW-01 (10-15) MS/MSD
SOIL VAPOR SAMPLES	FW-GW-01 (10-15) MS/MSD
Soil Vapor Point-ID	**TRIP BLANKS**
FW-SV-XX	SAMPLE- ID [DATE]
AMBIENT AIR SAMPLES	FW-TB-063007
Indoor Air	**BLIND DUPLICATES**
FW-IA-XX	SAMPLE -ID[XX][DATE]
Outdoor Air	FW-SS-XX-063007
FW-OA-XX	FW-SB-XX-063007
	FW-MW-XX-063007
	FW-GW-XX-063007

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the Data Manager and/or the GEI Project QA Officer.

6.1.4 Sample Handling

Samples will be handled in general accordance with Section 8 of the FSP.

6.2 Sample Custody

The COC provides a record of the custody of any environmental field sample from the time of collection to the delivery to the laboratory. Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and

authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample is considered to be under a person's custody if:

- The item is in the actual possession of a person
- The item is in the view of the person after being in actual possession of the person
- The item was in the actual physical possession of the person but is locked up to prevent tampering
- The item is in a designated and identified secure area

6.2.1 Field Custody Procedures

Samples will be collected following the sampling procedures indicated in the Final PDI Work Plan and the FSP. A summary of samples and collection methods are provided above in Section 5 of this QAPP. Documentation of sample collection is described above in subsection 6.1. Sample COC and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the COC intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented above in subsection 6.1.3.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions.
- Samples will be accompanied by a completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, and to the laboratory facility.
- All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.
- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the cooler and covered with clear plastic tape after being signed by field personnel.

- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.
- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on COC document as receiving the samples and signature of sampler as relinquishing samples.

6.2.2 Laboratory Custody Procedures

After accepting custody of the shipping containers, the laboratory will document the receipt of the shipping containers by signing the COC record. The laboratory will:

- Examine the shipping containers to verify that the custody tape is intact
- Examine all sample containers for damage
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the COC records
- Compare samples received against those listed on the COC
- Verify that sample holding times have not been exceeded
- Examine all shipping records for accuracy and completeness
- Determine sample pH (if applicable) and record on COC forms
- Sign and date the COC immediately (if shipment is accepted) and attach the air bill
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the laboratory PM, who will be responsible for contacting the GEI data manager
- Attach laboratory sample container labels with unique laboratory identification and test
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.
- The completed COC, air bills, and any additional documentation will be placed in the final evidence file.

7. Calibration Procedure

7.1 Field Instruments

Field instruments will be calibrated according to the manufacturer's specifications. Air monitoring instruments will be calibrated to a known reference gas standard and ambient air outside the work zone. Calibration will be completed daily. If concentrations of VOCs are encountered above the reference gas standard, the soil screening photoionization detector (PIDs) may be calibrated or re-checked against the reference gas standard. Water quality meters will be calibrated with known reference solutions. All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, and the readings. The following equipment has been identified for use to implement the Final PDI Work Plan.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), lower explosive limit (LEL), percent oxygen, hydrogen sulfide and hydrogen cyanide
- RAE Systems MiniRAE 2000 (PID) with 10.6 eV lamp
- Drager Chip Measurement System (CMS) and compound-specific chips (including benzene, hydrogen sulfide, hydrogen cyanide, etc.)
- MIE pDR 1200 with cyclone and pump [particulate monitor]
- MSA LC Pump or SKC 224-PCXR4 [air pump for dust monitoring]
- BIOS Dry Cal DC Lite Primary Flow Meter Model ML [air pump calibration]

Groundwater Sampling Activities

8. Sample Preparation and Analytical Procedures

Analytical samples will be collected in general accordance with the FSP and as specified in the Final PDI Work Plan. **Tables 1** through **3** provide a sample collection matrix that is separated by media. Analytical samples will be collected into laboratory-preserved sample containers and will be preserved as indicated in **Table 4**.

9. Data Reduction, Validation, and Reporting

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation to support the generation of a Data Usability Summary Report (DUSR) according to NYSDEC requirements will be provided by the analytical laboratory. Geotechnical laboratory sample data will not be validated.

9.1 Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Reviews of the field records by the field team leader, site manager, and PM will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the FSP and the Final PDI Work Plan, and that any deviations were documented and approved by the appropriate personnel.

9.2 Analytical Data Validation

GEI will be responsible for performing an independent validation of the analytical data. Project-specific procedures will be used to validate analytical laboratory data. The basis for the validation will be the USEPA CLP National Functional Guidelines for Organic Data Review (February 2005) and the USEPA CLP National Functional Guidelines for Inorganic Data Review (October 2004), modified to accommodate the criteria in the analytical methods used in this program, and Region II Standard Operating Procedures (SOPs) for CLP Organic Data review (Revision 11, June 1996) and Evaluation of Metals for the CLP Program (Revision 11, February 1992). Critical functions for determining the validity of generated data are: (1) strict adherence to the analytical methods, (2) assurance that the instrumentation employed was operated in accordance with defined operating procedures, (3) assurance that

quality parameters built into the analytical procedures have been adhered to, and (4) confirmation that the DQOs have been met.

Table 3 highlights the QC criteria and holding time requirements for all analyses conducted under this program. These criteria will be used to evaluate and qualify the data during validation.

GEI or qualified contracted personnel will validate all analytical samples collected as part of the Pinelawn/Farmingdale Hortonsphere Site Characterization. Samples collected for waste classification will not be validated. Validation will include all technical holding times, as well as QC sample results (blanks, surrogate spikes, laboratory duplicates, MS/MSDs, and LCSs), tunes, internal standards, calibrations, target compound identification, and results calculations.

For all analyses, the laboratory will report results, which are below the laboratory's reporting limit; these results will be qualified as estimated (J) by the laboratory. The laboratory may be required to report tentatively identified compounds (TICs) for the VOC and SVOC analyses; this will be requested by GEI on an as-needed basis

The overall completeness of the data package will also be evaluated by the data validator. Completeness checks will be administered on all data to determine whether full data deliverables were provided. The reviewer will determine whether all required items are present and request copies of missing deliverables.

Upon completion of the validation, a report will be prepared. This report will summarize the samples reviewed, elements reviewed, any nonconformance with the established criteria, and validation actions. Data qualifiers will be consistent with EPA National Functional Guidelines. This report will be in a format consistent with NYSDEC's DUSR.

9.3 Analytical Data Validation

Laboratory deliverables will consist of an original hard copy data package that is in general accordance with NYSDEC ASP Category B data deliverable requirements.

10. Internal Quality Control

10.1 Analytical Samples

Laboratory and field quality internal control checks will be used to ensure the data quality objectives. At a minimum, this will include:

- MS and/or MSD samples
- Matrix duplicate analyses
- Laboratory control spike samples
- Instrument calibrations
- Instrument tunes for VOC 8260B and SVOC 8270C analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for VOC 8260B and SVOC 8270C analyses
- Detection limit determination and confirmation by analysis of low-level calibration standard

The laboratory quality plan for the selected ELAP is located in **Appendix A**.

Field quality control samples will include:

- Equipment blanks as outlined in **Table 4**
- Field duplicate samples as outlined in **Table 4**
- Trip blanks as outlined in **Table 4**
- MS/MSDs as outlined in **Table 4**

10.2 Geotechnical Samples

Laboratory and field quality control checks will not be performed on geotechnical samples and the data will not be validated.

11. Performance and System Audits

Audits are an independent means of: 1) evaluating the operation or capability of a measurement system, and 2) documenting the use of QC procedures designed to generate data of know and acceptable quality.

Field audits may be completed to assess sample collection protocols, determine the integrity of COC procedures, and evaluate sample documentation and data handling procedures. Field audits may be scheduled by the QA officer, PM, site manager or in-house consultant, at their discretion. Written records of audits and any recommendations for corrective action will be submitted to the PM.

The QA officer is the interface between management and project activities in matters of project quality. The QA officer will review the implementation of the QAPP. Reviews will be conducted at the completion of field activities and will include the results of any audits and an evaluation of the data quality.

12. Preventative Maintenance

Preventative maintenance will be performed on field equipment in accordance with the manufacturer's recommendations. Preventative maintenance to field will be provided by equipment vendor, U.S Environmental Rental Corporation, Pine Environmental Services, or other selected vendors. The following equipment has been identified for use to implement the Final PDI Work Plan.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), LEL, percent oxygen, hydrogen sulfide and hydrogen cyanide
- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp
- RAE Systems VRAE Surveying Monitor with LEL, hydrogen cyanide, hydrogen sulfide, carbon monoxide, and percent oxygen
- Drager CMS and compound-specific chips
- MIE pDR 1200 with cyclone and pump
- MSA LC Pump
- BIOS DCL-5k pump calibrator

- In-Situ Troll 9000
- YSI 600 XLM

Similar equipment that perform the same functions can be substituted if selected equipment is not available from equipment supplier.

Laboratory equipment calibration and maintenance procedures are specified in the ELAP laboratory quality manual located in **Appendix A.**

13. Specific Procedures to Assess Data Quality Indicators

QC analyses conducted as a part of the testing program will provide a quantitative quality assessment of the data generated and their adherence to the data quality indicators. The data quality indicators ensure that the quality assurance objectives for the project are met.

13.1 Detection Limits

13.1.1 Method Detection Limit

The MDL is defined as follows for all measurements:

MDL = (t[n-1,1-a=0.99]) x (s)

where: s = standard deviation of the replicate analysis,
t(n-1, 1-a=0.99) = student's t-value for a one-sided, 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom

The MDLs calculated by the laboratory are determined under ideal conditions. MDLs for environmental samples are dependent on the sample aliquot, the matrix, the concentration of analyte, and interference present in the matrix, the percent of moisture, dilution factor, etc. The MDL for each sample analysis will be adjusted accordingly.

13.1.2 *Reporting Limit*

The RL is the concentration of an analyte in the sample that corresponds to the lowest concentration standard of the calibration curve. As with the MDLs, the RLs are dependent on the sample aliquot, the final sample volume, the percent of moisture, dilution factor, etc.

The RL is determined as follows:

$$RL = \frac{Lowest\ conc.\ std\ (ng)}{Volume\ injected\ (uL)} x \frac{Sample\ aliquot\ (mL\ or\ g)}{Final\ volume\ (mL)} x\ DF\ x \frac{100}{(100 - \%M)}$$

where:

DF = dilution factor, including all dilutions or lost samples not accounted for in a sample aliquot/final volume ratio
%M = percent moisture for solid samples.

13.2 Precision

Variability will be expressed in terms of the RPD when only two data points exist. The RPD is calculated as:

$$RPD = \frac{(Larger\ Value - Smaller\ Value)}{[(Larger\ Value + Smaller\ Value)/2]} x\ 100\%$$

For data sets greater than two points, the percent relative standard deviation (percent relative standard deviation [RSD]) is used as the precision measurement. It is defined by the equation:

$$Percent\ RSD = \frac{Standard\ Deviation}{Mean} x\ 100\%$$

Standard deviation (SD) is calculated as follows:

$$SD = \sqrt{\sum_{i=1}^{n} \frac{(y_i - y)^2}{n - 1}}$$

where: SD = standard deviation
yi = measured value of the ith replicate
y = mean of replicate measurements
n = number of replicates

For measurements such as pH, where the absolute variation is more appropriate, precision is usually reported as the absolute range (D) of duplicate measurements:

13.3 Accuracy

Accuracy is related to the bias in a measurement system. Accuracy describes the degree of agreement of a measurement with a true value. Accuracy will be expressed as percent recovery for each matrix spike analyte by using the following equation:

$$\%\ Recovery = \frac{Css - Cus}{Csa}\ X\ 100\%$$

where: Css = measured concentration in spiked sample
Cus = measured concentration in unspiked sample
Csa = known concentration added to the sample

Accuracy for a measurement such as pH is expressed as bias in the analysis of a standard reference sample according to the equation:

$$Bias = pH_m - pH_t$$

where: pH_m = measured pH
pH_t = the true pH of the standard reference sample

13.4 Completeness

Data completeness is a measure of the amount of usable data resulting from a measurement effort. For this program, completeness will be defined as the percentage of valid data obtained compared to the total number of measurements necessary to achieve our required statistical level of confidence for each test. The confidence level is based on the total number of samples proposed in the Final PDI Work Plan.

Data completeness is calculated as:

$$Completeness = \frac{Number\ of\ valid\ data\ points}{Number\ of\ data\ points\ necessary\ for\ confidence\ level}\ x\ 100\%$$

The completeness goal is to generate a sufficient amount of valid data. GEI anticipates that 95 percent of the data will be complete. Data validation criteria discussed in the Final PDI Work Plan and Section 10 of this QAPP will be used to determine data completeness. Any data deficiencies and their effect on project goals will be evaluated in the DUSR.

13.5 Representativeness

Representativeness is a qualitative statement that expresses the extent to which the sample accurately and precisely represents the characteristics of interest of the study. Representativeness is primarily concerned with the proper design of the sampling program and is best ensured by proper selection of sampling locations and the taking of a sufficient number of samples. It is addressed by describing the sampling techniques, the matrices sampled, and the rationale for the selection of sampling locations, which are discussed in the field sampling plan and the Final PDI Work Plan.

13.6 Comparability

Comparability is a qualitative parameter expressing the confidence that one set of data can be compared to another. Comparability is possible only when standardized sampling and analytical procedures are used.

14. Corrective Action

If unacceptable conditions are identified as a result of audits or are observed during field sampling and analysis, the PM, Field Team Leader, and QA officer will document the condition and initiate corrective procedures. The specific condition or problem will be identified, its cause will be determined, and appropriate action will be implemented.

The entire sampling program will be under the direction of the PM and QA officer. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data collection, laboratory analysis, and interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the Final PDI Work Plan and FSP. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the PM. The corrective action will usually involve recalculation, reanalysis, or repeating a sample run.

14.1 Immediate Corrective Action

Corrective action in the field may be needed when the sample requirements are changed (i.e., more/less samples, sampling locations other than those specified in the Final PDI Work Plan), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader, Site Manager, and PM will approve the corrective action and notify the QA officer. The PM and QA officer will approve the corrective measure. The Field Team Leader and Site Manager will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action
- The action taken in response
- The final resolution
- Any necessary approvals

No staff member will initiate corrective action without prior communication of findings through the proper channels.

Corrective action in the laboratory will be completed in accordance with the quality assurance procedures located in **Appendix A**. Any corrective actions completed by the laboratory will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the PM. If the corrective action does not rectify the situation, the laboratory will contact the PM, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action if necessary.

Tables

Table 1
Quantitation Limits for Soils
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	**SOIL BORING SAMPLE SELECTION PROTOCOL:** 1. Shallow soils within observed impacts (0 to 5' bgs); 2. Subsurface soils within heaviest observed impacts below 5 feet (if present); 3. Subsurface soils below deepest observed visual impacts. **IF NO IMPACTS ARE OBSERVED IN SOIL BORING:** 1. Shallow soils (0 to 5' bgs); 2. Water table interface; 3. Completion depth of boring.																					
		Sample Number								Analysis (Method[1])												
		Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soils below deepest observed visual impacts	Completion depth of boring	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000)	Total Cyanide (9012)[2]	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)	Grain Size (ASTM D422)	Unit Weight (ASTM D2937)	Moisture Content (ASTM D2216)	Organic Content (ASTM D2974)	Atterberg Limits (ASTM D4318)	UUC (ASTM D2850)	CIUC (ASTM D4767)	Consolidation (ASTM D2435)
Subsurface Soils																						
FW-SB-XXX	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FW-CPT-100	Within the canal, along the western canal bulkhead.	0	TBD	TBD	TBD	TBD	TBD	TBD	54	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-101		9	TBD	TBD	TBD	TBD	TBD	TBD	55	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-CPT-102		0	TBD	TBD	TBD	TBD	TBD	TBD	55	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-103		9	TBD	TBD	TBD	TBD	TBD	TBD	55	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-SB-104	Within the canal, along the eastern canal bulkhead.	9	TBD	TBD	TBD	TBD	TBD	TBD	57	--	--	--	--	--	--	--	2	1	2	1	2	-	1	-
FW-CPT-105		0	TBD	TBD	TBD	TBD	TBD	TBD	56	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-106		9	TBD	TBD	TBD	TBD	TBD	TBD	57	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-SB-107	Sackett Street ROW, west of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	64	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-
FW-SB-108	495 Sackett Street, west of canal	9	TBD	TBD	TBD	TBD	TBD	TBD	65	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-SB-109	Degraw Street ROW, west of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-
FW-SB-110	497 Degraw Street, west of canal	10	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	-	1	1
FW-SB-111	270 Nevins Street, east of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-
FW-SB-112	Degraw Street ROW, east of canal	9	TBD	TBD	TBD	TBD	TBD	TBD	67	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-SB-113	424 Nevins Street, east of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-
FW-SB-114	226 Nevins Street, east of canal	9	TBD	TBD	TBD	TBD	TBD	TBD	67	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-SB-107A	Sackett Street, west of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	65	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-
FW-SB-108A	495 Sackett Street, west of canal	10	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	-	1	1
FW-SB-109A	Degraw Street ROW, west of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-
FW-SB-110A	497 Degraw Street, west of canal	9	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-SB-111A	270 Nevins Street, east of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	66	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-

Table 1
Quantitation Limits for Soils
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	**SOIL BORING SAMPLE SELECTION PROTOCOL:** 1. Shallow soils within observed impacts (0 to 5' bgs); 2. Subsurface soils within heaviest observed impacts below 5 feet (if present); 3. Subsurface soils below deepest observed visual impacts. **IF NO IMPACTS ARE OBSERVED IN SOIL BORING:** 1. Shallow soils (0 to 5' bgs); 2. Water table interface; 3. Completion depth of boring.																					
		Sample Number								Analysis (Method[1])												
		Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soils below deepest observed visual impacts	Completion depth of boring	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000)	Total Cyanide (9012)[2]	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)	Grain Size (ASTM D422)	Unit Weight (ASTM D2937)	Moisture Content (ASTM D2216)	Organic Content (ASTM D2974)	Atterberg Limits (ASTM D4318)	UUC (ASTM D2850)	CIUC (ASTM D4767)	Consolidation (ASTM D2435)
FW-SB-112A	Degraw Street ROW, east of Canal	9	TBD	TBD	TBD	TBD	TBD	TBD	67	--	--	--	--	--	--	--	2	1	2	1	2	1	-	-
FW-SB-113A	424 Nevins Street, east of canal	8	TBD	TBD	TBD	TBD	TBD	TBD	67	--	--	--	--	--	--	--	2	1	2	1	2	-	-	-
FW-SB-114A	226 Nevins Street, east of canal	9	TBD	TBD	TBD	TBD	TBD	TBD	68	--	--	--	--	--	--	--	2	1	2	1	2	-	1	-
FW-SB-115	510 Sackett Street, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	47	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-116	495 Sackett Street, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	45	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-117/ FW-MW-24	267 Bond Street, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	46	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-118	Degraw Street ROW, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	46	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-119	497 Degraw Street, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	46	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-120	Douglas Street ROW, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	46	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-121	525 Union Street, east of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	46	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-122	424 Nevins Street, east of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	47	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-123	226 Nevins Street, east of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	47	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-124	267 Bond Street, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	45	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-125	267 Bond Street, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	47	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
FW-SB-126/ FW-MW-25	267 Bond Street, west of canal	0	TBD	TBD	TBD	TBD	TBD	TBD	47	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Surface Soils																						
FW-SS-XX	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Notes:
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
PCBs - polychlorinated biphenols
UUC - unconsolidated undrained compression test
CIUC - consoildated isotropic undrained triaxial compression test
1. Chemical analysis test methods specified are from U.S. EPA SW-846 test methods.
2. If elevated cyanide readings are present in a sample, then analysis for cyanide speciation may be completed
3. One sample from within the fill in each soil boring

Table 2
Groundwater Field Sampling Matrix
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	**SAMPLE SELECTION PROTOCOL:** Collect one groundwater sample at the water table or installed monitoring well depth.																
		Sample Number			Sample Zone	Water Quality Measurements							Analysis (Method[1])					
		Number Samples Proposed	Number Samples Collected	Date Collected	Water Table	pH	Specific Conductance	Temperature	Oxidation Reduction Potential (ORP)	Turbidity	Salinity	Dissolved Oxygen	VOCs (EPA Method 8260B)	SVOCs (EPA 8270C)	TAL Metals (EPA Method 6000/7000)	Herbicides (EPA Method 8151A)	PCBs/ Pesticides (EPA 8082)	Total Cyanide (EPA Method 9012)
Monitoring Well Sample																		
FW-MW-XX	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Temporary Monitoring Well Sample																		
FW-SB-XX	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Previous New York State Department of Environmental Conservation Monitoring Wells																		
MW-XX	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Notes:

VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
PCBs - polychlorinated biphenols
1. Chemical analysis test methods specified are from U.S. EPA SW-846 test methods.
2. If elevated cyanide readings are present in a sample, then analysis for cyanide speciation may be completed

Table 3
Soil Vapor and Ambient Air Field Sampling Matrix
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	**SAMPLE SELECTION PROTOCOL:** **1. Collect one soil vapor sample at the installed soil vapor point depth.** **2. Collect indoor air and outdoor air samples from the height of the breathing zone, approximately 3-5 feet above the ground surface.**			
		Sample Number			**Analysis (Method)**
		Number Samples Proposed	**Number Samples Collected**	**Date Collected**	**VOCs (expanded) (modified TO-15)**
Soil Vapor					
FW-SV-XX	TBD	TBD	TBD	TBD	TBD
Indoor Air					
FW-IA-XX	TBD	TBD	TBD	TBD	TBD
Outdoor Air					
FW-OA-XX	TBD	TBD	TBD	TBD	TBD

Notes:
VOCs - volatile organic compounds

Table 4
Analytical Methods/Quality Assurance Summary Table
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Media	Number of Primary Samples	QA/QC Samples				Total Number of Samples	Analytical Parameters	Method	Preservative	Holding Time	Container
		TB	FB[2]	DUP	MS/MSD						
Subsurface Soil	40	0	0	0	0	40	Grain Size	ASTM D422	None	None[3]	Closed container, large enough to hold representative sample size (at least 8 oz.)
	20	0	0	0	0	20	Unit Weight	ASTM D2937	None	ASAP, maximum ~3 months[3]	Sealed container, Zip-lock® bag, jar, or Shelby tube
	40	0	0	0	0	40	Moisture Content	ASTM D2216	None	ASAP, maximum ~3 months[3]	Sealed container, Zip-lock® bag, jar, or Shelby tube, minimal head space
	20	0	0	0	0	20	Organic Content	ASTM D2974	None	ASAP, maximum ~3 months[3]	Sealed container, Zip-lock® bag, jar, or Shelby tube, minimal head space
	40	0	0	0	0	40	Atterberg Limits	ASTM D4318	None	ASAP, maximum ~6 months (~3 months if sample contains organics)[3]	Sealed container, Zip-lock® bag, jar, or Shelby tube
	8	0	0	0	0	8	UUC	ASTM D2850	None	ASAP, maximum ~3 months[3]	Shelby Tube
	4	0	0	0	0	4	CIUC	ASTM D4767	None	ASAP, maximum ~3 months[3]	Shelby Tube
	2	0	0	0	0	2	Consolidation	ASTM D2435	None	ASAP, maximum ~3 months[3]	Shelby Tube
	TBD	TBD	TBD	TBD	TBD	TBD	VOCs	8260B	Cool to 4°C	14 days to analysis	Wide mouth 2-oz. VOA, clear glass jar
	TBD	TBD	TBD	TBD	TBD	TBD	SVOCs	8270C	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	TAL Metals	6000/7000	Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	Total Cyanide	9012	Cool to 4° C	28 days to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	Herbicides	8151A	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	PCBs	8082	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	Pesticides	8081A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
Surface Soil	TBD	TBD	TBD	TBD	TBD	TBD	VOCs	8260B	Cool to 4°C	14 days to analysis	Wide mouth 2-oz. VOA, clear glass jar
	TBD	TBD	TBD	TBD	TBD	TBD	SVOCs	8270C	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	TAL Metals	6000/7000	Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	Total Cyanide	9012	Cool to 4° C	14 days to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	Herbicides	8151A	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	PCBs	8082	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	TBD	TBD	TBD	TBD	TBD	TBD	Pesticides	8081A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]

Table 4
Analytical Methods/Quality Assurance Summary Table
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Media	Number of Primary Samples	QA/QC Samples				Total Number of Samples	Analytical Parameters	Method	Preservative	Holding Time	Container
		TB	FB[2]	DUP	MS/MSD						
Soil Vapor	TBD	TBD	TBD	TBD	TBD	TBD	VOCs (including naphthalene)	*TO-15 Modified	None	14 Days to analysis	2.7-Liter Summa Canister
Indoor Air	TBD	TBD	TBD	TBD	TBD	TBD	VOCs (including naphthalene)	*TO-15 Modified	None	14 Days to analysis	6-Liter Summa Canister
Outdoor Air	TBD	TBD	TBD	TBD	TBD	TBD	VOCs (including naphthalene)	*TO-15 Modified	None	14 Days to analysis	6-Liter Summa Canister
Ground Water	TBD	TBD	TBD	TBD	TBD	TBD	VOCs	8260B	pH<2 with HCl, Cool to 4°C	14 days to analysis	(2) 40 mL VOA vials
	TBD	TBD	TBD	TBD	TBD	TBD	SVOCs	8270C	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(2) 1 L amber glass jar
	TBD	TBD	TBD	TBD	TBD	TBD	TAL Metals	6000/7000	pH<2 with HNO_3; Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	(1) 500 mL polyethylene container
	TBD	TBD	TBD	TBD	TBD	TBD	Total Cyanide	9012	NaOH to pH>12/Cool to 4°C	14 days to analysis	(1) 500 mL polyethylene container
	TBD	TBD	TBD	TBD	TBD	TBD	Herbicides	8151A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(1) 1 L amber glass jar
	TBD	TBD	TBD	TBD	TBD	TBD	PCBs	8082	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(1) 1 L amber glass jar
	TBD	TBD	TBD	TBD	TBD	TBD	Pesticides	8081A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(1) 1 L amber glass jar

Notes:

[1]: SVOC, Total Cyanide, TAL metals, herbicides, pesticides and PCBs will be collected from the (1)- 8 oz jar and the (1)- 4 oz jar

[2]: Soil field blanks will include bottles listed in groundwater section of the table.

[3]: For Shelby tubes, some soils are very corrosive to steel and will start to react with a steel tube in days or weeks. Brass and stainless tubes have a longer storage capacity.

VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
PCBs - polychlorinated biphenols
* Expanded TO-15 list shown on Table 7
°C - Degrees Celsius
L - Liter
oz. - ounce
mL - Milliliter
HNO_3 - Nitric acid
HCl - Hydrochloric Acid
NaOH - Sodium Hydroxide

Table 5
Quantitation Limits for Soils
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Surface/Subsurface Soil			
Metals by EPA Method 6000/7000 series			
Aluminum	258	20	mg/kg
Antimony	11.7	1.14	mg/kg
Arsenic	8	1.22	mg/kg
Barium	2	0.18	mg/kg
Beryllium	2	0.5	mg/kg
Cadmium	3	1	mg/kg
Calcium	85	11.6	mg/kg
Chromium	3	0.34	mg/kg
Cobalt	2	0.42	mg/kg
Copper	5	0.8	mg/kg
Iron	145	10.2	mg/kg
Lead	9	0.76	mg/kg
Magnesium	35	9.2	mg/kg
Manganese	2.5	0.64	mg/kg
Mercury	0.05	0.02	mg/kg
Nickel	6.25	0.44	mg/kg
Potassium	200	40	mg/kg
Selenium	16	1.6	mg/kg
Silver	3	0.32	mg/kg
Sodium	94	20	mg/kg
Thallium	20	4.17	mg/kg
Vanadium	4	0.36	mg/kg
Zinc	20	3.8	mg/kg
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C			
1,2,4-Trichlorobenzene	333	55.96	ug/kg
1,2-Dichlorobenzene	333	56.43	ug/kg
1,2-Diphenylhydrazine	333	32.86	ug/kg
1,3-Dichlorobenzene	333	50.49	ug/kg
1,4-Dichlorobenzene	333	52.75	ug/kg
2,2-oxybis (1-chloropropane)	333	47.18	ug/kg
2,4,5-Trichlorophenol	1667	120.96	ug/kg
2,4,6-Trichlorophenol	333	85.18	ug/kg
2,4-Dichlorophenol	333	108.95	ug/kg
2,4-Dimethylphenol	333	172.3	ug/kg
2,4-Dinitrophenol	1667	114.87	ug/kg
2,4-Dinitrotoluene	333	60.09	ug/kg
2,6-Dinitrotoluene	333	60.57	ug/kg
2-Chloronaphthalene	333	48.46	ug/kg
2-Chlorophenol	333	86.27	ug/kg
2-Methylnaphthalene	333	52.92	ug/kg
2-Methylphenol	333	89.03	ug/kg
2-Nitroaniline	1667	42.32	ug/kg
2-Nitrophenol	333	115.71	ug/kg
3,3-Dichlorobenzidine	667	88.96	ug/kg
3-Nitroaniline	1667	68.54	ug/kg
4,6-Dinitro-2-methylphenol	1667	239.28	ug/kg
4-Bromophenyl phenyl ether	333	51.16	ug/kg

Table 5
Quantitation Limits for Soils
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Surface/Subsurface Soil			
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C (Continued)			
4-Chloro-3-methylphenol	333	112.76	ug/kg
4-Chloroaniline	333	107.34	ug/kg
4-Chlorophenyl phenyl ether	333	45.74	ug/kg
4-Methylphenol	333	179.39	ug/kg
4-Nitroaniline	667	48.17	ug/kg
4-Nitrophenol	1667	141.69	ug/kg
Acenaphthene	333	55.32	ug/kg
Acenaphthylene	333	40.59	ug/kg
Aniline	333	73.83	ug/kg
Anthracene	333	54.55	ug/kg
Benzidine	3333	1134.9	ug/kg
Benzo(a)anthracene	333	45.31	ug/kg
Benzo(a)pyrene	333	41.16	ug/kg
Benzo(b)fluoranthene	333	93.11	ug/kg
Benzo(ghi)perylene	333	36.99	ug/kg
Benzo(k)fluoranthene	333	37.12	ug/kg
Benzoic acid	1667	90.33	ug/kg
Benzyl alcohol	333	62.93	ug/kg
Bis(2-chloroethoxy)methane	333	57.03	ug/kg
Bis(2-chloroethyl)ether	333	44.86	ug/kg
Bis(2-ethylhexyl)phthalate	333	44.37	ug/kg
Butyl benzyl phthalate	333	43.04	ug/kg
Carbazole	333	48.63	ug/kg
Chrysene	333	41.6	ug/kg
Dibenzo(a,h)anthracene	333	36.71	ug/kg
Dibenzofuran	333	52.67	ug/kg
Diethyl phthalate	333	48.88	ug/kg
Dimethyl phthalate	333	51.27	ug/kg
Di-n-butyl phthalate	333	43.98	ug/kg
Di-n-octyl phthalate	333	34.97	ug/kg
Fluoranthene	333	41.87	ug/kg
Fluorene	333	43.39	ug/kg
Hexachlorobenzene	333	48.52	ug/kg
Hexachlorobutadiene	333	67.85	ug/kg
Hexachlorocyclopentadiene	333	247.96	ug/kg
Hexachloroethane	333	59.22	ug/kg
Indeno(1,2,3-cd)pyrene	333	33.74	ug/kg
Isophorone	333	60.02	ug/kg
Naphthalene	333	56.66	ug/kg
Nitrobenzene	333	40.4	ug/kg
n-Nitrosodimethylamine	333	48.87	ug/kg
n-Nitroso-di-n-propylamine	333	44.63	ug/kg
n-Nitrosodiphenylamine	333	49.76	ug/kg
Pentachlorophenol	1667	287.85	ug/kg
Phenanthrene	333	38.58	ug/kg
Phenol	333	96.98	ug/kg
Pyrene	333	45.56	ug/kg
Pyridine	667	39.9	ug/kg

Table 5
Quantitation Limits for Soils
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Surface/Subsurface Soil			
Volatile Organic Compounds (VOCs) by EPA Method 8260B			
1,1,1-Trichloroethane	5	0.84	ug/kg
1,1,2,2-Tetrachloroethane	5	1.21	ug/kg
1,1,2-Trichloroethane	5	1.04	ug/kg
1,1-Dichloroethane	5	0.81	ug/kg
1,1-Dichloroethene	5	1.09	ug/kg
1,2,3-Trichloropropane	5	1.62	ug/kg
1,2,4-Trichlorobenzene	5	0.61	ug/kg
1,2-Dichloroethane	5	0.99	ug/kg
1,2-Dichloropropane	5	1.06	ug/kg
2-Butanone (MEK)	10	1.78	ug/kg
2-Chloroethylvinylether	5	1.37	ug/kg
2-Hexanone	10	2.53	ug/kg
4-Methyl-2-pentanone (MIBK)	5	1.18	ug/kg
Acetone	20	3.15	ug/kg
Acrolein	20	3.1	ug/kg
Acrylonitrile	5	1.19	ug/kg
Benzene	5	0.86	ug/kg
Bromodichloromethane	5	0.84	ug/kg
Bromoform	5	0.99	ug/kg
Bromomethane	5	0.82	ug/kg
Carbon disulfide	5	0.61	ug/kg
Carbon tetrachloride	5	0.78	ug/kg
Chlorobenzene	5	0.79	ug/kg
Chloroethane	5	1.89	ug/kg
Chloroform	5	0.53	ug/kg
Chloromethane	5	0.9	ug/kg
cis-1,2-Dichloroethene	5	1.04	ug/kg
cis-1,3-Dichloropropene	5	0.78	ug/kg
Dibromochloromethane	5	0.41	ug/kg
Dichlorodifluoromethane	5	1.25	ug/kg
Ethylbenzene	5	0.79	ug/kg
Isopropyl ether	5	0.44	ug/kg
Methylene chloride	20	2.21	ug/kg
Methyl-tert-butyl-ether (MTBE)	5	0.93	ug/kg
Styrene	5	1.06	ug/Kg
tert-Butyl alcohol	20	4.69	ug/kg
Tetrachloroethene	5	0.7	ug/kg
Toluene	5	0.84	ug/kg
trans-1,2-Dichloroethene	5	0.58	ug/kg
trans-1,3-Dichloropropene	5	0.92	ug/kg
Trichloroethene	5	0.68	ug/kg
Trichlorofluoromethane	5	0.6	ug/kg
Trichlorotrifluoroethane	5	0.63	ug/kg
Vinyl acetate	10	2.7	ug/kg
Vinyl chloride	5	0.87	ug/kg
Xylenes (total)	5	1.96	ug/kg
Herbicides by EPA Method 8151A			
2,4-D	80	20.64	ug/kg
2,4,5-TP (Silvex)	20	5.042	ug/kg
2,4,5-T	20	5.149	ug/kg

Table 5
Quantitation Limits for Soils
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Surface/Subsurface Soil			
Pesticides by EPA Method 8082A			
4,4'-DDD	3.3	0.381	ug/kg
4,4'-DDE	3.3	0.434	ug/kg
4,4'-DDT	3.3	0.309	ug/kg
Aldrin	2	0.356	ug/kg
alpha-BHC	1.7	0.275	ug/kg
alpha-Chlordane	1.7	0.11	ug/kg
beta-BHC	1.7	0.269	ug/kg
delta-BHC	1.7	0.103	ug/kg
Dieldrin	3.3	0.321	ug/kg
Endosulfan I	1.7	0.147	ug/kg
Endosulfan II	3.3	0.17	ug/kg
Endosulfan sulfate	3.3	0.173	ug/kg
Endrin	5	0.89	ug/kg
Endrin aldehyde	3.3	0.323	ug/kg
Endrin ketone	3.3	0.144	ug/kg
gamma-BHC (Lindane)	1.7	0.152	ug/kg
gamma-Chlordane	1.7	0.091	ug/kg
Heptachlor	1.7	0.15	ug/kg
Heptachlor epoxide	1.7	0.114	ug/kg
Methoxychlor	17	2.11	ug/kg
Toxaphene	67	4.833	ug/kg
PCBs by EPA Method 8082A			
Aroclor 1016	17	2.808	ug/kg
Aroclor 1221	33	1.533	ug/kg
Aroclor 1232	17	1.859	ug/kg
Aroclor 1242	17	2.989	ug/kg
Aroclor 1248	17	2.69	ug/kg
Aroclor 1254	17	1.215	ug/kg
Aroclor 1260	17	3.988	ug/kg
Cyanide by EPA Method 9012A			
Cyanide	500	53	ug/kg

Table 6
Quantitation Limits for Groundwater
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Metals by EPA Method 6000/7000 series			
Aluminum	500	92	ug/L
Antimony	20	5.4	ug/L
Arsenic	40	3.9	ug/L
Barium	5	0.74	ug/L
Beryllium	5	0.54	ug/L
Cadmium	10	1.1	ug/L
Calcium	300	56	ug/L
Chromium	10	1.3	ug/L
Cobalt	10	1.8	ug/L
Copper	10	4.3	ug/L
Iron	100	54	ug/L
Lead	10	3	ug/L
Magnesium	100	26	ug/L
Manganese	15	6.9	ug/L
Mercury	0.4	0.07	ug/L
Nickel	10	1.9	ug/L
Potassium	400	191	ug/L
Selenium	30	5	ug/L
Silver	6	1.1	ug/L
Sodium	400	98	ug/L
Thallium	40	10	ug/L
Vanadium	6	1.5	ug/L
Zinc	50	11	ug/L
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C			
1,2,4-Trichlorobenzene	10	0.68	ug/L
1,2-Dichlorobenzene	10	0.74	ug/L
1,2-Diphenylhydrazine	10	0.84	ug/L
1,3-Dichlorobenzene	10	0.68	ug/L
1,4-Dichlorobenzene	10	0.46	ug/L
2,2-oxybis (1-chloropropane)	10	0.62	ug/L
2,4,5-Trichlorophenol	50	0.78	ug/L
2,4,6-Trichlorophenol	10	0.79	ug/L
2,4-Dichlorophenol	10	0.84	ug/L
2,4-Dimethylphenol	10	0.73	ug/L
2,4-Dinitrophenol	50	5.13	ug/L
2,4-Dinitrotoluene	10	0.8	ug/L
2,6-Dinitrotoluene	10	0.59	ug/L
2-Chloronaphthalene	10	0.73	ug/L
2-Chlorophenol	10	0.6	ug/L
2-Methylnaphthalene	10	0.64	ug/L
2-Methylphenol	10	0.59	ug/L
2-Nitroaniline	50	1.12	ug/L
2-Nitrophenol	10	0.75	ug/L
3,3-Dichlorobenzidine	10	0.98	ug/L
3-Nitroaniline	50	0.67	ug/L
4,6-Dinitro-2-methylphenol	50	4.24	ug/L
4-Bromophenyl phenyl ether	10	0.91	ug/L
4-Chloro-3-methylphenol	10	0.51	ug/L

Table 6
Quantitation Limits for Groundwater
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C (Continued)			
4-Chloroaniline	10	0.43	ug/L
4-Chlorophenyl phenyl ether	10	0.82	ug/L
4-Methylphenol	10	0.33	ug/L
4-Nitroaniline	20	1.05	ug/L
4-Nitrophenol	50	1.85	ug/L
Acenaphthene	10	0.8	ug/L
Acenaphthylene	10	0.75	ug/L
Aniline	10	0.63	ug/L
Anthracene	10	0.99	ug/L
Benzidine	100	2.15	ug/L
Benzo(a)anthracene	10	1.19	ug/L
Benzo(a)pyrene	10	1.08	ug/L
Benzo(b)fluoranthene	10	1.54	ug/L
Benzo(ghi)perylene	10	1.04	ug/L
Benzo(k)fluoranthene	10	0.91	ug/L
Benzoic acid	50	5.88	ug/L
Benzyl alcohol	10	0.99	ug/L
Bis(2-chloroethoxy)methane	10	0.87	ug/L
Bis(2-chloroethyl)ether	10	0.87	ug/L
Bis(2-ethylhexyl)phthalate	10	1.31	ug/L
Butyl benzyl phthalate	10	0.96	ug/L
Carbazole	10	1.11	ug/L
Chrysene	10	0.97	ug/L
Dibenzo(a,h)anthracene	10	1.34	ug/L
Dibenzofuran	10	0.82	ug/L
Diethyl phthalate	10	0.82	ug/L
Dimethyl phthalate	10	0.63	ug/L
Di-n-butyl phthalate	10	1.14	ug/L
Di-n-octyl phthalate	10	1.3	ug/L
Fluoranthene	10	1.08	ug/L
Fluorene	10	0.77	ug/L
Hexachlorobenzene	10	1.07	ug/L
Hexachlorobutadiene	10	0.84	ug/L
Hexachlorocyclopentadiene	10	2.21	ug/L
Hexachloroethane	10	1.06	ug/L
Indeno(1,2,3-cd)pyrene	10	1.17	ug/L
Isophorone	10	0.66	ug/L
Naphthalene	10	0.66	ug/L
Nitrobenzene	10	0.79	ug/L
n-Nitroso-di-n-propylamine	10	0.7	ug/L
n-Nitrosodiphenylamine	10	1.08	ug/L
n-Nitrosomethylethylamine	10	0.5	ug/L
Pentachlorophenol	50	5.04	ug/L
Phenanthrene	10	0.66	ug/L
Phenol	10	0.35	ug/L
Pyrene	10	1.01	ug/L
Pyridine	20	2.31	ug/L

Table 6
Quantitation Limits for Groundwater
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Volatile Organic Compounds (VOCs) by EPA Method 8260B			
1,1,1-Trichloroethane	5	0.4	ug/L
1,1,2,2-Tetrachloroethane	5	0.4	ug/L
1,1,2-Trichloroethane	5	0.6	ug/L
1,1-Dichloroethane	5	0.6	ug/L
1,1-Dichloroethene	5	0.7	ug/L
1,2,3-Trichloropropane	5	1.1	ug/L
1,2,4-Trichlorobenzene	5	0.9	ug/L
1,2-Dichloroethane	5	0.6	ug/L
1,2-Dichloropropane	5	0.9	ug/L
1,3-Dichloropropane	5	0.4	ug/L
2-Butanone (MEK)	5	1.2	ug/L
2-Chloroethylvinylether	5	0.6	ug/L
2-Hexanone	5	0.8	ug/L
4-Methyl-2-pentanone (MIBK)	5	0.7	ug/L
Acetone	5	1.4	ug/L
Acrolein	10	7.8	ug/L
Acrylonitrile	5	1.6	ug/L
Benzene	5	0.4	ug/L
Bromodichloromethane	5	0.4	ug/L
Bromoform	5	0.8	ug/L
Bromomethane	5	1.2	ug/L
Carbon disulfide	5	0.9	ug/L
Carbon tetrachloride	5	1	ug/L
Chlorobenzene	5	0.4	ug/L
Chloroethane	5	0.8	ug/L
Chloroform	5	0.7	ug/L
Chloromethane	5	0.5	ug/L
cis-1,2-Dichloroethene	5	0.6	ug/L
cis-1,3-Dichloropropene	5	0.5	ug/L
Dibromochloromethane	5	0.5	ug/L
Dichlorodifluoromethane	5	0.6	ug/L
Ethylbenzene	5	1	ug/L
Isopropyl ether	5	N/A	ug/L
Methylene chloride	5	0.4	ug/L
Methyl-tert-butyl-ether (MTBE)	5	0.3	ug/L
Styrene	5	0.5	ug/L
Tetrachloroethene	5	0.5	ug/L
Toluene	5	0.3	ug/L
trans-1,2-Dichloroethene	5	0.5	ug/L
trans-1,3-Dichloropropene	5	0.3	ug/L
Trichloroethene	5	0.7	ug/L
Trichlorofluoromethane	5	0.6	ug/L
Trichlorotrifluoroethane	5	0.5	ug/L
Vinyl acetate	5	0.2	ug/L
Vinyl chloride	5	0.8	ug/L
Xylenes (total)	5	1	ug/L
Herbicides by EPA Method 8151A			
2,4-D	4	0.435	ug/L
2,4,5-TP (Silvex)	1	0.0934	ug/L
2,4,5-T	1	0.0938	ug/L

Table 6
Quantitation Limits for Groundwater
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Pesticides by EPA Method 8082A			
4,4'-DDD	0.15	0.014	ug/L
4,4'-DDE	0.1	0.009	ug/L
4,4'-DDT	0.1	0.01	ug/L
Aldrin	0.05	0.006	ug/L
alpha-BHC	0.05	0.011	ug/L
alpha-Chlordane	0.05	0.006	ug/L
beta-BHC	0.05	0.013	ug/L
delta-BHC	0.05	0.002	ug/L
Dieldrin	0.1	0.006	ug/L
Endosulfan I	0.05	0.004	ug/L
Endosulfan II	0.1	0.012	ug/L
Endosulfan sulfate	0.1	0.014	ug/L
Endrin	0.1	0.025	ug/L
Endrin aldehyde	0.1	0.0282	ug/L
Endrin ketone	0.1	0.0162	ug/L
gamma-BHC (Lindane)	0.05	0.005	ug/L
gamma-Chlordane	0.05	0.006	ug/L
Heptachlor	0.05	0.008	ug/L
Heptachlor epoxide	0.05	0.006	ug/L
Methoxychlor	0.5	0.041	ug/L
Toxaphene	2.5	0.215	ug/L
Total Cyanide by EPA Method 9012A			
Cyanide, Total	10	1	ug/L

Table 7
Quantitation Limits for Soil Vapor and Ambient Air
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Compound	Reporting Limit[1] (ppbv)[3]	Reporting Limit (ug/m^3)[4]
1,1,1-Trichloroethane	0.20	1.1
1,1,2,2-Tetrachloroethane	0.20	1.4
1,1,2-Trichloroethane	0.20	1.1
1,1-Dichloroethane	0.20	0.81
1,1-Dichloroethene	0.20	0.79
1,2,3-Trimethylbenzene	0.20	0.98
1,2,4,5-Tetramethylbenzene	2.5	14
1,2,4-Trichlorobenzene	0.20	1.5
1,2,4-Trimethylbenzene	0.20	0.98
1,2-Dibromoethane	0.20	1.5
1,2-Dichlorobenzene	0.20	1.2
1,2-Dichloroethane	0.20	0.81
1,2-Dichloropropane	0.20	0.92
1,3,5-Trimethylbenzene	0.20	0.98
1,3-Butadiene	0.20	0.44
1,3-Dichlorobenzene	0.20	1.2
1,4-Dichlorobenzene	0.20	1.2
1,4-Dioxane	0.20	0.72
1-Methylnaphthalene	1.0	5.8
2,2,4-Trimethylpentane	0.20	0.93
2-Butanone	0.20	0.59
2-Chlorotoluene	0.20	1.0
2-Ethylthiophene	0.20	0.92
2-Hexanone	0.20	0.82
2-Methylnaphthalene	2.5	14
2-Methylthiophene	0.20	0.80
3-Chloropropene	0.20	0.63
3-Methylthiophene	0.20	0.80
4-Ethyl toluene	0.20	0.98
4-Methyl-2-pentanone	0.20	0.82
Acetaldehyde	1.0	1.8
Acetone	1.0	2.4
Acrolein	0.20	0.46
Benzene	0.20	0.64
Benzothiophene	2.5	14
Bromodichloromethane	0.20	1.3
Bromoform	0.20	2.1
Bromomethane	0.20	0.78
Butane	0.20	0.48
Carbon disulfide	0.20	0.62
Carbon tetrachloride	0.20	1.3
Chlorobenzene	0.20	0.92
Chloroethane	0.20	0.53
Chloroform	0.20	0.98
Chloromethane	0.20	0.41
cis-1,2-Dichloroethene	0.20	0.79
cis-1,3-Dichloropropene	0.20	0.91
Cyclohexane	0.20	0.69
Decane	0.20	1.2
Dibromochloromethane	0.20	1.7
Dichlorodifluoromethane	0.20	0.99
Dodecane	0.20	1.4
Ethanol	1.0	1.9

Table 7
Quantitation Limits for Soil Vapor and Ambient Air
Fulton Municipal Works MGP Site
Remedial Investigation
Brooklyn, New York

Compound	Reporting Limit[1] (ppbv)[3]	Reporting Limit (ug/m^3)[4]
Ethylbenzene	0.20	0.87
Freon-113	0.20	1.5
Freon-114	0.20	1.4
Heptane	0.20	0.82
Hexachlorobutadiene	0.20	2.1
Hexane	0.20	0.70
Indan	0.20	0.97
Indene	0.20	0.95
Isopropyl Alcohol	0.20	0.49
Methylene chloride	0.20	0.69
MTBE	0.20	0.72
Naphthalene	0.20	1.0
Nonane	0.20	1.0
Octane	0.20	0.93
o-Xylene	0.20	0.87
p+m-Xylene	0.40	1.7
Pentane	0.20	0.59
Styrene	0.20	0.85
Tertiary butyl Alcohol	0.20	0.61
Tetrachloroethene	0.20	1.4
Thiophene	0.20	0.69
Toluene	0.20	0.75
trans-1,2-Dichloroethene	0.20	0.79
trans-1,3-Dichloropropene	0.20	0.91
Trichloroethene	0.20	1.1
Trichlorofluoromethane	0.20	1.1
Undecane	0.20	1.3
Vinyl bromide	0.20	0.87
Vinyl chloride	0.20	0.51

Notes:

1. Actual reporting limits of field samples may be higher due to sample dilution by the laboratory to quantify compounds at elevated concentrations. (see note 2)
2. The laboratory must notify National Grid prior to sample dilution.
3. ppbv = part per billion by volume
4. ug/m^3 = microgram per cubic meter

Table 8
Soil Cleanup Objectives
Fulton Municipal Works Former MGP Site
Remedial Investigation
Brooklyn, New York

Analytes	Unrestricted Use (ppm)	Residential Use (ppm)	Restricted-Residential Use (ppm)	Restricted-Commercial Use (ppm)	Restricted-Industrial Use (ppm)	Protection of Groundwater (ppm)	Protection of Ecological Resources (ppm)
Volatile Organic Compounds							
Acetone	0.05	100	100	500	1,000	0.05	2.2
Benzene	0.06	2.9	4.8	44	89	0.06	70
Butanone, 2-	0.12	100	100	500	1,000	0.12	100
Butylbenzene, n-	12	100	100	500	1,000	12	NE
Butylbenzene, tert-	5.9	100	100	500	1,000	5.9	NE
Butylbenzene,sec-	11	100	100	500	1,000	11	NE
Carbon tetrachloride	0.76	1.4	2.4	22	44	0.76	NE
Chlorobenzene	1.1	100	100	500	1,000	1.1	40
Chloroform	0.37	10	49	350	700	0.37	12
Dichlorobenzene,1,2-	1.1	100	100	500	1,000	1.1	NE
Dichlorobenzene,1,3-	2.4	17	49	280	560	2.4	NE
Dichlorobenzene,1,4-	1.8	9.8	13	130	250	1.8	20
Dichloroethane,1,1-	0.27	19	26	240	480	0.27	NE
Dichloroethane,1,2-	0.02	2.3	3.1	30	60	0.02	10
Dichloroethene, cis-1,2-	0.25	59	100	500	1,000	0.25	NE
Dichloroethene,1,1-	0.33	100	100	500	1,000	0.33	NE
Dioxane,1,4-	0.1	9.8	13	130	250	0.1	0.1
Ethylbenzene	1	30	41	390	780	1	NE
Methyl tert-butyl ether	0.93	62	100	500	1,000	0.93	NE
Methylene chloride	0.05	51	100	500	1,000	0.05	12
Naphthalene	12	100	100	500	1,000	12	NE
Propylbenzene, n-	3.9	100	100	500	1,000	3.9	NE
Tetrachloroethene	1.3	5.5	19	150	300	1.3	2
Toluene	0.7	100	100	500	1,000	0.7	36
Trans-1,2-dichloroethene	0.19	100	100	500	1,000	0.19	NE
Trichloroethane, 1,1,1-	0.68	100	100	500	1,000	0.68	NE
Trichloroethene	0.47	10	21	200	400	0.47	2
Trimethylbenzene, 1,2,4-	3.6	47	52	190	380	3.6	NE
Trimethylbenzene, 1,3,5-	8.4	47	52	190	380	8.4	NE
Vinyl chloride	0.02	0.21	0.9	13	27	0.02	NE
Xylene, total	0.26	100	100	500	1,000	1.6	0.26
Semi-Volatile Organic Compounds							
Acenaphthene	20	100	100	500	1,000	98	20
Acenaphthylene	100	100	100	500	1,000	107	NE
Anthracene	100	100	100	500	1,000	1,000	NE
Benz[a]anthracene	1	1	1	5.6	11	1	NE
Benzo[a]pyrene	1	1	1	1	1.1	22	2.6
Benzo[b]fluoranthene	1	1	1	5.6	11	1.7	NE
Benzo[g,h,i]perylene	100	100	100	500	1,000	1,000	NE
Benzo[k]fluoranthene	0.8	1	3.9	56	110	1.7	NE
Chrysene	1	1	3.9	56	110	1	NE
Dibenz[a,h]anthracene	0.33	0.33	0.33	0.56	1.1	1,000	NE
Dibenzofuran	7	14	59	350	1,000	210	NE
Fluoranthene	100	100	100	500	1,000	1,000	NE
Fluorene	30	100	100	500	1,000	386	30
Hexachlorobenzene	0.33	0.33	1.2	6	12	3.2	NE
Indeno[1,2,3-cd]pyrene	0.5	0.5	0.5	5.6	11	8.2	NE
Methylphenol, 4-	0.33	34	100	500	1,000	0.33	NE
Cresol, m (methylphenol, 3-)	0.33	100	100	500	1,000	0.33	NE
Methylphenol,2-	0.33	100	100	500	1,000	0.33	NE

Table 8
Soil Cleanup Objectives
Fulton Municipal Works Former MGP Site
Remedial Investigation
Brooklyn, New York

Analytes	Unrestricted Use (ppm)	Residential Use (ppm)	Restricted-Residential Use (ppm)	Restricted-Commercial Use (ppm)	Restricted-Industrial Use (ppm)	Protection of Groundwater (ppm)	Protection of Ecological Resources (ppm)
Pentachlorophenol	0.8	2.4	6.7	6.7	55	0.8	0.8
Phenanthrene	100	100	100	500	1,000	1,000	NE
Phenol	0.33	100	100	500	1,000	0.33	30
Pyrene	100	100	100	500	1,000	1,000	NE
Pesticides							
Aldrin	0.005	0.019	0.097	0.68	1.4	0.19	0.14
Alpha-bhc	0.02	0.097	0.48	3.4	6.8	0.02	0.04
Alpha-chlordane	0.094	0.91	4.2	24	47	2.9	1.3
Beta-BHC	0.036	0.072	0.36	3	14	0.09	0.6
DDD,4,4-	0.0033	2.6	13	92	180	14	0.0033
DDE,4,4-	0.0033	1.8	8.9	62	120	17	0.0033
DDT,4,4-	0.0033	1.7	7.9	47	94	136	0.0033
Delta-BHC	0.04	100	100	500	1,000	0.25	0.04
Dieldrin	0.005	0.039	0.2	1.4	2.8	0.1	0.006
Endosulfan I	2.4	4.8	24	200	920	102	NE
Endosulfan II	2.4	4.8	24	200	920	102	NE
Endosulfan sulfate	2.4	4.8	24	200	920	1,000	NE
Endrin	0.014	2.2	11	89	410	0.06	0.014
Gamma-BHC	0.1	0.28	1.3	9.2	23	0.1	6
Heptachlor	0.042	0.42	2.1	15	29	0.38	0.14
Silvex	3.8	58	100	500	1,000	3.8	NE
Polychlorinated Biphenyls (PCBs)							
Total PCBs	0.1	1	1	1	25	3.2	1
Total Metals							
Arsenic	13	16	16	16	16	16	13
Barium	350	350	400	400	10,000	820	433
Beryllium	7.2	14	72	590	2700	47	10
Cadmium	2.5	2.5	4.3	9.3	60	7.5	4
Chromium (VI)	1	22	110	400	800	19	1
Chromium (III)	30	36	180	1500	6800		41
Copper	50	270	270	270	10,000	1720	50
Lead	63	400	400	1000	3900	450	63
Manganese	1600	2000	2,000	10,000	10,000	2,000	1600
Mercury	0.18	0.81	0.81	2.8	5.7	0.73	0.18
Nickel	30	140	310	310	10,000	130	30
Selenium	3.9	36	180	1500	6800	4	3.9
Silver	2	36	180	1500	6800	8.3	2
Zinc	109	2200	10,000	10,000	10,000	2480	109
Cyanide							
Cyanide, Total	27	27	27	27	10,000	40	NE

Appendix A

Laboratory Quality Manual (electronic only)

Cover Page:

Quality Assurance Manual

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Title Page:

Quality Assurance Manual
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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-006	Detection Limits
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CA-L-S-001	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CA-L-P-001	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CW-F-P-002	Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-007	Controlled Purchases Policy
CW-F-S-018	Vendor Selection
CA-Q-M-002	Corporate Quality Management Plan
CW-E-M-001	Corporate Environmental Health & Safety Manual

REFERENCED LABORATORY SOPs

SOP Reference	Title
CT-QAS-3	SOP for Document Control (Sec. 3.4.1)
CT-MKS-7	Complaint Resolution (Sec .10.1)
QAF00810 QAW01200/1300/1400 QAW1700 QAW01500 QAW01600	SOP Listing (Sec. 13.2) PT Tracking Equipment Table Master Certification Spreadsheet Personnel & Qualifications
CT-RPS-7	LIMS Final Reporting (Sec. 14.1.4)
CT-QAS-16	SOP for Employee Training (Sec. 17.3)
CT-QAS-8	Generating SOPs (Sec. 19.2)
CT-QAS-27	Demonstration of Capability (Sec. 19.4.2)
CT-QAS-17	Conducting MDL Studies (Sec. 19.7)
CT-SMS-11	SOP for Compositing, Homogenization and Subsampling Environmental Samples (Sec. 22.5)
CT-SMS-4	Sample Processing at Sample Arrival (Sec. 23.2.1.3)

SECTION 3

INTRODUCTION *(NELAC 5.1 - 5.3)*

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Connecticut's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with the 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards and ISO/IEC Guide 17025 (1999). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan(CQMP) and the various accreditation and certification programs listed in Appendix 3. The relevant NELAC section is included in the heading of each QAM section.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- EPA SW-846, *Test Methods for the Evaluation of Solid Waste, 3rd Edition,* September 1986; Update I, July 1992; Update II, September 1994; and Update III, December 1996.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- USEPA Contract Laboratory Program. *Statement of Work for Inorganics Analysis. Multi-Media, Multi-Concentration.* Document ILM04.0.
- USEPA Contract Laboratory Program. *Statement of Work for Organics Analysis. Multi-Media, Multi-Concentration.* Document Number OLMO3.1, August 1994, OLM04.2.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th and 21st Edition.
- Nuclear Regulatory Commission (NRC) quality assurance requirements.

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical parameters. The Program also contains guidelines on maintaining documentation of analytical process, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 4 of the QAM. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director/Manager and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director/Manager and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

This manual is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & Updating procedures (refer to SOP No. CT-QAS-3).

SECTION 4

ORGANIZATION AND MANAGEMENT *(NELAC 5.4.1)*

4.1 OVERVIEW

TestAmerica Connecticut is a local operating unit of TestAmerica Laboratories, Inc.. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. TestAmerica Connecticut has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Operating Officer, Corporate Quality Assurance, etc.). The TestAmerica Connecticut laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Connecticut is presented in Figure 4-1.

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Quality Assurance Program

The responsibility for quality lies with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Connecticut laboratory.

4.2.2 General Manager (GM)

Each GM reports directly to a COO. Each GM has full responsibility for the overall administrative and operational management of their respective laboratories. The GM's responsibilities include allocation of personnel and resources, long-term planning, setting goals, and achieving the financial, business, and quality objectives of TestAmerica. The GM ensures timely compliance with corporate management directives, policies, and management systems reviews. The GM is also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.3 Laboratory Director

TestAmerica Connecticut's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical directors for the appropriate fields of testing. The name(s) of the Technical Director will be included in the national database. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, CSM and the Technical Director(s), as direct reports.

4.2.4 Quality Assurance (QA) Manager

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025.

The QA Manager reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.

- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 13.
- Monitoring standards of performance in quality control and quality assurance.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Captains the QA team to enable communication and to distribute duties and responsibilities.

4.2.5 Supervisors

Supervisors (Technical Directors) report to the Laboratory Director. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to analysts, participates in the selection, training (as documented in Section 8.1), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager and Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.6 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Director, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.

- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.7 Environmental Health and Safety Officer

The Safety Officer reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The Safety Officer is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.

4.2.8 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties consist of:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.

4.2.9 Client Service Manager

The Client Service Manager reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).

4.2.10 Project Manager

The Project Manager reports directly to the Division Manager and serves as liaison between the laboratory and its clients. The Project Manager's responsibilities include:

- Ensure client specifications are met by communicating project and quality assurance requirements to the laboratory. Ensure client specific reporting and quality control requirements are met.
- Notify laboratory personnel of incoming projects and sample delivery schedules.
- Monitor the status of all projects in-house to ensure timely delivery of reports.
- Inform clients of project-related problems, resolving service issues and coordinating technical issues with the laboratory staff.
- Coordinate client requests for sample containers and other services.
- Schedule sample pick-ups from client offices or project sites and notifying the laboratory staff of incoming samples.
- Coordinate subcontract work.
- Assist clients in procuring the proper sampling supplies.
- Respond to client inquiries concerning sample status.
- Assist clients with resolution of problems concerning Chains-of-Custody.

- Prepare laboratory quotes and project bids.
- Review sample log-in sheets, when there is a question regarding a Chain of Custody issue.

4.2.11 Sample Custodian

The Sample Custodian reports to the Project Management Department. The responsibilities of the Sample Manager are outlined below:

- Direct the logging of incoming samples into the LIMS.
- Insure timely and correct shipment of sample containers to clients. Maintain accurate records of sample container shipments.

- Perform sample collection and sample pick-up
- Ensures sample containers are prepared for sampling
- Performs field tests and measurements and operates and maintains equipment used for those purposes.

4.3 DEPUTIES

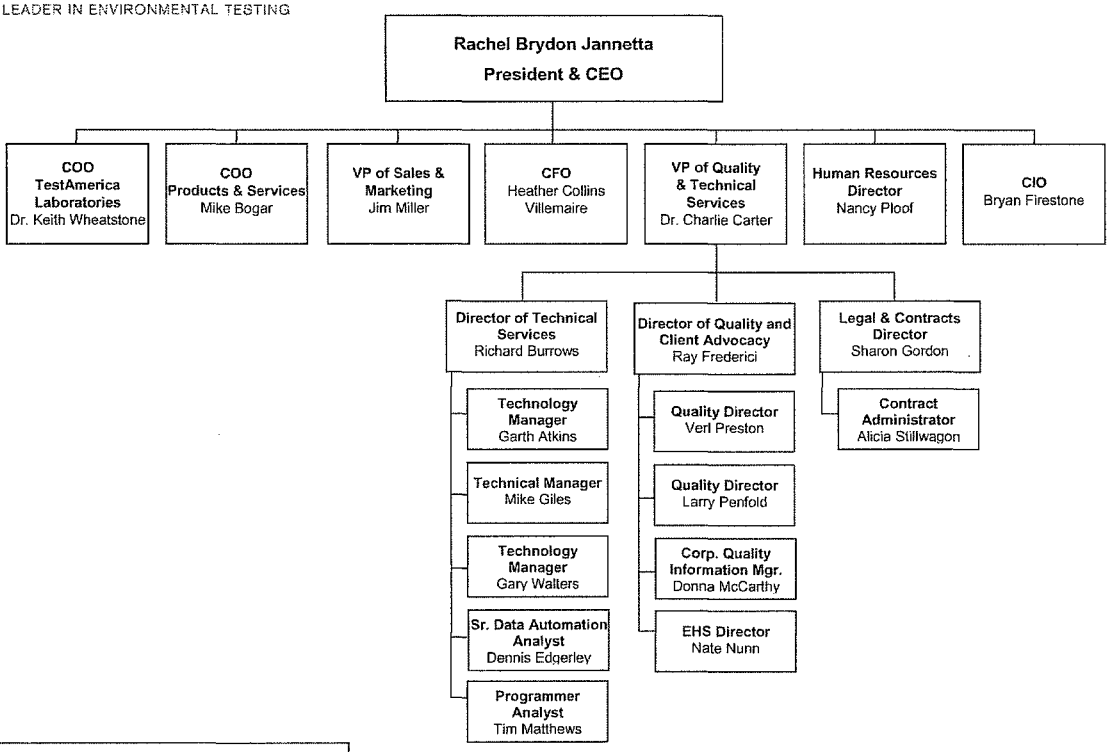
The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director Larry Decker	Paul Hobart	
QA Manager Dawn May	Patty Mercure	
Organic Technical Director Kim Maturo	Magdalena Szymczuk	
Metals Technical Director Nestor Petronchak	Joseph Voytek	
Wet Chemistry Technical Director Doreen Nemeth	David Madumadu	
EHS Coordinator Daniel Helfrich	Joseph Voytek	

Figure 4-1.

Corporate and Laboratory Organization Charts

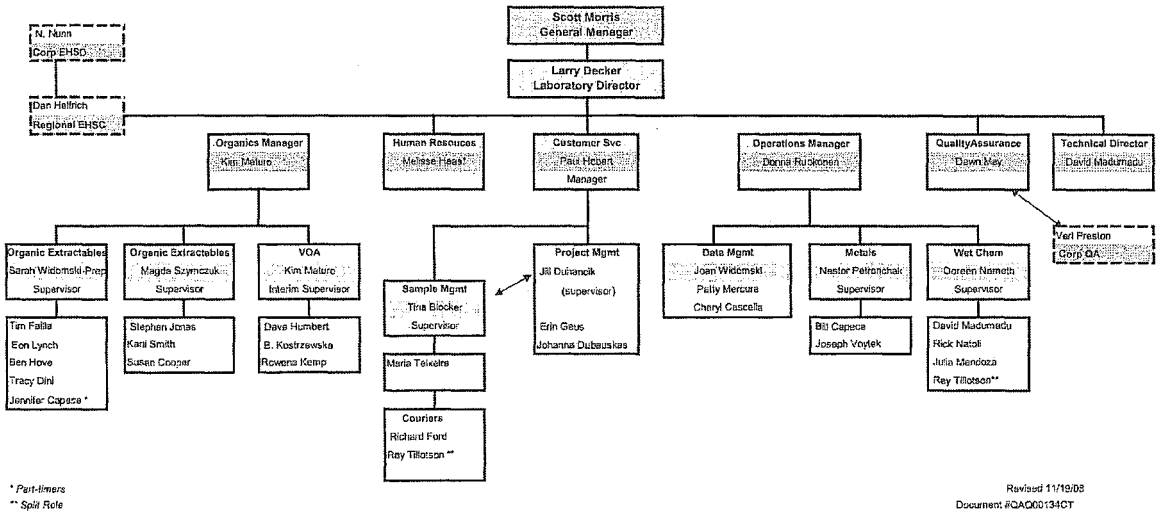
TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING



Note: QA Managers and Safety Coordinators in all laboratories and facilities have a dotted line reporting relationship to Corporate QA and EHS.

November 2008

TestAmerica Connecticut Organization



SECTION 5

QUALITY SYSTEM *(NELAC 5.4.2)*

5.1 QUALITY POLICY STATEMENT

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CA-L-P-001) and Employee Ethics Statements.
- ~~An~~ Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CA-L-S-001.)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CA-L-S-001).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.

- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Corporate Quality Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Policy Memorandum
- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory's has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's (QAM) shall take precedence over the CQMP in those cases.

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be

documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory maintains a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes

an effective date, is updated each time new limits are generated and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in Section 24.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Supervisor and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. All control limits are stored within a LIMS Method limit group. These are set up under the control of the QA department. Any time a limit is updted, a historical record with activiation and expiration date is generated for the limit type. Archived limits can be exported to excel at any time by utilizing the "Historical" button in the Method limit group. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Surrogate recoveries are determined for a specific time period as defined above. The resulting ranges are entered in LIMS.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

Control charts are used to establish method performance of a given analysis and to monitor trends of QC results graphically over time. Once a data base of the laboratory results for a method/matrix/QC analyte combination is established, the acceptability of a given analysis of that QC parameter (and of the analytical batch to which it belongs) can be evaluated in light of the laboratory's normal performance. This is intended to help identify problems before they might affect data. Often, patterns of response that are not at all evident in sets of numbers are very distinct when the same values are viewed as a chronological graph.

Establishment of Limits

The purpose of using statistical control limits is to define, for each analyte in a given method/matrix/QC type combination, a range of expected values. This range encompasses the random variation that occurs normally in the laboratory and allows one to evaluate control samples

in that context, rather than according to an arbitrary or external set of values. Limits for accuracy and precision are defined below:

Accuracy

As recoveries of a QC analyte in a given matrix are tabulated over time, a mean value for recovery is established, as is the standard deviation (s) of those recoveries. If the analysis is in statistical control (e.g., if the set of QC recoveries over time show random variation about the mean) approximately 99.7% of all recoveries for that QC will fall within three standard deviations (3s) of the mean. Thus, assuming that the mean itself is an acceptable level of recovery, the values corresponding to 3s above and 3s below the mean are defined as the Control Limits. Any single recovery outside these values is assumed to have resulted from some circumstance other than normal variation and shall be investigated.

Roughly 95% of points should fall within 2s of the mean. The values +2s and -2s are the Warning Limits. Any normal result has approximately a 1/20 chance of being between 2s and 3s from the mean, so a result in this region doesn't necessarily warrant corrective action, but attention should be paid to such points.

Precision

Precision is used to indicate matrix variability so that appropriate decisions can be made by the client when repeated analyses vary significantly. The coefficient of variation, expressed as a percentage (e.g., the %RSD) for the data set used to calculate accuracy control limits defines the control limit for precision. Duplicate analyses of the QC samples, such as duplicates or MS/MSD, should have an RPD less than or equal to this established precision control limit to be considered free of matrix interferences.

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL *(NELAC 5.4.3)*

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. CT-QAS-3.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a document control system for each document include a unique document title and number, the number of pages of the item, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains the official document on file. The official document is provided to all applicable operational units (may include electronic access). Controlled documents are

identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QA Manual, refer to SOP on Document Control, SOP No. CT-QAS-3. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in the QA folder for the applicable revision.

For changes to SOPs, refer to SOP No. CT-QAS-008, Standard Operating Procedure for Generating SOPs. The SOP identified above also defines the process of changes to SOPs.

Forms, worksheets, work instructions and information are organized by department in the QA office. These are tracked by excel spreadsheet. Electronic versions are kept on the laboratory server; hard copies are kept in QA files. The procedure for the care of these documents is in SOP CT-QAS-3, SOP for Document Control.

6.4 OBSOLETE DOCUMENTS

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to the SOP on Document Control SOP No. CT-QAS-3.

SECTION 7

SERVICE TO THE CLIENT *(NELAC 5.4.7)*

7.1 OVERVIEW

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these regulatory and client requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the lab's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002, Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below) :

- Legal & Contracts Director
- General Manager
- The Laboratory Client Service Manager
- The Laboratory Operations Manager
- Laboratory and/or Corporate Technical Directors
- Laboratory and/or Corporate Information Technology Managers/Directors
- Regional and/or National Account representatives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director/Manager reviews the formal laboratory quote and makes final acceptance for their facility.

The National Account Director, Legal Contracts Director, or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts. The PM assigned to the project maintains a copy for the lab.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. All relevant information is stored on a designated corporate server in the contracts\Connecticut directory.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Regional Account Manager. A copy of the contract and formal quote will be filed with the laboratory PM and the Lab Director/Manager.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log in a note book of pertinent conversations with the client. If need be, a follow up email is sent.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during operation or supervisor meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 SPECIAL SERVICES

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

Note: ISO 17025/NELAC 2003 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 CLIENT COMMUNICATION

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Directors are available to discuss any technical questions or concerns that the client may have.

7.6 REPORTING

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service.

TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS *(NELAC 5.4.5)*

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in NELAC/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-NELAC accredited work where required.

Project Managers (PMs), Customer Service Managers (CSM), or Regional Account Executives (RAE) for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

Note: In addition to the client, some regulating agencies, such as the US Army Corps of Engineers and the USDA, require notification prior to placing such work.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM, Regional Account Executive (RAE), or Customer Service Manager (CSM) becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica: A listing of all approved subcontracting laboratories and supporting documentation is available on the

TestAmerica intranet site. Verify necessary accreditation, where applicable, (e.g., on the subcontractors NELAC, A2LA accreditation or State Certification).

- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- NELAC or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director/Manager. The Laboratory Director/Manager requests that the QA Manager or Operations Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to Corporate Contracts for formal contracting with the laboratory. They will add the lab to the approved list on the intranet site along with the associate documentation and notify the finance group for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.

- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Lab Directors/Managers, QA Managers and Sales Personnel.

8.3 OVERSIGHT AND REPORTING

The PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM (or RAE or CSM) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented on a Subcontracted Sample Form (Figure 8-1) and the form is retained in the project folder. For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a Chain of Custody (COC). A copy of the original COC sent by the client must be included with all samples subbed within TestAmerica.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-NELAC accredited work must be identified in the subcontractor's report as appropriate. If NELAC accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs. In the event this provision is utilized, the QA Manager will be required to verify certifications. The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

Figure 8-1.
Example - Subcontracting Laboratory Approval Form (Initial / Renewal)

SUBCONTRACTING LABORATORY APPROVAL

Reference: Section 8 – Quality Assurance Manual

Date: _____
Laboratory: _____
Address: _____
_____
Contact and e-mail address: _____
Phone: Direct _____ Fax _____

Requested Item[3]	Date Received	Reviewed/ Accepted	Date
1. Copy of State Certification[1]			
2. Insurance Certificate			
3. USDA Soil Permit			
4. Description of Ethics Program[3]			
5. QA Manual[3]			
6. Most Recent (and relevant) 2 Sets of WP/WS Reports with Corrective Action Response[1,3]			
7. State Audit with Corrective Action Response (or NELAC or A2LA Audit)[3]			
8. Sample Report[3]			
9. SOQ or Summary list of Technical Staff and Qualifications [3]			
10. SOPs for Methods to Be Loadshifted[2,3]			
11. For DoD Work: Statement that Lab quality system complies with QSM.			
12. For DoD Work: Approved by specific DoD Component laboratory approval process.			

1 - Required when emergency procedures are implemented.
2 - Some labs may not submit copies due to internal policies. In these cases, a copy of the first page and signature page of the SOP is acceptable. This requirement may also be fulfilled by supplying a table of SOPs with effective dates.
3 – If the laboratory has NELAC accreditation, Item #s 4 through 10 are not required.

On Site Audit Planned: YES NO If yes, Date Completed: _____ By Whom: _____

Comments: _____

Lab Acceptable for Subcontracting Work: YES NO Limitations: _____

QA Manager: _____ Date: _____
(Printed Name)

□ Forwarded to Contract Coordinator, by: _____ Date: _____

SECTION 9

PURCHASING SERVICES AND SUPPLIES *(NELAC 5.4.6)*

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Corporate Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 REAGENTS, STANDARDS & SUPPLIES

Purchasing guidelines for equipment and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP.

The laboratory utilizes the JD Edwards One World software accessed thru the corporate intranet for materials requisitions. User names and passwords are distributed to authorized personnel. Orders are placed bi-weekly by the users and are approved by the Laboratory Director. Only corporate approved suppliers are allowed to be used.

Orders are reviewed by Corporate and placed to the suppliers.

The analyst may also check the item out of the on-site consignment system that contains items approved for laboratory use.

9.3.2 Receiving

It is the responsibility of the purchasing manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to date the material when received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. Material Safety Data Sheets (MSDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method. Chemicals should not be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date can not be extended if the dry chemical is discolored or appears otherwise physically degraded, the dry chemical must be discarded.

- Expiration dates can be extended if the dry chemical is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical is compared to an unexpired independent source in performing the method and the performance of the dry chemical is found to be satisfactory.

The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained with the QA Manager.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 500 psig or the tank must be replaced. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- mmho/cm (or specific resistivity of greater than 1.0 megaohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Department Managers/Supervisors must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased VOA vials must be certified clean and the certificates must be maintained. If uncertified VOA vials are purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Director or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate

Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers and Laboratory Director.

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Corporate Finance documents on Vendor Selection (SOP No. CW-F-S-018) and Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Laboratory Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10

COMPLAINTS *(NELAC 5.4.8)*

10.1 OVERVIEW

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following SOP CT-MKS-7. Complaints are documented and tracked utilizing the lims Non-Conformance module. An NCM is generated within the lims system and the complaint is fully documented and connected with the job for which it originated from. At the end of each month, all complaints are compiled using a the Management reports in LIMS and all are listed in the monthly QA report.

10.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to (SOP# CT-MKS-7).

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelyhood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery

- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11

CONTROL OF NON-CONFORMING WORK *(NELAC 5.4.9)*

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed.

When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Laboratory Director and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with NELAC (or the analytical method) requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run.

11.2 RESPONSIBILITIES AND AUTHORITIES

TestAmerica's Corporate SOP entitled *Internal Investigation of Potential Data Discrepancies and Determination for Data Recall* (SOP No. CA-L-S-001), outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of TestAmerica's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances, the Laboratory Director or QA Manager may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient

sample to reanalyze, etc.. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Department Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Director of Quality & Client Advocacy and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director/Manager, QA Manager, ECOs, Corporate Quality, the COO, General Managers and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

TestAmerica's Corporate Data Investigation & Recall Procedure (SOP No. CA-L-S-001) distinguishes between situations when it would be appropriate for laboratory management to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CA-L-S-001.

11.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. On a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc...). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Director, QA Manager, Supervisor) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management, and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION *(NELAC 5.4.10)*

12.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memo's (NCM) and Corrective Action Reports (CAR) (refer to Figure 12-1 and 12-2).

12.2 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc..

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify Systematic Problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client complaints

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the monthly review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors

- Health and Safety violations
-

12.3 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Supervisor, Laboratory Director/Manager, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Monitoring of the Corrective Actions

- The Department Manager/Supervisor and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Department Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM is generated through the LIMS system. NCM are tracked and a monthly summary of all corrective actions can be generated and exported to excel for review to aid in esuring that the corrective actions have taken effect.
- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.4 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.2.4, Special Audits.)

12.4 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintains Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.

12.5 BASIC CORRECTIONS

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Corrective Action Report

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Corrective Action Report

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Open Date:_____ **Initiated By:**_____

Basis:

- ☐ Audit
- ☐ PT Failure
- ☐ SOP Departure
- ☐ Complaint
- ☐ QC Failure
- ☐ Prevention

Description:

Method:

Root Cause / Purpose:

Investigated By: **Date:**

Potential Corrective / Preventive Actions:

Recommended By: **Date:**

Corrective Actions Performed:

Performed By: **Date:**

Disposition of Data:

- ☐ Reanalyzed
- ☐ Rejected
- ☐ Qualified
- ☐ Recalled

Follow-Up Activities:

- ☐ Continue with another Corrective Action
- ☐ Change SOP

Assessed By: **Date:**

QA Manager:	Date:	Closed Date:

Document number QAF04700.CT

Figure 12-2
Example – Non-Conformance Memo

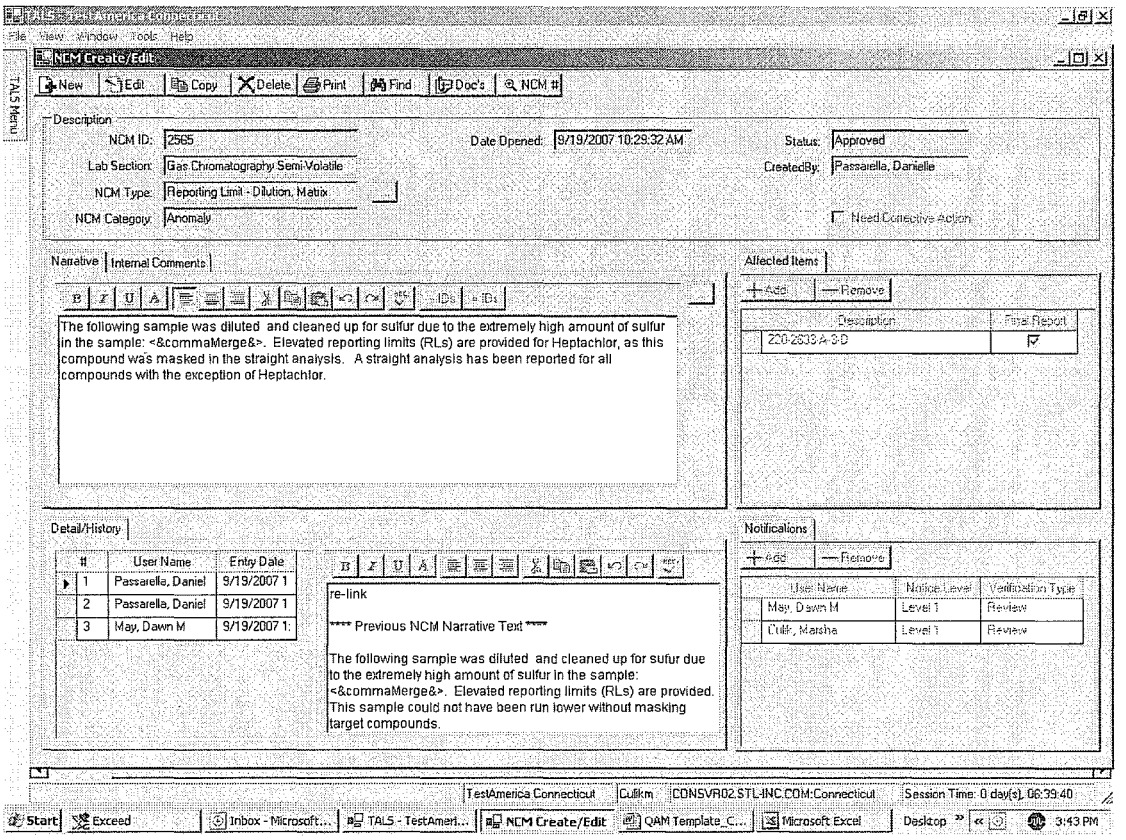


Table 12-1.

Example – General Corrective Action Procedures

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank *(Analyst)*	- Instrument response < ½ RL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Supervisor)*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery/%RSD within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and/or recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Supervisor)*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery/ % Difference within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in SOPs/LIMS	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set.
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in SOPs/LIMS.	- Batch must be re-prepared and re-analyzed. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method /Standard Operating Procedures	- Individual sample must be repeated/reextracted. Place comment in LIMS.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Method Blank (MB_ *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results.
Proficiency Testing (PT) Samples *(QA Manager, Department Manager/Supervisor)*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager/ Supervisor, QA Manager, Corporate QA, Corporate Management)	- SOP CA-L-S-001, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CA-L-S-001.
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 17 for an example) (QA Manager, Lab Director/Manager, Department Supervisors/Managers)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.

Note:

1. Except as noted below for certain compounds, the method blank should be below the detection limit. Certain programs may require less than ½ the detection limit. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, acetone, 2-butanone and phthalates. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur.

SECTION 13

PREVENTIVE ACTION *(NELAC 5.4.11)*

13.1 OVERVIEW

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the QA Metrics Report, internal or external audits, proficiency testing performance, client complaints, staff observation, etc..

The monthly QA Metrics Report shows performance indicators in all areas of the quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used to help evaluate quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Review (Section 16). A highly detailed recap is not required; a simple

recount of success and failure within the preventive action program will provide management a measure for evaluation.

13.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these various tracking indicators, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of indicators monitored under this collective system include:

- SOP Tracking
  - Current Revisions w/ Effective Dates
  - Required Biennial Revisions w/ Due Date
- Proficiency Testing (PT) Sample Tracking
  - Pass / Fail – most current 2 out of 3 studies.
- Instrument / Equipment List
  - Current / Location
- Accreditations
  - New / Expiring
- Method Capabilities
  - Current Listing by program (e.g., Potable Water, Soils, etc.)
- Key Personnel
  - Technical Managers, Department Supervisors, etc..

These items are maintained on TestAmerica's Intranet (Proposal Library) or on our internal database (TotalAccess) which uploads to our company internet site.

SECTION 14

CONTROL OF RECORDS *(NELAC 5.4.12)*

The laboratory maintains a record system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

14.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA department in a database, which is backed up as part of the regular laboratory backup or archived in banker boxes. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by department supervisors.

Table 14-1. Record Index[1]

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Respones - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*

	Record Types [1]:	Retention Time:
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits, Disposal Records	7 years
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	7 Years (HR Personnel Files must be maintained indefinitely)
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees. Records archived off-site are stored in a secure location. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records are maintained on-site at the laboratory for at least 1 year after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
NY Potable Water NYCRR Part 55-2	10 years

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.12.1 for more information. More Information on data archive can be found in the SOP for Data Backup Procedure, CT-SYS-31.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP CT-RPS-7, Lims final Reporting.

- Also refer to Section 19.13.1 'Computer and Electronic Data Related Requirements'.

14.2 TECHNICAL AND ANALYTICAL RECORDS

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code;
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a benchsheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically stored in method parameters associated with each data file, where available.
- analysis type;
- all manual calculations and manual integrations;
- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods or

subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and

- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access.

14.5.4 The laboratory has a record management system (a.k.a. as document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in the LIMS – no logbooks are used to record that data. Records are considered archived when noted as such in the records management system (a.k.a. as document control).

14.5.5 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.6 Records Disposal

14.5.6.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

14.5.6.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

14.5.6.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15

AUDITS *(NELAC 5.4.13)*

15.1 INTERNAL AUDITS

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Audits, SOP No. CA-Q-S-004. The types and frequency of routine internal audits are shown in Table 16-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems	QA Department or Designee	All areas of the laboratory annually
QA Technical Audits - Evaluate raw data versus final reports - Analyst integrity - Data authenticity	QA Department or Designee	All methods within a 2-year period, with at least 15% of methods every quarter
SOP Method Compliance	Technical Director	- All SOPs within a 2-year period - All new analysts or new analyst/methods within 3 months of IDOC
Special	QA Department or Designee	Surveillance or spot checks performed as needed
Performance Testing	Analysts with QA oversight	Two successful per year for each NELAC field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, the laboratory's Data Integrity and Ethics Policies, NELAC quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed. The audit is divided into modules for each operating or support area of the lab, and each module is comprehensive for a given

area. The area audits may be done on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, MintMiner is used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Director at least every two years. The work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Nonpotable Water, and Soil.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. A copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2003 NELAC standards.

15.3 AUDIT FINDINGS

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. . A copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16

MANAGEMENT REVIEWS *(NELAC 5.4.14)*

16.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Directors, Operation Manager, their Quality Director as well as the General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Directors, QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining quality goals & objectives. Corporate Operations and Corporate QA personnel is be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This management review (Corporate Work Instruction No. CA-Q-WI-020) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:

- Adequacy of staff, equipment and facility resources.
- Adequacy of policies and procedures.
- Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigation/Recall SOP shall be followed (SOP No. CA-L-S-001). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's COO, VP of Client & Technical Services, General Managers and Quality Directors receive a monthly report from the Director of Quality & Client Advocacy summarizing any current data integrity or data recall investigations. The General Manager's are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL *(NELAC 5.5.2)*

17.1 OVERVIEW

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, aseptic or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Directors/Department Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Director – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Department Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 TRAINING

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

Further details of the laboratory's training program are described in the Employee Training SOP (CT-QAS-16).

17.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CA-L-P-001) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS *(NELAC 5.5.3)*

18.1 OVERVIEW

The laboratory is a 14,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may effect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas. The volatile analysis laboratory containing GC/MS instrumentation has a separate air handling system which is maintained at a positive pressure at all times. The organic sample preparation laboratory has a separate HVAC system that creates negative pressure in the area. This design results in a contaminant-free environment for trace level volatile analysis.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 FLOOR PLAN

A floor plan can be found in Appendix 1.

18.5 BUILDING SECURITY

Building keys are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19

TEST METHODS AND METHOD VALIDATION *(NELAC 5.5.4)*

19.1 OVERVIEW

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 STANDARD OPERATING PROCEDURES (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002 or the laboratory's SOP entitled 'SOP for Generating SOPS, #CT-QAS-8.
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 LABORATORY METHODS MANUAL

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*

- *Statement of Work for Inorganics Analysis, ILM04.1, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- *Statement of Work for Organics Analysis, OLM04.2, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.*
- *Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, OLMO4.1, USEPA Contract Laboratory Program, September 1998.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (Demonstration of Capability(DOC), Lab SOP # CT-RPS-7) is performed whenever there is a change in instrument type (e.g., new instrumentation), method or personnel.

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Technical Director/Department Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

19.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements (refer to 19.7.10). Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP No. CT-QAS-17 for details on the laboratory's MDL process.

19.8 INSTRUMENT DETECTION LIMITS (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL.

19.9 VERIFICATION OF DETECTION AND REPORTING LIMITS

19.9.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at approximately 2-3 times the calculated MDL

for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and 1-4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

19.9.2 When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waved for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption and specific electrode response factors.

19.12 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable,

assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is 1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 SAMPLE REANALYSIS GUIDELINES

Because there is a certain level of uncertainty with any analytical measurement, a sample reanalysis may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supercede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Supervisor or Laboratory Director/Manager if unsure.

19.14 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOPs for back-up recovery and archive for each of the servers. The laboratory is currently running the TALS Lims system which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Microsoft SQL Server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity: Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use.

19.14.1.2 Ensure Information Availability: Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 Maintain Confidentiality: Ensure data confidentiality through physical access controls, and encryption of when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, *Acceptable Manual Integration Practices*.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1**%.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and, eventually, to a tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample

ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Department Manager and QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are out lined in several SOPs *[e.g. Sample Control,, Project Management]* and work instructions, to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has a corporate SOP discussing Manual Integrations to ensure the authenticity of the data CA-Q-S-002 as well as information within the analytical method SOPs discussing the reason code documentation. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 The data review process at the laboratory starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Control Supervisor reviews the transaction of the chain-of-custody forms and the inputted information. The Project Managers perform final review of the chain-of-custody forms and inputted information.

19.14.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add data qualifiers if applicable. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Approximately 15% of all sample data from manual methods and from automated methods, all GC/MS spectra and all manual integrations are reviewed. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to ethics and manual integration policies. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit

- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.3 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.4.6 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002). Proper manual integration documentation procedures are referenced in the applicable analytical method SOP's in the Manual integration section.

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required.

Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas to for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation

Demonstration of Capability
Certification Statement

Laboratory Name: TestAmerica Connecticut Date:
Laboratory Address: 128 Long Hill Cross Road
Shelton, CT 06484

Method:_____
Matrix: _____

Analyst Name: _____

*Analyst Name: _____

We the undersigned certify that:

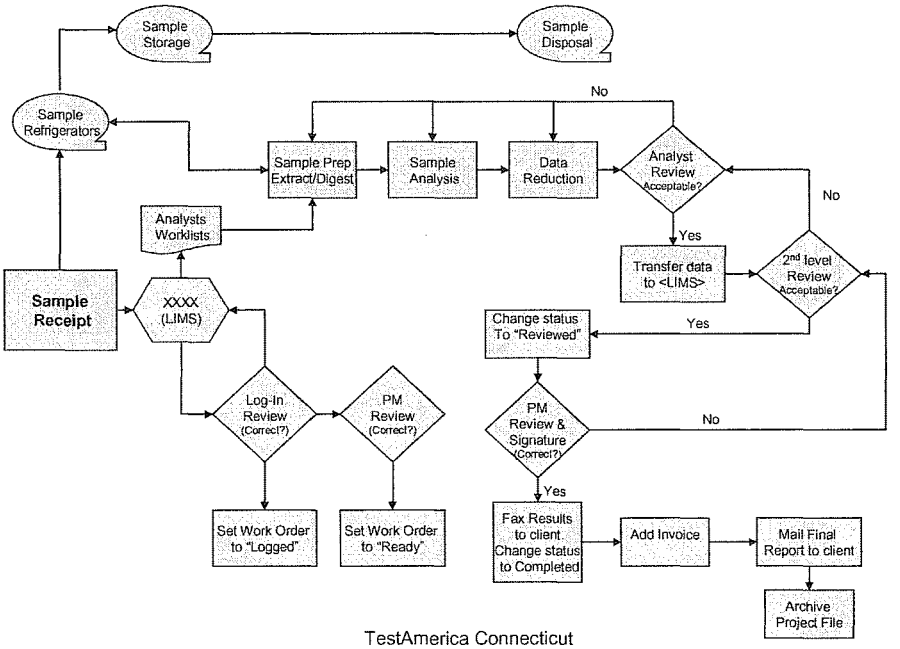
1. The analyst identified above, using the cited test method, which is in use at this facility for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Initial Demonstration of Capability.
2. The test method was performed by the analyst identified on this certification.
3. Copies of the test method and SOP are available for all personnel on site.
4. The data associated with the DoC are true, complete and representative.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is available for review by authorized inspectors.

Laboratory Manager/Supervisor	Signature	Date
Quality Assurance Manager	Signature	Date

* second analyst if sample prepped by another person

Figure 19-2

Example: Work Flow



TestAmerica Connecticut
Workflow

SECTION 20

EQUIPMENT (AND CALIBRATIONS) *(NELAC 5.5.5)*

20.1 OVERVIEW

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturers instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 PREVENTIVE MAINTENANCE

20.2.1 The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be / are also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed are filed with the Department Manager.

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

20.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

20.2.7 If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or

other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Refer to the SOP for Balance Calibration, CT-QAS-9 .

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers, digital probes and thermocouples are calibrated quarterly.

The NIST thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the SOP for Thermometer Calibration, CT-QAS-11.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0°C and ≤ 6 °C.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. Glass micro-syringes are considered the same as Class A glassware.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements.

Receivers are filled to the meniscus with distilled water. The water is then decanted off to a calibrated weighing vessel. The weight is recorded and is converted to the proper volume. Calibration verfication procedures can be found in specific method SOPs that use this type of glassware.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an "Accuracy and Precision Statement of Conformance" from Hamilton attesting established accuracy.

20.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response,

type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually

20.4.1 CALIBRATION STANDARDS

20.4.1.1 Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP.

20.4.1.2 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

20.4.1.3 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

20.4.1.4 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.2 Calibration Verification

The calibration relationship established during the initial calibration must be verified at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and NELAC (2003) standard, Section 5.5.5.10. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

20.4.2.1 Verification of Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

20.4.2.2 Verification of a Non-Linear Calibration

Calibration verification of a non-linear calibration is performed using the percent drift or percent recovery calculations.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

20.5 TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Example: Instrumentation List

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler	Method Performed
ICP	Thermo Jarrell Ash (61P) S/N 464790	61E Trace	1997	Yes	6010B, 200.7
ICP-MS	Agilent S/N JP51202170	7500 Series ICP-MS	2008	Yes	6020, 200.8
Mercury Analyzer	Perkin Elmer S/N 1398 509550	FIMS100	1999	Yes	7471A, 7470, 245.1
GC/MS Semivolatiles	Agilent (U) S/N US33210086	6890/5973	2004	Yes	8270C, 625, SIM
	Agilent (Z) S/N US52430633	6890/5975	2005	Yes	8270C, 625, SIM
	Agilent (A) S/N US52420834	6890/5975	2006	Yes	8270C, 625, SIM
	Agilent (C) S/N US52430481	6890/5975	2006	Yes	8270C, 625, SIM
GC/MS Volatiles	Agilent (L) S/N 3240A18492	5890/5971	1992	Yes	8260B, 624
	Agilent (O) S/N 3203A41807	5890/5971	1991	Yes	8260B, 624 – waters
	Agilent (N) S/N 3133A37851	5890/5971	1991	Yes	8260B, 624
	Agilent (W) S/N U544621422	6890/5973	2005	Yes	8260B, 624 – soils
	Agilent (Y) S/N U544621422	6890/5973	2005	Yes	8260B, 624
	Agilent (V) S/N U540620567	6890/5973	2004	Yes	8260B, 624
GC Semivolatiles	Agilent (GCX-C/D) S/N CN10832045	7890 - Dual FID	2008	Yes	CTETPH 8015B (DRO)
	Agilent (GC4C/D) S/N 3033A33529	5890II - Dual ECD	1992	Yes	8082
	Agilent (GC7C/D) S/N CN10416081	6890-Dual micro ECD	2004	Yes	8081, 8082, 608
	Agilent (GC8C/D) S/N CN10630046	6890-Dual micro ECD	2006	Yes	8081, 8082, 608
	Agilent (GC9C/D) S/N US00028263	6890-Dual micro ECD	2007	Yes	8081, 8082, 608

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler	Method Performed
	Agilent (GC2C/D) S/N 3033A32099	5890II – FID	1991	Yes	CTETPH 8015B (DRO)
	Agilent (GC3) S/N 3033A32563	5890 - FID	1991	Yes	8015B (DRO)
Ion Chromatograph	Lachat S/N A83000-1476	Quickchem 8000	1999	Yes	300.0, 9056 350.1, 351.2 9012, 335.4, 353.2, 420.2
TOC	Dohrmann S/N 98315003	Phoenix 8000	2004	No	415.2, 9060
	Vario Elementar III S/N 11054049	Vario EL	2005	Yes	415.2, 9060, Lloyd Kahn
TKN Digestion System	Scientific Instruments	AD-4020	1994	No	351.2, 351.3
UV/VIS	Thermo electron	Genesys 10	2006	No	7196A, 365.1 or Equiv.
UV/VIS	Buck Scientific (not in use)	HC 404	2000	No	418.1
PH Meter	Orion Research (not in use)	SA 720	1998	No	9040B, 9045C, 150.1
PH Meter	VWR	8025		No	9040B, 9045C, 150.1
Autotitrator (pH, Alkalinity, Conductance)	Man-Tech (ATZ) S/N MS-0A3-615	PC 1300-475	2003	Yes	9040B, 9045C, 150.1, 2320B, 310.1, 310.2, 2510B, 9050A, 120.1
Dissolved Oxygen Meter	YSI	51A	1994	No	405.1
Turbidimeter	HACH	2100 N	1990	No	180.1
Conductivity	Cole-Parmer	1484-20	1996	No	120.1
Automated Distillation Apparatus	Westco S/N 1028	1075 Easy Dist	2003	No	350.1, 420.2, 9066
COD	HACH	45600	1991	No	410.4
Flash Point Apparatus	ERDCO	RT-00001		No	1020
Midi Distillation Setups	Andrews Galss	110-10-R	1995	No	9012A, 335.1, 335.3
TCLP Spinners	Dayton	3M137B/5K939B	1990	No	1311, 1312
GPC	ABC	Autoprep 1000	1999	Yes	8270, 8081, 8082
Selective Chemistry Analyzer	Thermo electron S/N E1519588	Konelab Aqua 20	2004	Yes	350.1, 351.2, 353.2, 365.2
Solvent Evaporator	Horizon Technology	Speed-Vap III	2004	No	1664A
Colorimeter	Hach	DR/890		No	410.4

Table 20-2. Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear	Daily
	Replace lamps	As required
	Insert clean drying tube filled with Magnesium Perchlorate	Daily
	Fill reductant bottle with 10% Stannous Chloride	Daily
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check torch	Daily
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	As required
	Check entrance slit for debris	Monthly
	Replace pump tubing	As required
ICP-MS	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check torch	Daily
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	As required
	Check entrance slit for debris	Monthly
	Replace pump tubing	As required
	Clean/Replace Sample Cones/Skimmer Cones	As required
UV-Vis Spectrophotometer	Clean ambient flow cell	As required
	Precision check/alignment of flow cell	As required
	Wavelength verification check	Semi-annually
Auto Analyzers	Clean sampler	Daily
	Check all tubing	Daily
	Clean inside of colorimeter	Daily
	Clean pump well and pump rollers	Quarterly
	Clean wash fluid receptacle	Weekly
	Inspect line coils, heating baths and filters	Weekly
	Clean optics and cells	Quarterly
Agilent GC/MS	Clean injection ports	As required
	Pump oil-level check	Monthly
	Pump oil changing	Annually
	Ion source cleaning and filament replacement	As required
	Replace electron multiplier	As required
	Change exhaust trap absorbent	Every 6 months
	Inspect and refill the calibration sample vial with PFTBA	As required
	Vacuum fan grills and filters	Every 6 months
	Change liners and septum	As required
	Column replacement and conditioning	As required
	Column cutting and reinstallation	As required

Instrument	Procedure	Frequency
Gas Chromatograph	Injection port cleaning Septum replacement Check for loose/frayed wires and insulation Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	As required As required As Required As Required As Required As Required
Purge and Trap concentrators/ Archon	Check purge flow Inspect line and valve temperatures Change and condition trap Adjust purge flow Rinse sample lines Bake out trap Replace lines and fittings Check syringe Check reagent water and waste bottles Autocalibrate robotic arm Replace inline filter	Daily Daily As required As required As required After each analysis, extend as needed As required Daily Daily As required As required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01M KCl calibration Conductivity cell cleaning	Daily As required
Turbidimeter	Check light bulb	Daily, when used
Deionized/Distilled Water	Daily conductivity check System cleaning Replace cartridge & large mixed bed resins	Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed

SECTION 21

MEASUREMENT TRACEABILITY *(NELAC 5.5.6)*

21.1 OVERVIEW

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware (including glass microliter syringes that have a certificate of accuracy), quarterly accuracy checks are performed for all mechanical volumetric devices. Microsyringes are verified at least semi-annually or disposed of after 6 months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware should be routinely inspected for chips, acid etching or deformity. If the Class A glassware is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP, with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

21.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. (Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.)

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained within the departments. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name

- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (generated by the LIMS system)
- Special Health/Safety warnings if applicable

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include a preparation date, expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22

SAMPLING *(NELAC 5.5.7)*

22.1 OVERVIEW

The laboratory does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory

22.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria used by the laboratory are derived from the source documents for the methods and are listed in the lab's SOPs. If method required holding times this info is in the SOPs or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located in the SOP for Compositing, Homogenization and Subsampling Environmental Samples, # CT-SMS-11.

SECTION 23

HANDLING OF SAMPLES *(NELAC 5.5.8)*

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

The samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. Samples are only considered to be received by lab when personnel at the laboratory have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. Airbills from the courier are stored in the log-infolder. Tracking numbesr are entered into the LIMS in the cooler receipt comments field.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal retain the shipping record with the COC, and initiate an internal COC for laboratory use by analysts and a sample disposal record.

23.2 SAMPLE RECEIPT

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented in the LIMS sample Receipt check list and brought to the immediate attention of the Project Manager and subsequently the Client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;

- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- all samples submitted for water/solid Volatile Organic analyses must have a Trip Blank submitted at the same time;
- Apparent tampering of cooler and/or samples
- Temperature specifications not met
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined. A copy of the sample acceptance policy is provided to each client prior to shipment of samples.

23.2.1.2 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.2.1.3 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according to the SOP for Sample Processing at Sample arrival, SOP No. CT-SMS-4.

23.3 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers(for soils), are returned to the secure sample control area. Empty water containeres are disposed of by the department using the sample.

All samples are kept in the refrigerators for 30 days after invoice prior to disposal. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.4 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. Samples should be received into the lab as outlined in the SOPs for sample receiving.

If samples are received with additional paperwork indicating samples are from foreign sources then the samples must be handled and disposed of accordingly. Foreign source samples must be identified as needing special handling upon disposal by placing a green sticker on the top of the jar lid. Mixed waste radiological samples are identified with an orange sticker.

Foreign soil samples are autoclaved then sent out for incineration by a USDA-approved waste hauler.

23.5 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

23.6 SAMPLE DISPOSAL

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP for Sample Disposal: #CT-SMS-14. All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory

no longer than three months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

(TALS Lims generated)

TestAmerica Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Phone (203) 929-8140 Fax (203) 929-8142

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler:	Lab PM: Dubauskas, Johanna	Carrier Tracking No(s):	COC No: 220-744.1
Client Contact: Mr. David Heuer	Phone:	E-Mail: johanna.dubauskas@testamericainc.com		Page: Page 1 of 1
Company: ARCADIS U.S., Inc.		**Analysis Requested**		STL Job #:
Address: 101 Fieldcrest Ave Suite 5E	Due Date Requested:			
City: Edison	TAT Requested (days):			
State, Zip: NJ, 08817				
Phone:	PO #: NJ000389.0008.00002			
Email: david.heuer@arcadis-us.com	WO #:			
Project Name: Trust Maybrook	Project #: 22000351			
Site: New Jersey	SSOW#:			

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)													Total Number of containers	Special Instructions/Note:
			Preservation Code:																	

Possible Hazard Identification ☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*	*Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)* ☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*
Deliverable Requested: I, II, III, IV, Other (specify)	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Company Confidential & Proprietary

Figure 23-2

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
   - *Client name, address, phone number and fax number (if available)*
   - *Project name and/or number*
   - *The sample identification*
   - *Date, time and location of sampling*
   - *The collectors name*
   - *The matrix description*
   - *The container description*
   - *The total number of each type of container*
   - *Preservatives used*
   - *Analysis requested*
   - *Requested turnaround time (TAT)*
   - *Any special instructions*
   - *Purchase Order number or billing information (e.g. quote number) if available*
   - *The date and time that each person received or relinquished the sample(s), including their signed name.*
   - ***The date and time of receipt must be recorded between the last person to relinquish the samples and the person who receives the samples in the lab, and they must be exactly the same.***
   - **Information must be legible**

2) Samples must be properly labeled.
   - Use durable labels (labels provided by TestAmerica are preferred)
   - Include a unique identification number
   - Include sampling date and time & sampler ID
   - Include preservative used.
   - Use indelible ink
   - **Information must be legible**

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested. See Lab Sampling Guide.

4) Samples must be preserved according to the requirements of the requested analytical method (See Sampling Guide.
5) Most analytical methods require chilling samples to 4° C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6° C. **Note:** Samples that are hand delivered to the laboratory immediately after collection may not have had time

to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

- Chemical preservation (pH) will be verified upon receipt with the exception of volatiles and the project manager will be notified immediately if there is a discrepancy. Improperly preserved samples will be adjusted and recorded through a preservative sheet and NCM.

6) Sample Holding Times
   - TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (working days) remaining on the holding time for us to ensure analysis.

   - Analyses that are designated as "field" analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for "field" analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis. Samples analyzed in the laboratory will be qualified on the final report with an 'H' to indicate holding time exceedance.

7) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

8) Recommendations for packing samples for shipment.

   - Pack samples in Ice rather than "Blue" ice packs.

   - Soil samples should be placed in bubble wrap or bubble bags to help prevent breakage upon shipment. TestAmerica will supply these bags with the bottle order.

   - Water samples would be best if wrapped with bubble-wrap or bubble bags to help prevent breakage upn shipment. TestAmerica will supply these bags with the bottle order.

   - Fill extra cooler space with bubble wrap.

Figure 23-3.

Example: Cooler Receipt Form

TestAmerica - Connecticut
Internal Chain-of-Custody

Trip Blank: QC: Air: Date Received:

FB: Sample #s:

Soil: Water: Locations:

Laboratory Sample #	Relinquished by	Accepted by	Date	Time	Reason	Relinquished by	Accepted by	Date	Time

TestAmerica Form# SMF00508.CT

SECTION 24

ASSURING THE QUALITY OF TEST RESULTS *(NELAC 5.5.9)*

24.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 NEGATIVE CONTROLS

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Example – Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses. Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is

made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

24.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

24.4.1.4 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.5 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

24.4.1.5.1 For methods that have 1-10 target analytes, spike all components.

24.4.1.5.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

24.4.1.5.3 For methods with more than 20 target analytes, spike at least 16 components.

24.4.1.5.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

24.4.1.5.5 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 SAMPLE MATRIX CONTROLS

Table 24-2. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

24.6.1 As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

24.6.3.4 The maximum acceptable recovery limit will be 150%.

24.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

24.6.3.6 If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to the SOP for Control Charts, QAS02601.ct.

24.6.4.1 One example: The QA department generates a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica Connecticut. This summary includes an effective date, is updated each time new limits are generated and is located with the QA manager. Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Director and QA Manager) and entered into

the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 21.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 18.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25

REPORTING RESULTS *(NELAC 5.5.10)*

25.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed, reviewed, and signed by the appropriate signatory. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report For Samples) with a "sample results" column header.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. Job number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Practical quantitation limits or reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.20 When NELAC accreditation is required, the lab shall certify that the test results meet all requirements of NELAC or provide reasons and/or justification if they do not.

25.2.21 The laboratory includes a cover letter.

25.2.22 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.23 When soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

25.2.24 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.25 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., partial report). A complete report must be sent once all of the work has been completed.

25.2.26 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.2.27 REPORTING LEVEL OR REPORT TYPE

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above.
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 25.7.

25.2.28 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. TestAmerica Connecticut offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), NJ Haz Site, Standard Excel, Dbase, GISKEY, and EQuis.

EDD specifications are submitted to the IT department by the Data Reporting Department for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.3 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

25.3.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.3.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature.

25.3.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.3.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.4 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP # CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.5 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.5.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the 1-203-929-8140 (or for e-mails: please notify us immediately by e-mail or by phone (1-203-929-8140) and delete this material from any computer).

25.6 FORMAT OF REPORTS

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.7 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the LIMS server, as is the original report. The revised report is stored under the Job Deliverables and identified with a revision number.

When the report is re-issued, a notation of "Revision #" is placed on the cover/signature page of the report *or at the top of the narrative page* with a brief explanation of reason for the re-issue and a reference back to the last final report generated. *For Example: Report was revised on 11/3/08 to include toluene in sample NQA1504 per client's request. This final report replaces the final report generated on 10/27/08 at 10:47am.*

25.8 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

25.8.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

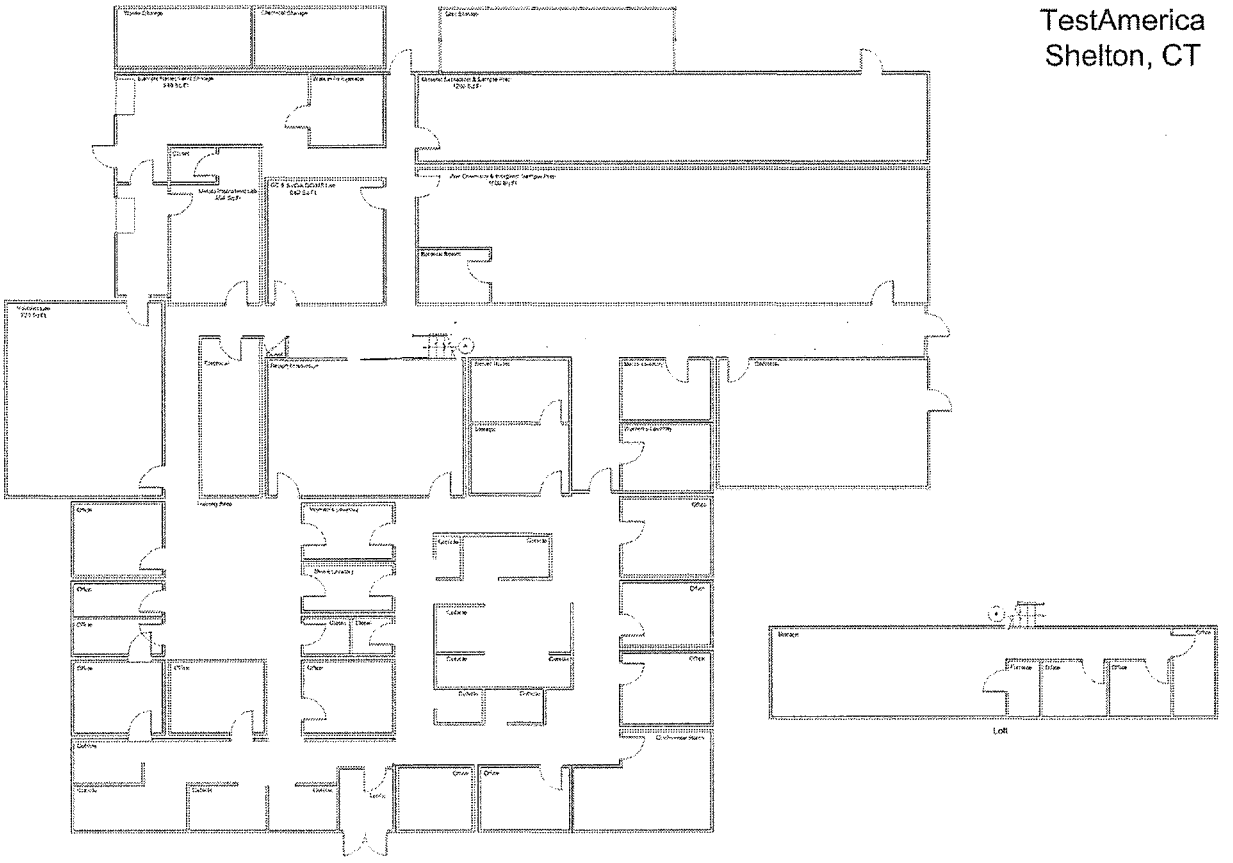
25.8.2 Multiple Reports

TestAmerica does not issue multiple reports for the same workorder where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.

Laboratory Floor Plan

TestAmerica
Shelton, CT



Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (NELAC) [1.5.2.3]

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst:
The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample:
A sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration:
To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve:
The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method:
A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30–2.2)

Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Clean Air Act:
The enabling legislation in 42 U>S>C> 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):
The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures

(NELAC)

Conformance:
An affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis. No significant action is taken to change behavior, process or procedure.

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:
The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Detection Limit:
The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL):
The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Federal Water Pollution Control Act (Clean Water Act, CWA):
The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Testing:
NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Holding Times (Maximum Allowable Holding Times):
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard:
A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), there is no LCS. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (NELAC)

Laboratory Duplicate:
Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit.

In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory dependent. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample):

Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):
A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document their procedure

to select the use of an appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate. (QAMS)

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):
A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation:
Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Quality Assurance:
An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:
An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC (ANSI/ASQC-E-41994)

Quantitation Limits:
The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Range:
The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Reagent Blank (method reagent blank):
A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Reference Material:
A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard:
A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Replicate Analyses:
The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Report Limit (RL):
The laboratory nominal Quantitation Limit (QL) or the level of sensitivity required by the client but not lower than the LOD.

Resource Conservation and Recovery Act (RCRA):
The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA):
The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate:
Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.. (NELAC)

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedures (SOPs):
A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM):
A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Toxic Substances Control Act (TSCA):
The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:
The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

BS – Blank Spike
BSD – Blank Spike Duplicate
CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
CRS – Change Request Form
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DU – Duplicate
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography

ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
MDL – Method Detection Limit
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3.

Laboratory Certifications, Accreditations, Validations

TestAmerica Connecticut maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

State	Responsible Agency	Certification	Lab Number
Connecticut	Department of Health Services	Drinking Water, Wastewater	PH-0497
Maine	Department of Health and Environmental Services	Wastewater/Solid, Hazardous Waste	CT023
Massachusetts	Department of Environmental Protection	Potable/Non-Potable Water	CT023
New Hampshire	Department of Environmental Services	Drinking Water, Wastewater NELAC	2528
New Jersey	Department of Environmental Protection	Drinking Water, Wastewater **NELAC***	CT410
New York	Department of Health	CLP, Drinking Water, Wastewater, Solid/ Hazardous Waste NELAC	10602
Rhode Island	Department of Health	Chemistry...Non- Potable Water and Wastewater	A43
Utah	Department of Health	RCRA-NELAC	2032614458

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site, the laboratory's public server, the final report review table, and in the following offices: QA, marketing, and project management.

* Primary Accrediting Authority - NELAC

Appendix 4.

Laboratory Test Methods

Analysis	Method	Analysis	Method
GC/MS Volatiles Prep	5030B	COD	410.4
GC/MS Volatiles Prep	5035H	Total Residual Chlorine	SM4500CL G
GC/MS Volatiles Prep	5035L	Hexavalent Chromium	7196A
GC/MS Volatiles Prep	3585	Trivalent Chromium	SM3500 CR D
GC/MS Volatiles-TCLP	1311ZHE	Color	SM2120B
GC/MS Volatiles	624	Specific Conductance	120.1
GC/MS Volatiles	8260B	Specific Conductance	SM2510B
GC/MS Volatiles	OLM3.2	Cyanide (Amenable)	SM4500 CN G
GC/MS Volatiles	OLM4.3	Cyanide (Total)	335.4
GC/MS Volatiles	524.2	Cyanide (Total & Amenable)	9012B
GC/Svoa Prep - Waters	3510C	Free Cyanide	D4282_02
GC/Svoa Prep - Soils	3550B	CLP Cyanide	ILM4.0
GC/Svoa Prep - Soils	3541	Cyanide Prep – oils/soils	9013
GC/Svoa Prep - Oils	3580A	Ignitability	1030
Florisil Cleanup	3620B	Flashpoint	1020A
Sulfur Cleanup	3660B	Odor	140.1
Acid Cleanup	3665A	Oil & Grease	1664A
GC/Svoa/Metals TCLP Prep	1311	Dissolved Oxygen	SM4500O G
GC/Svoa/Metals SPLP Prep	1312	Nitrogen (Ammonia)	350.1
Pesticides/PCB	608	Nitrogen (Ammonia)	SM4500NH3 B&G
Pesticides	8081A	Total Kjeldahl Nitrogen	351.2
PCB's	8082	Nitrogen – Nitrate/Nitrite	353.2
DRO(Diesel Range Organics)	8015B	Organic Nitrogen	351.2
CTETPH	CTETPH	Paint Filter Liquids test	9095A
GC/MS Svoa	625	Phenolics	420.4
GC/MS Svoa	8270C	Phenolics	9066
Metals Prep – Water	3010A	Phopsphorus	SM4500 PB.5 & E
Metals Prep - Soil	3050B	Orthophosphate	365.3
Metals Analysis	200.7	pH	SM4500H+B
Metals Analysis	200.8	Filterable Residue (TDS)	SM2540C
Metals Analysis	6010B	Non-Filterable Res (TSS)	SM2540B
Metals Analysis	6020	Total Residue (TS)	SM2540B
Mercury - Water	245.1	Total Volatile Residue (TVS)	160.4
Mercury - Water	7470A	Setteable Matter, Residue	SM2540F
Mercury – Soils	7471A	Total Fixed & Vol solids	SM2540G
Hardness	SM2340B	Salinity	SM2520B
Alkalinity	SM2320B	Sulfide	SM4500 S2 E
Anions	300.0	Temperature	SM2550B
Anions	9056	TOC	SM5310C
BOD/CBOD	SM5210B	TOC	9060
		TOC	Lloyd Kahn

Appendix 4.

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GC/MS Volatiles	624	Specific Conductance	120.1
GC/MS Volatiles	8260B	Specific Conductance	SM2510B
GC/MS Volatiles	OLM3.2	Cyanide (Amenable)	SM4500 CN G
GC/MS Volatiles	OLM4.3	Cyanide (Total)	335.4
GC/MS Volatiles	524.2	Cyanide (Total & Amenable)	9012B
GC/Svoa Prep - Waters	3510C	Free Cyanide	D4282_02
GC/Svoa Prep - Soils	3550B	CLP Cyanide	ILM4.0
GC/Svoa Prep - Soils	3541	Cyanide Prep – oils/soils	9013
GC/Svoa Prep - Oils	3580A	Ignitability	1030
Florisil Cleanup	3620B	Flashpoint	1020A
Sulfur Cleanup	3660B	Odor	140.1
Acid Cleanup	3665A	Oil & Grease	1664A
GC/Svoa/Metals TCLP Prep	1311	Dissolved Oxygen	SM4500O G
GC/Svoa/Metals SPLP Prep	1312	Nitrogen (Ammonia)	350.1
Pesticides/PCB	608	Nitrogen (Ammonia)	SM4500NH3 B&G
Pesticides	8081A	Total Kjeldahl Nitrogen	351.2
PCB's	8082	Nitrogen – Nitrate/Nitrite	353.2
DRO(Diesel Range Organics)	8015B	Organic Nitrogen	351.2
CTETPH	CTETPH	Paint Filter Liquids test	9095A
GC/MS Svoa	625	Phenolics	420.4
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Metals Prep – Water	3010A	Phopsphorus	SM4500 PB.5 & E
Metals Prep - Soil	3050B	Orthophosphate	365.3
Metals Analysis	200.7	pH	SM4500H+B
Metals Analysis	200.8	Filterable Residue (TDS)	SM2540C
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Metals Analysis	6020	Total Residue (TS)	SM2540B
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Mercury - Water	7470A	Setteable Matter, Residue	SM2540F
Mercury – Soils	7471A	Total Fixed & Vol solids	SM2540G
Hardness	SM2340B	Salinity	SM2520B
Alkalinity	SM2320B	Sulfide	SM4500 S2 E
Anions	300.0	Temperature	SM2550B
Anions	9056	TOC	SM5310C
BOD/CBOD	SM5210B	TOC	9060
		TOC	Lloyd Kahn

Appendix C

Field Sampling Plan (electronic only)

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Field Sampling Plan

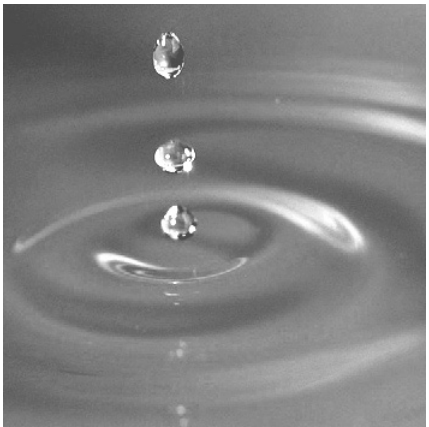
Fulton Municipal Works
Former Manufactured Gas Plant Site

Brooklyn, New York
AOC Index No. A2-0552-0606
Site #: 224051

Submitted to:
National Grid
1 MetroTech Center
Brooklyn, NY 11201

Submitted by:
GEI Consultants, Inc.
455 Winding Brook Drive
Glastonbury, CT 06033

March 2012
093020-2-1202



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Abbreviations and Acronyms

ASTM	American Society for Testing and Materials
COC	Chain Of Custody
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
ELAP	Environmental Laboratory Approval Program
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Phase Liquid
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PDA	Personal Data Assistant
PID	Photo Ionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
SOP	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
USDOT	United States Department of Transportation
VOC	Volatile Organic Compound

1. Purpose

1.1 Introduction

GEI Consultants, Inc. (GEI) has prepared this Field Sampling Plan (FSP) to address the Pre-Design Investigation (PDI) of the Fulton Municipal Works (Fulton) Former Manufactured Gas Plant (MGP) site located on multiple parcels located along Degraw and Sackett Streets and 3rd Avenue and the Gowanus Canal in the Gowanus neighborhood in Brooklyn, New York. This FSP is a companion document to the *Fulton Municipal Works Former MGP Final Interim Remedial Measure (IRM) Pre-Design Investigation Work Plan* dated March 2012 (Final PDI Work Plan) that was prepared by National Grid. The project location is shown in Figure 1 of the Final PDI Work Plan. Proposed sample locations are summarized in Figure 3 of the Final PDI Work Plan. The FSP was prepared to provide the applicable procedures for collecting, transporting, and logging analytical samples during the Fulton Municipal Works MGP PDI.

A Quality Assurance Project Plan (QAPP) dated March 2012 has been prepared under a separate cover. The QAPP details the project data objectives and quality assurance/quality control (QA/QC) measures that will be implemented during the implementation of the Final PDI Work Plan.

2. General Field Procedures

2.1 Utility Clearance Procedure

Underground utilities, including electric, telephone, cable television, sewers, water, natural gas, etc., will be identified by owners/operators prior to any intrusive activity. National Grid will provide underground utility locations on National Grid property, if necessary. The drilling contractor will place a call to the New York City/ Long Island One Call Center (1-800-272-4480) at least two, but not more than 10 days, prior to the commencement of work activities. The New York City and Long Island One Call Center is open 24 hours a day, 7 days a week. The drilling and excavation contractors will make note of ticket reference number and names of the utility operators that will be notified by the New York City and Long Island One Call Center. Public and privately owned utilities will be located by responsible agencies at least 48 hours prior to field activities. The contractor will check that each notified operator has either marked the work site or given an "all clear" prior to commencing work. Other potential on-site hazards such as sharp objects, known subsurface structures, overhead power lines, and building hazards will be identified during the site reconnaissance visit.

If intrusive activity occurs on private property, then a private mark out company will be contracted to identify any subsurface utilities or obstructions prior to sample collection. As a precaution, the first 5 feet or 1 foot below the nearest identified utility of the boring location will be cleared using hand tools, vacuum excavation, or non-intrusive methods.

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.
2. New York City One Call Center & Long Island internet web page online http://www.nycli1calldsi.com accessed on March 5, 2007.

2.2 Field Notebook Procedure

Objective

The field notebook is intended to serve as a record of significant field activities performed or observed during the project. The field notebook will serve as a factual basis for preparing field observation reports, if required, and reports to clients and regulatory agencies.

Procedure

1. Use a separate all-weather bound notebook for each site/location/project number.
2. Write neatly using black or blue waterproof pen (or note if field conditions [i.e., cold or wet weather] require use of pencil).
3. Write the project name, project number, and book number (i.e., 1 of 3) on the front cover. On the inside cover, identify the project name, project number, and "Return Book To:" the office address of the Project Manager (PM).
4. Number all of the pages of the field book starting with the first entry.
5. Record activities as they occur.
6. Neatly cross out mistakes using a single line and initial them. Erasures are not permitted. If an error is made on an accountable document assigned to one individual, that individual will make all corrections. The person who made the entry will correct any subsequent error discovered on an accountable document. All subsequent corrections will be initialed and dated.
7. Sign or initial and date the bottom of every page with an entry. Cross out unused portions of a page.
8. Record the following information upon each arrival at the site:
    a. Date/time/weather/project number
    b. Consultant personnel
    c. Purpose of visit/daily objectives
9. Record conversations with: [Recommendation - If possible, record telephone numbers of individual contacts for the site in the field notebook.]
    a. Contractors
    b. Clients
    c. Visitors (include complete names, titles, and affiliations whenever possible).
    d. Consultant office staff
    e. Landowners (site or abutters)
    f. Note time of arrival and departure of individuals visiting the site.
10. Examples of the field information to be recorded include time of occurrences.
    a. General site work activities
    b. Subcontractor progress
    c. Type and quantity of monitoring well construction materials used
    d. Use of field data sheets or electronic logging equipment (i.e., boring logs, monitoring well sampling logs, etc.)
    e. Ambient air monitoring data

f. Locations and descriptions of sampling points
g. Sample media (soil, sediment, groundwater, etc.)
h. Sample collection method
i. Number and volume of sample(s) collected and sample bottle preservatives used
j. Sample identification number (s) and date and time of sample collection
k. Approximate volume of groundwater removed before sampling
l. Field observations
m. Any field observations made such as pH, temperature, turbidity, conductivity, water level, etc.
n. References for all maps and photographs of the sampling site(s)
o. Information pertaining to sample documentation such as; bottle lot numbers/ dates and method of sample shipments/chain-of custody record numbers and overnight shipping air bill numbers.
p. Surveying data (including sketches with north arrows)
q. Changes in weather
r. Rationale for critical field decisions
s. Recommendations made to the client representative and PM.

11. Record the following information upon departure.
    a. Include a site sketch or representative site photograph of conditions at the end of the day, if required.
    b. Time
    c. Summarize work completed/work remaining
    d. Place a diagonal line though and sign portions of pages not used or skipped.

Precautions

- Only record facts.
- Do not fail to record an observation because it does not appear to be relevant at that time.
- Identify conditions or events that could affect/impede your ability to observe conditions.
- Do not use spiral notebooks because pages can be easily removed.

References

1. *ASFE Model Daily Field Report* (1991), ASFE, Inc.
2. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

2.3 Daily Activity Report Procedure

Objective

A daily activity report will be generated daily from the field database or field notebook to summarize the activities, observations, and decisions made during the day's fieldwork.

Procedure

At the completion of the day's fieldwork, all pertinent field observations will be recorded in the site database, computer electronic form or on a hard copy paper form. If the electronic database is used, the database will generate the daily activity report that includes all samples collected and submitted to the laboratory for analysis. A daily activity report form is located in **Appendix A**. This report must be completed at the end of the workday. The daily activity report will be forwarded to the PM and site manager once completed. Field reports will be maintained at the site electronically and/or in hard copy form.

Contents of the report should include, at a minimum, the following information:

1. Date, project name, project number/phase/task, and site location.
2. A record of person(s) present at the site during the workday.
3. A brief description of the daily activities performed (e.g., drilled five borings in the overburden).
4. A summary of any significant field observations to include:
    a. A summary of deviation(s) from the work plan or objectives.
    b. A summary of field decision(s) made, who made it/them, and the basis for such decision(s).
    c. Any recommendations that may result from field observations and any actions that resulted from those recommendations.
5. A summary of specific fieldwork completed (e.g. FWSB-01, drilled depth 20 feet).
6. A summary of samples submitted for laboratory analysis.

Precautions

- The daily activity report should be based solely upon information. Any speculation should be clearly noted in the report as such.
- The daily activity report should never be released to anyone other than the PM or client unless explicitly authorized by the PM or client.

2.4 Field Boring Data Logging

Objective

To prepare and record a succinct, accurate representation of subsurface conditions, drilling and soil sampling activities, monitoring well installation details, and borehole abandonment procedures. A completed boring log should contain sufficient information to facilitate the preparation of geologic cross sections, to identify possible contaminant sources or pathways observed, and to offer readers a thorough account of drilling and borehole abandonment procedures.

Procedures

1. All borings will be recorded in a field notebook and/or electronically on a personal data assistant (PDA) in utilizing pLog™ or similar soil logging program. Prior to beginning drilling activities, generic project header information, project staff, subcontractors, and anticipated geologic formations should be entered into the pLog™ database and downloaded to the PDA. If a field notebook is used, then logging will be completed in accordance with procedures described above in subsection 2.2.
2. Complete the log concurrently with drilling procedures (i.e., do not let the driller work faster than your ability to accurately represent the subsurface conditions).
3. If applicable, record the conventional geotechnical parameters during Standard Penetration Testing as per American Society for Testing and Materials (ASTM)-D1586, including blow counts of the hammer per 6-inch increment, total penetration of the split-spoon sampler, and length of the entire sample recovered. Record the weight of the hammer, size of the split-spoon sampler, and distance of the hammer fall.
4. Record the depth at which casing, augers, or drilling equipment are seated and the sizes of the equipment. Be certain to include sizes and seating depths of telescoped casing (if used).
5. Record the time at which each sample is retrieved from the borehole.
6. Record the results of any headspace tests performed on samples collected from discrete depths and also the type of field equipment used.
7. Provide soil descriptions in accordance with soil description procedures located below in Section 5.
8. Use the field book to record any relevant drilling observations that cannot be recorded

on the PDA such as advance rate, water levels, drilling difficulties, changes in drilling method or equipment, amounts and types of any drilling fluids, running sands, and borehole stability.

9. Record the procedures and material used to abandon or seal each borehole upon completion.
10. At the completion of the day's activities, download the PDA to the database and generate, review, and edit (if necessary) the completed boring log. If a field notebook is used, make photocopies of the field notebook at the end of each day.

Precautions

- Electronic files should be backed up daily to prevent loss of data. A hardcopy of the boring logs for work performed each day should be generated as a backup. Hardcopy documents should be backed up also.
- Keep boring logs and rock core logs focused on actual observations. Record only factual information on the logs.

3. Surface Soil Sample Collection Procedure

The following surface soil sample collection procedure is applicable to the collection of representative surface soil. Alternative methods may be used at the field representative's discretion with the authorization of National Grid and New York State Department of Environmental Conservation (NYSDEC).

Procedure

1. Surface soil samples will be collected at the locations indicated in the site work plan. Sample management is detailed in the QAPP.
2. Samples will be collected using decontaminated stainless steel or disposable sampling equipment.
3. If the selected sampling location is in a vegetated area, the vegetation will be removed over a one square foot area prior to sample collection. The sample will be collected from within the top two (2) inches of the exposed ground surface.
4. Samples will be collected by digging into the soil with a pre-cleaned stainless steel trowel or disposable sampling equipment.
5. All samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory. Sample containers for volatile organic analysis will be filled first. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated steel trowel or disposable scoop. This composite sample will be analyzed for all remaining parameters identified in the site work plan.
6. All samples collected for analysis will be placed immediately into laboratory sample jars and properly stored in a cooler with ice to 4°C before transport to the laboratory.
7. Duplicate samples will be collected at the frequency detailed in the QAPP by alternately filling two sets of sample containers. Composite samples may be required to obtain a sufficient soil volume.
8. Procedures for geologic logging, sample collection, and field classification are presented in Section 5. In addition, the surface soil sample will be described including:
    - Site;
    - Location number;

- Interval sampled;
- Date;
- Initials of sampling personnel;
- Soil type;
- Color;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

4. Subsurface Soil Sample Collection Procedure

The following subsurface soil sample collection procedure is applicable to the collection of representative subsurface soil using direct push Geoprobe® drilling methods. Conventional hollow-stem auger or resonant sonic drilling technologies may also be used if drilling conditions warrant. Alternative methods may be used at the field representative's discretion with the authorization of National Grid and New York State Department of Environmental Conservation (NYSDEC).

4.1 Sampling Methods

Location, equipment, and sampling situations will dictate the applicable method of sample collection for each boring location. Borings will generally be accomplished through the use of one of the following samplers or techniques:

- Geoprobe® Drilling Techniques
- Conventional Hollow-Stem Auger Drilling Methods
- Resonant Sonic Drilling Methods
- Cone Penetrometer Test Drilling Methods

These samplers and sampling techniques will result in the collection of representative samples.

4.2 Sample Interferences

Proper sampling procedures will be used to collect samples in accordance with the standard operating procedures (SOP) to prevent cross contamination and improper sample collection. Common causes of sample interferences are listed below to ensure that the samplers can avoid potential sample collection problems.

1. Cross Contamination: Eliminated or minimized through the use of dedicated or disposable sampling equipment where appropriate. Where the use of dedicated or disposable sampling equipment is not possible or practical, the equipment will be decontaminated in accordance with the SOP for Decontamination of Field Sampling Equipment is located in Section 10.

2. Improper Sample Collection: Typical improper sample collection techniques include:
    - Improper decontamination of sampling equipment
    - Use of sampling equipment or sample containers that are not compatible with the contaminants of concern or the laboratory analytical method.
    - Sample collection in an obviously disturbed or non-representative area.

4.3 Equipment/Apparatus

Equipment needed for collection of subsurface soil samples may include (depending on technique chosen):

- Geoprobe® Sampling Apparatus
- Rotary Hollow-Stem Auger Sampling Apparatus
- Rotosonic Sampling Apparatus
- Stainless Steel Sampling Tools
- Laboratory Provided Sample bottles
- Resealable plastic bags
- Ice
- Coolers, packing material
- Chain of Custody (COC) records, custody seals
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Tape measure
- Digital Camera
- Field data sheets/Logbook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal protective equipment (PPE)

4.4 Subsurface Soil Sample Procedure

Subsurface sampling will be conducted in accordance with the following general procedures and specific guidance for the methods discussed below.

4.4.1 General Procedures

Prior to sampling, New York City and Long Island One Call will be contacted and an accurate utility mark out will be established as described in subsection 2.1. If drilling on private property, then a private mark out company may be contracted to identify any subsurface utilities or obstructions prior to sample collection.

At each location, plastic sheet, plywood sheet, or other suitable cover will be placed around the augers during conventional hollow stem auger drilling rig to contain soil cuttings.

Procedures for geologic logging, sample collection, and field classification are presented in Section 5.

If a boring exhibits the presence of non-aqueous phase liquid (NAPL), drilling will proceed until signs of the free and residual product are no longer visible in accordance with the work plan and the limitations of the drilling equipment. Any deep drilling through nearby impacted zones will ensure that there is no vertical communication caused by the drilling. Specifically, the upper impacted units may be cased and grouted into a lower, more confining unit, if encountered.

All the borings will be backfilled using a tremie pipe from the bottom to the top of the bore hole with cement/bentonite grout in accordance with NYSDEC guidelines for standard grout mixtures:

- One 94-pound bag Type I Portland cement
- 3.9 pounds powdered bentonite
- 7.8 gallons potable water

The boring will be grouted to the surface and allowed to cure overnight. If excessive settling is observed in the borehole due to seepage of the grout into the formation, then additional grout may be applied. The surface conditions including any asphalt/concrete surface will then be restored to its original condition.

All borings performed in the canal will be backfilled using a tremie pipe from the bottom to the top of the hole with a grout mixture suitable for saltwater. The mixture is intended to prevent platelet flocculation and will be proportioned as follows: 1 pint LIQUI-TROL™, 16 pounds ZEOGEL®, 5 pounds powdered bentonite, and 40 gallons potable water.

Investigation derived wastes will be handled as specified in investigation-derived waste handling procedure located in Section 12.

4.4.2 Direct Push Geoprobe® Procedures

For direct push Geoprobe® methods, discrete soil samples will be collected from each boring using a 4-foot or 5-foot close piston Macro-Core® sampler configuration. Macro-Core® will be advanced to the beginning of the intended sample interval, the piston will be released, and the Marco-Cores® will be driven to the end the intended sample interval. This method will ensure that sampling of "slough" does not occur. The Macro-Core® will then be retrieved and the collected soil core will be extruded from the sampler along with the liner. After decontamination, the Macro-Core® sampler will be re-assembled using a new liner. The

Macro-Core®, rods and other sample collection equipment will be decontaminated as indicated below in subsection 10.2.2.

4.4.3 Rotary Hollow Stem Auger Procedures

For rotary hollow-stem auger methods, split-spoon sampling will be conducted in accordance with ASTM Specification D-1586-84 for standard penetration test and split barrel sampling. Soil samples will be collected continuously through split-spoon sampling methods at the boring location. Split spoon samples will be collected ahead of the lead auger flight. Upon collection of each split spoon sample, the lead auger will be advanced over the sampled interval prior to collection of the next split spoon sample. This method will ensure that "double-spooning" ahead of the augers does not occur. In addition, while the augers are being advanced a temporary auger plug will be placed at the bottom of the lead auger to minimize or eliminate the potential for formation materials to run up into the augers. The use of an auger plug will help assure that split spoon samples are representative of in-situ formation materials. Split-spoons will be decontaminated after each sample is collected as indicated below in subsection 10.2.2.

4.4.4 Rotosonic Procedures

For rotosonic methods, soil samples will be collected utilizing a stainless steel core barrel that is advanced utilizing resonant sonic energy. A larger diameter casing is then advanced over the core barrel. The core barrel is retrieved to the surface for sample extrusion. Core samples will be taken directly from the core barrel by extruding it into a plastic baggie-like sleeve, stainless steel tray, or retained in a clear plastic liner. The core barrel will be cleaned with tap water following each use. The field geologist will classify and sample the soil located within the liner. Upon completion, the excess soil will be placed into a 55-gallon drum for disposal and the inner liner properly disposed as indicated in 13. The core barrel will then be advanced within the isolation casing on the same borehole to collect the next soil core interval. The core barrel, casing, and other sample collection equipment will be decontaminated as indicated below in subsection 10.2.2.

4.4.5 Cone Penetrometer Testing

For cone penetrometer testing (CPT) methods, sampling will be conducted in accordance with ASTM Specification D-5778-07 for electronic friction cone and piezocone penetration testing of soils. During CPT work, soil parameters including: cone bearing / tip resistance (q_c), sleeve friction (f_s), both of which are used to calculate the friction ratio (Rf), and pore water pressure (U) will be continuously measured, at five centimeter intervals, as the cone penetrometer is advanced into the ground.

References

1. New York State Department of Environmental Conservation, Division of Environmental Remediation, 2003. *Groundwater Monitoring Well Decommissioning Procedures*. NYSDEC, April, 2003.
2. ASTM, 1997. *D1586-84 (1992) Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.* ASTM, West Conshohocken, PA. 1997.
3. ASTM, 2007. *D5778-07 (2007) Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils.* ASTM, West Conshohocken, PA. 2007.

4.5 Shelby Tube Sampling

Shelby tube samples will be collected in accordance with the latest revision of ASTM D/587. When the desired sampling depth is reached, the hollow-stem auger or casing will be cleaned out using whatever method is preferred so as not to disturb the material to be sampled. The Shelby tube will be lowered to the bottom of the borehole, then advanced (pushed) via pressure without rotation by a continuous relatively rapid motion until 24 inches of penetration is achieved. At the discretion of the field geologist, a period of approximately 10 minutes, measured from the time of insertion, will be allowed to provide for sample adhesion to the tube walls. Prior to removal, the tube may be rotated two complete revolutions to shear the bottom of the sample from the native material.

Upon removal, the field geologist will log the tops and bottoms of the sample for soil classification. Samples recovered via Shelby tube will be preserved in conformance with the latest revision of ASTM D 4220. To preserve the natural moisture content of the samples, the tube ends will be sealed with a minimum of 0.50 inch of paraffin wax. Plastic slip caps will be applied at the ends of the sample tube, taped, then dipped and sealed in wax.

5. Soil/Sediment Description Procedure

The following soil description procedure is applicable for use in describing surface and subsurface soils. This procedure may be varied or changed as required, dependent upon site conditions and equipment limitations. Any deviation from this standard will be documented in the field-sampling book and in the final report.

5.1 Description Method

All soils will be described using the Unified Soil Classification System/ASTM D2488. The use of one standard will allow continuity of sampling descriptions between sample locations and personnel.

5.2 Sample Interferences

Proper handling of cores while recording descriptions will be used to ensure that handling does not affect sample collection or cause cross contamination within the core sample.

Cross Contamination: Eliminated or minimized with dedicated or disposable sampling equipment where appropriate. Where the use of dedicated or disposable sampling equipment is not possible or practical, the equipment will be decontaminated in accordance with the procedure for the decontamination of field sampling equipment located below in Section 10.

5.3 Equipment/Apparatus

Equipment needed for description of soil samples may include:

- Stainless steel sampling tools
- Decontamination equipment/supplies
- Safety equipment
- Tape measure
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent marker
- PPE

5.4 Soil Sample Description Procedure

The sampling procedure is as follows:

All soils are to be logged using ASTM D2488 *Standard Practice for Description and Identification of Soils*. The description of each sample interval should be prepared as follows:

1. The specific intervals for description should be noted for each sample. The description should not necessarily be for the entire subsurface soil interval. Geologic horizons, small-scale units, or other changes in soil conditions within the subsurface soil sample should be identified and described separately.
2. Soil description should include particular notes if the field representative believes that there is a possibility the soil sample being described is not representative of the interval sampled.
3. The following data will be recorded on the sample collection method, if applicable:
    a. Method of collection, hollow stem auger, rotosonic, Geoprobe®, etc.
    b. Interval sampled vs. amount recovered.
    c. Blow counts, weight of hammer, and hammer free fall distance for split spoon samplers, if used.
4. For course grained soils with less than 50% fines:
    a. GROUP NAME (SYMBOL), Structure, % Gravel Sand and Fines in order of predominance, % Cobbles and/or boulders (by Volume), Maximum Particle Size, Other (moisture, depositional descriptions, representativeness), Color, Local or Geologic Name, environmental/geologic descriptions.
5. For fine grained soils with greater than or equal to 50% fines:
    a. GROUP NAME (SYMBOL), Structure, Plasticity, Plasticity characteristics (if performed), % Gravel Sand, and size ranges, Other (moisture, depositional descriptions, representative nature), Color, Local, or Geologic Name, Field Soil Strength measurements (if performed), environmental/geologic descriptions.
6. Specific descriptions of each of the above description categories are described in **Appendix B** or below.
7. Soil moisture will be described as Dry, Moist, or Wet.
8. Soil color will be described using the color chart in **Appendix B**. Colors may be combined: e.g., red-brown. Color terms should be used to describe the "natural color" of the sample as opposed to staining caused by contamination.

9. The representative nature of the sample interval should be noted if there is a possibility the soil sample being described is not representative of the interval sampled.

10. Visual evidence of contamination should be described in the sample log with the specific depths or depth intervals where the contamination was noted. Descriptions of visual, olfactory, and product observed should conform to the following standards.
    a. **Sheen** - iridescent petroleum-like sheen. Not to be used to describe a "bacterial sheen" this can be distinguished by its tendency to break up on the water surface at angles, whereas petroleum sheen will be continuous and will not break up. A field test for sheen is to put a soil sample in a jar of water and shake the sample (jar shake test), then observe the presence/absence of sheen on the surface of the water in the jar.
    b. **Stained** - used w/color (i.e., black or brown stained) to indicate that the soil matrix is stained a color other than the natural (non-impacted) color of the soil.
    c. **Coated** - soil grains are coated with tar/free product – there is not sufficient free-phase material present to saturate the pore spaces.
    d. **Blebs** - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically, this is residual product.
    e. **Saturated** - the entirety of the pore space for a sample is saturated with the tar/free product. Care should be taken to ensure that you are not observing water saturating the pore spaces if you use this term. Depending on viscosity, tar/free-phase saturated materials may freely drain from a soil sample.
    f. **Oil**. Used to characterize free and/or residual product that exhibits a distinct fuel oil or diesel fuel like odor; distinctly different from MGP-related odors/impacts.
    g. **Tar**. Used to describe free and/or residual product that exhibits a distinct "coal tar" type odor (e.g., naphthalene-like odor). Colors of product can be brown, black, reddish-brown, or gold.
    h. **Solid Tar**. Used to describe product that is solid or semi-solid phase. The magnitude of the observed solid tar should be described (e.g. discrete granules or a solid layer).
    i. **Purifier Material**. Purifier material is commonly brown/rust or blue/green wood chips or granular material. It is typically associated with a distinctive sulfur-like odor. Other colors may be present.
    j. **Olfactory Descriptors.** Use terms such as " tar-like odor" or "naphthalene-like odor" or "fuel oil-like odor" that provide a qualitative description (opinion) as to the possible source of the odor. Use modifiers such as strong, moderate, faint to indicate intensity of the observed odor.

k. **Dense Non-Aqueous Phase Liquid (DNAPL)/Light Non-Aqueous Phase Liquid (LNAPL).** A jar shake test should be performed to identify and determine whether observed tar/free-phase product is either denser or lighter than water. In addition, MGP residues can include both light and dense phases - this test can help determine if both light and dense phase materials are present at a particular location.

l. **Viscosity of Free-Phase Product** – If free-phase product/tar is present, a qualitative description of viscosity should be made. Descriptors such as:

Highly viscous (e.g. taffy-like)
Viscous (e.g. No. 6 fuel oil or bunker crude like)
Low viscosity (e.g. No. 2 fuel oil like)

11. A photo ionization detector or flame ionization detector (PID/FID) will be used to screen all soil samples at the core location at 6 to 12-inch intervals. This screening data may be used to aid in selection of specific analytical sampling intervals. In addition, the PID or FID will be used to screen samples using the jar headspace method described below in subsection 5.5. The maximum readings from the jar headspace screening will be recorded and included on the logs. PID or FID will be calibrated daily at a minimum.

5.5 Soil Screening Procedure

The objective of field screening of soils is to measure the relative concentrations of volatile organic compounds (VOCs) present in soil at the project site. This information can be used to: 1) segregate soil based upon the degree of impacts, 2) to identify samples for laboratory analysis of VOCs, and 3) as a qualitative method to evaluate the presence or absence of VOCs in soils. A PID or FID may be used.

Procedure

1. Prior to sampling event, the instrument must be calibrated to the appropriate standard and have the appropriate detector for the contaminants expected to be encountered at the site. The type of standard and detector to be used is indicated in the QAPP.
2. Record background readings of atmospheric conditions in the work area while walking across the work area. The highest meter response should be recorded in the field notebook.
3. Fill a clean, glass jar approximately half way with soil. Use a clean stainless steel sampling implement. Quickly cover the top of the jar with a sheet of aluminum foil

and affix the lid to the jar. Each jar should be labeled to indicate the sample location and depth from which the sample was collected.

4. Allow the soil to volatilize for at least 10 minutes. Shake vigorously at the beginning and at the end of the headspace development period. If ambient temperatures are below 50 °F, headspace development should occur, if possible, with a heated area.
5. After headspace development, gently remove the screw cap and expose the foil seal. Quickly puncture the foil seal with the instruments tip to approximately ½ of the headspace depth.
6. Following the probe insertion through the foil seal, record the highest meter response as the jar headspace concentration. Maximum response should occur within 3 to 5 seconds after probe insertion.

Precautions

- Follow safety procedures defined within the Fulton Municipal Works MGP Site Health and Safety Plan (HASP).
- The various instruments may work poorly in rain, high humidity, or in cold temperatures. In these instances, headspace readings will be completed in dry or warm areas.
- Care must be taken to prevent water or soil particulates from entering the tip of the instrument. If this occurs, the probe tip should be cleaned before further use.
- While establishing background conditions and performing jar headspace screening, care should be taken to avoid extraneous VOC sources such as vehicle emissions or other organic vapor sources.

5.6 Air Monitoring Procedure

Air monitoring will be conducted as specified in the Final PDI Work Plan and the HASP dated March 2012 that is provided as part of the Final PDI Work Plan. Air monitoring will be conducted utilizing a PID during all intrusive subsurface soil-sampling activities. A multiple gas meter will be used to monitor will be used to monitor for total VOCs, hydrogen cyanide, hydrogen sulfide, lower explosive limit (LEL) and percent oxygen during intrusive subsurface soil sampling activities. During subsurface soil sampling, particulate monitoring will be conducted with a personal mini-ram digital particulate meter up wind and downwind of the work zone. All monitoring equipment will be calibrated at the beginning of the day and more frequently, if needed, with manufacturer specified calibration gas.

5.7 Quality Assurance/Quality Control

There are no specific QA activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

5.8 Sample Labeling Procedure

All samples collected will be labeled in accordance with the table listed below.

PRIMARY SAMPLES TYPES	QA/QC SAMPLE TYPES
SOIL SAMPLES	**FIELD BLANKS**
Surface Soil-ID (SAMPLE DEPTH-FEET)	SAMPLE-ID – [DATE]
FW-SS-XX (0-0.2)	FW-SS-FB-033107
Boring -ID (SAMPLE DEPTH-FEET)	FW-SB-FB-033107
FW-SB-101 (X-X)	FW-MW-FB-033107
GROUNDWATER SAMPLES	FW-GW-FB-033107
Monitoring Well-ID	**MATRIX SPIKE/DUP**
FW-MW-24	SAMPLE [ID] [DEPTH] [EITHER MS OR MSD]
Temporary Groundwater Monitoring Point-ID	FW-SS-01 (10-15) MS/MSD
(SAMPLE DEPTH-FEET)	FW-SB-01 (10-15) MS/MSD
FW-GW-XX (X-X)	FW-MW-01 (10-15) MS/MSD
SOIL VAPOR SAMPLES	FW-GW-01 (10-15) MS/MSD
Soil Vapor Point-ID	**TRIP BLANKS**
FW-SV-XX	SAMPLE- ID [DATE]
AMBIENT AIR SAMPLES	FW-TB-063007
Indoor Air	**BLIND DUPLICATES**
FW-IA-XX	SAMPLE -ID[XX][DATE]
Outdoor Air	FW-SS-XX-063007
FW-OA-XX	FW-SB-XX-063007
	FW-MW-XX-063007
	FW-GW-XX-063007

In addition to the information listed above, each sample will be labeled with the date and time the sample was collected, laboratory analysis requested, initials of the sampler(s), and the project number. Sample handling procedures are located in the QAPP.

References

1. ASTM *D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).* ASTM International, West Conshohocken, PA.
2. ASTM *D 2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).* ASTM International, West Conshohocken, PA.

6. Test Pit Excavation

The following test pit soil sample collection procedure is applicable to the collection of representative subsurface soil using a backhoe. Alternative methods may be used at the field representative's discretion with the authorization of KeySpan and NYSDEC.

6.1 Test Pit Specifications

Test Pits will be installed according to the following specifications:

1. When specified in the site work plan, test pits will be excavated using a rubber-tired backhoe. In the event deep excavations are required, a track hoe will be utilized.
2. Locations of test pits will be finalized in the field, based on the location of potential source areas and existing underground utilities.
3. If the prospective test pit location is covered by asphalt or concrete, the area will be saw cut prior to excavation.
4. During excavation activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring will be conducted in accordance with the HASP.
5. Test pit materials will be visually described, as well as photographed for future reference.
6. Material removed from the test pit will be placed on polyethylene sheeting.
7. Should sampling of excavated material be performed, samples will be collected from the stockpiled material and/or the backhoe bucket.
8. Upon completion, the materials from the test pit will be placed back in the excavation in the reverse order in which it was excavated.
9. Visually clean soils, such as surface soils, will be segregated from soils that may be impacted. The visually clean soils will be used to cover the impacted soils/source materials when placed back in the excavation.
10. Test pits will be backfilled as soon as possible after completion. No test pit excavation will remain open overnight.
11. For gravel roadways and parking areas, the backfill will be tamped down in 18-inch lifts. A six (6) inch layer of clean run of crushed gravel will be tamped in-place as the final lift. For test pits located in asphalt-covered areas, the surface will be

replaced with cold or hot asphalt mix, compacted by rolling, and trimmed flush with the adjoining surface. Test pits located in grassed areas will be reseeded.

12. Following restoration of the excavation, the test pit will be staked to facilitate subsequent location by surveying crews, if necessary.

13. If during test pit activities a pipe or other buried utility is encountered, excavation will cease, the orientation and dimensions will be recorded, the test pit backfilled and a new test pit attempted in the general vicinity of the initial location. If a pipe or underground utility is accidentally severed, the owner of the utility, then KeySpan, will immediately be notified. Liquid flows or electricity will be shut off immediately and appropriate repairs initiated as soon as possible. If a release of liquid occurs, the Consultant/Contractor PM will notify KeySpan who will then notify NYSDEC. Appropriate response actions will be implemented.

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

7. Monitoring Well Installation and Development

Monitoring wells will be installed at the completion of the soil boring installation; all permanent wells will be developed prior to the collection of groundwater samples. The following procedures will be used to install and develop all permanent monitoring wells.

7.1 Monitoring Well Specifications

Monitoring wells installed in unconsolidated deposits that do not penetrate a presumed confining layer will be constructed according to the following specifications:

1. Install polyvinyl chloride (PVC) 1.5-inch pre-packed or 1 or 2-inch diameter, threaded, flush-joint casing, and 1.5-inch pre-packed or 1 or 2-inch diameter inner diameter screens.
2. Wells will be screened in the unconsolidated deposits. Screens will be 10 feet in length, and slot openings will be 0.010 inch. Alternatives may be used at the discretion of the field geologist, based on site-specific geologic conditions.
3. If appropriate, a sump, at least 2 feet in length, may be attached to the bottom of the screen to collect DNAPLs.
4. Where appropriate, the annulus around the screens will be backfilled with clean silica sand (based on Site-specific geologic conditions and screen slot size) to a minimum height of 1 to 2 feet above the top of the screen.
5. Where appropriate a bentonite pellet seal or bentonite slurry will be placed above the sand pack. If a pellet seal is used, it will be allowed to hydrate for at least 30 minutes before placement of grout above the seal. Where possible, the bentonite pellet seal will be a minimum of 24-inches in depth, except in those instances where the top of the well screen is in close proximity to the ground surface. In these instances, the well will be completed in accordance with specifications provided by the field geologist who will incorporate an adequate surface seal into the well design.
6. The remainder of the annular space will be filled with a cement grout up to the ground surface. The grout will be pumped from the bottom up. The grout will be mixed in the following relative proportions: One 94-pound bag Type I Portland cement, 3.9 pounds powdered bentonite, and 7.8 gallons potable water. The grout will be allowed to set for a minimum of 48 hours before wells are developed.
7. The top of the casing will be finished using flush-mount casings with keyed-alike locks.

8. A concrete surface pad (2 feet x 2 feet x 6 inches) will be sloped to channel water away from the well casing.

9. A weep hole will be drilled at the base of the protective standpipe casing to allow any water between the inner and outer casing to drain.

10. The top of the PVC well casing will be marked and surveyed to 0.01 foot, and elevations will be determined relative to a fixed benchmark or datum. The measuring point on all wells will be on the innermost PVC casing.

11. Characteristics of each newly installed well will be recorded in the field notebook. A monitoring well checklist is shown on Figure 1 and a generic overburden well monitoring diagram is shown on Figure 2 attached within **Appendix C**.

Monitoring wells that penetrate a confining layer will be installed via double/ isolation casing.

A typical double-cased monitoring well construction diagram for wells installed in unconsolidated soils that penetrate a presumed confining layer is located in **Appendix C**. The decision to install double-cased wells will be made on a boring-specific basis by the field geologist. Double-cased wells will be installed when the boring for the monitoring well penetrates a presumed confining layer. The confining layer shall be defined as a minimum five (5) foot thick, predominantly clay unit that has been shown to be laterally continuous across the Site. In the event the field geologist, National Grid, and NYSDEC PMs decide a reasonable possibility exists for contamination to be deposited in deeper, clean zones during the drilling and installation of a monitoring well, the well will be double-cased. The purpose of the steel protective casing will be to minimize the possibility that residual contamination is deposited at the depth of the screened interval during the drilling process.

Monitoring wells that penetrate confining layers will be installed according to the following specifications:

- 6-inch inner diameter (ID) steel outer casings will be installed to a depth of at least 2 feet below the lower limit of observed or measured contamination and/or the confining layer. This casing will be grouted in place with cement or sealed by alternate methods approved by the NYSDEC to inhibit downward migration of contamination.

- The 6-inch casing will be installed through 6.25-inch ID hollow-stem augers. The augers will be filled with grout prior to their removal to ensure the integrity of the borehole and the grout seal. Then, the 6-inch casing will be installed into the grout and hydraulically pushed approximately 1-foot beyond the bottom of the boring. Potable water will be tremied to the bottom of the inside of the casing to dilute the

grout, thereby allowing the grout to be more easily pumped out of the casing. The grout pumped out of the casing will be drummed and staged with other investigation-derived waste (IDW). Alternate isolation methods may be used as approved by the NYSDEC.

- The cement-bentonite grout remaining in the annulus between the casing and the formation will be allowed to set for at least 24 hours before drilling is continued. The drilling will then continue using a 4-inch diameter flush-joint spin casing or other appropriately sized drill casing and potable water. All lubricant water will be containerized.

The well will be constructed of 2-inch diameter PVC or stainless steel riser pipe and screen, sand pack, bentonite seal, grout, and surface casing as specified for single cased monitoring wells and in accordance with NYSDEC requirements. The bentonite seal may consist of pellets or a mixture of bentonite slurry and sealed with grout. The grout will be mixed in the following relative proportions: One 94-pound bag Type I Portland cement, 3.9 pounds powdered bentonite, and 7.8 gallons potable water. The grout will be allowed to set for a minimum of 48 hours before wells are developed.

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

7.2 Monitoring Well Development

After a minimum of 48 hours after completion of permanent monitoring wells, one or a combination of the following techniques will be used in the monitoring well development:

1. Surging;
2. Bailing;
3. Using a centrifugal pump and dedicated polyethylene tubing; and/or
4. Positive displacement pumps and dedicated polyethylene tubing.

Development water will initially be monitored for organic vapors with a PID. In addition, the development water will be observed for the presence of non-aqueous phase liquids NAPLs or sheens. The development water will be contained in a tank and/or 55-gallon steel drums on-site. The purge water will be disposed of in accordance with NYSDEC requirements. The wells will be developed until the water in the well is reasonably free of visible sediment (<50 nephelometric turbidity units (NTU) if possible). Well development will not exceed 10 well volumes. Following development, wells will be allowed to recover

for at least two weeks before groundwater is purged and sampled. All monitoring well development will be overseen by a field representative and recorded in the field logbook.

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

7.3 In-Situ Hydraulic Conductivity Testing

In-situ hydraulic conductivity testing may be performed on selected monitoring wells as indicated in the site work plan to obtain estimates of groundwater velocities and potential groundwater recovery rates for the aquifer. The objective of the hydrogeologic testing is to determine the hydraulic properties of the aquifer in the vicinity of the Site.

Slug tests may be conducted in selected monitoring wells utilizing the rising or falling head slug test technique. Rising head tests can be performed in unconfined and confined aquifers. Falling head tests should only be performed in confined aquifers. The slug tests will be performed by subjecting water-bearing units in the screened interval to a stress caused by the sudden displacement of the water level within the well. The rising head tests will be conducted as follows:

1. Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 10.
2. Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electronic water level indicator and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
3. A weighted slug of known volume will be inserted gently into the well below the water table. The water level will be measured until the water level returns to static conditions.
4. The slug will be suddenly withdrawn from the well and the water level recovery will be monitored at appropriate intervals until recovery is complete and stabilized.
5. Wells that were bailed dry during development may not be able to provide meaningful data through slug tests. Tests will be terminated in wells that do not recover significantly (>80% of static level) within one hour. These wells will be bailed dry and their recovery measured with an electronic water level indicator.

The falling head tests will be conducted as follows:

1. Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 10.
2. Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electronic water level indicator and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
3. A weighted slug of known volume will be quickly inserted into the well below the water table. The water level will be measured until the water level returns to static conditions.
4. The test will be terminated in wells that do not recover significantly (>80% of static level) within one hour.

The slug test data will be analyzed using either the Cooper, Bredehoeft, and Papadopulos (1967) type curve method or the Bouwer and Rice (1976, 1989) method. The Cooper et al. analysis assumes that the well penetrates a confined aquifer, and the Bouwer and Rice method applies where unconfined conditions are prevalent.

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

8. Groundwater Sampling Procedure

The following is a step-by-step sampling procedure to be used to collect groundwater samples from the monitoring wells and temporary groundwater monitoring points. Well sampling procedures will be recorded in the field notebook. Sample management is detailed in the QAPP.

1. Groundwater samples will not be collected until at minimum, two weeks following well development of permanent wells.

2. Prior to sampling, a round of groundwater elevation measurements will be collected. The measurements will be made from the surveyed well elevation mark on the top of the inner PVC casing with a decontaminated electric water/product level probe. The measurements will be made in as short a period as practical to minimize temporal fluctuations in hydraulic conditions. The time, date, and measurement to nearest 0.01 foot will be recorded in the field logbook. The water probe will be decontaminated between measurements.

3. Place a plastic sheet on the ground to prevent contamination of the bailer rope and/or the tubing associated with the purging (pump) equipment.

4. Each monitoring well will be purged with a centrifugal, submersible, peristaltic, or whale pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist, and with the prior approval of National Grid and NYSDEC.

5. Monitoring wells will be purged at a rate to minimize drawdown within the well to the extent practicable.

6. The water quality parameters of temperature, pH, conductivity, salinity, oxygen reduction potential, turbidity, and dissolved oxygen (DO) will be measured and recorded, at 3 to 5 minute intervals with a multi-parameter water quality probe. At least, one well volume of water will be removed prior to sampling. When the parameters stabilize over three consecutive readings, sampling may commence. Stability is achieved when pH is within 0.1 standard unit, temperature is within 0.5ºC, Eh is within 10% and specific conductivity is within 10% for three consecutive readings. Record results in the field logbook prior to sample collection.

7. Collect VOC samples with a dedicated polyethylene bailer lowered by a dedicated polypropylene rope or other methods as indicated. Other parameters may be collected with a submersible or peristaltic pump using the low-flow sampling technique. The pump should be capable of throttling to a low flow rate suitable for sampling.

8. If the well goes dry before the required volumes are removed, the well may be sampled when it recovers sufficiently.

9. After all samples are collected, the water level in the monitoring well will be gauged and the locking cap will be re-installed.

10. Investigation derived water will be stored in 55-gallon drums, roll-off or frac tank. PPE will be disposed of dedicated disposable sampling equipment in garbage bags or stored in 55-gallon drums

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.
2. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples From Monitoring Wells*, published July 30, 1996 by the United States Environmental Protection Agency (EPA).

9. Soil Vapor and Indoor Air Sampling Procedure

9.1 Soil Vapor Sample Collection

This set of procedures outlines the general steps to collect soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

9.1.1 Soil Vapor Probe Installation

Permanent and temporary soil vapor probes will be installed using the procedure outlined below:

- Record weather information (temperature, barometric pressure, rainfall, wind speed, and wind direction). Record substantial changes to these conditions that may occur during the course of the probe installation. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Install soil vapor probes using a direct-push drill rig (e.g., GeoProbe® or similar) or manually using a slide hammer. Probes will consist of stainless-steel drive points with stainless steel screens attached to food-grade (inert) Teflon or polyethylene tubing through which the soil vapor sample will be drawn.
- Attach the drive points to a drive rod (stainless-steel tube) and drive the rod to the target depth, as define in the work plan.
- Withdraw the drive rods from the hole, leaving the drive point and tubing.
- Place filter pack material, such as glass beads or clean silica sand, in the annular space surrounding the tubing directly above the sample point to a height of approximately 1 to 2 feet. The depth of the filter pack material should always be adequate to prevent the bentonite slurry above from going over the drive point and sample inlet screen.
- Place bentonite slurry in the annulus above the filter pack material to provide a seal in the borehole. Ideally, place the bentonite annular seal at least 3 feet thick, although adjustments to this thickness may be required based on site-specific conditions. The entire borehole must be filled to the ground surface with either entirely bentonite or with natural fill between two bentonite seals (one above the filter pack material and

one at the ground surface). Permanent installations must have a surface seal made of cement or cement/bentonite grout.

- For permanent installations, install flush-mounted protective covers to protect the probe and the tubing.
- Cut the end of the tubing to allow proper closure of the flush-mounted protective cover, but with a sufficient length of tubing exposed at the surface to facilitate connection of sampling equipment.
- Close or cap the sample tubing following installation and following collection of each sample.

9.1.2 Collection of Soil Vapor Samples

Collecting soil vapor samples will be accomplished by using the following procedure:

- Record weather information (i.e., temperature, barometric pressure, rainfall, wind speed, and wind direction) at the beginning of the sampling event. Also, record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Identify sampling locations on a plot plan that also identifies buildings, other landmarks, and potential sources of VOC contamination to both the surface and outdoor air. Record the depth of the probe screen below grade.
- If necessary, connect additional tubing to the tubing extending from the soil vapor probe to allow for connection to sample collection equipment.
- Calculate the volume of air in the probe, tubing (volume = $\pi r^2 h$), including any additional tubing added in the step above and the annular space between the probe and the native material if sand or glass beads were used.
- Connect a vacuum pump or gas-tight syringe (~60 cubic centimeters [cc]) to the sample tubing. At a flow rate of no more than 0.2 liter per minute (lpm), purge air from the tubing until one to three of the above-calculated air volumes are removed.
- During purging, evaluate the potential for ambient air to be introduced in the soil vapor sample through the annulus of the soil vapor probe or tubing connections using a tracer gas such as helium. The procedures for the tracer gas evaluation are described below. Note that the bentonite used in the probe installation should have

sufficient time to seal before the samples are collected. The tracer gas evaluation will verify if the seal is sufficient.

- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the soil vapor sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as identified in the project-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be batch certified as clean by the laboratory.
- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.
- Connect the tubing from the soil vapor probe to the flow controller.
- Completely open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.

- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).
- Provided that no additional sampling is expected to be conducted, either pull out (if practical) or abandon in place the sampling probe. When abandoning, cut the tubing back as far down as practical and cover to surface with native soil.

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15.

9.1.3 Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the soil vapor probe seal and assess the potential for introduction of ambient air into the soil vapor sample. A tracer gas evaluation should be conducted on all soil vapor probes. After the initial round of sampling and with the approval of the regulating agency, the use of tracer gas may be reduced to a minimum of 10 percent for permanent and semi-permanent probes if the initial round results showed installations with competent seals.

The following tracer gas evaluation procedure uses in-field tracer gas measurements and tracer gases (e.g., helium) that can be measured by portable detectors.

- Retain the tracer gas around the sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. A tracer gas detector will be attached to the valve fitting at the bottom of the chamber to verify the presence of the tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >50%.

- The chamber will have a gas-tight fitting or sealable penetration to allow the soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract soil vapor at a rate of no more than 0.2 lpm. Purge the tubing using the pump. Calculate the volume of air in the tubing and probe and purge one to three tubing/probe volumes prior measuring the tracer gas concentration.
- Use the tracer gas detector to measure the tracer gas concentration in the pump exhaust.
- Record the tracer gas concentrations in the chamber and in the soil vapor sample. If the evaluation indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement of the sample collection. A nondetectable level of tracer gas is preferred; however, if the evaluation indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

9.2 Sub-Slab Soil Vapor Collection

This set of procedures outlines the general steps to collect sub-slab vapor samples. The Final PDI Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

9.2.1 Sub-Slab Vapor Probe Installation

Temporary sampling probes will be installed using the following procedures:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- If appropriate, record weather information (temperature, barometric pressure, rainfall, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).

- Identify sampling location(s) on a floor plan that also identifies any slab breeches (e.g., utility penetrations, sumps, drains, and cracks) and locations of HVAC equipment.
- Insert a section of food-grade (inert) Teflon® or other appropriate tubing through a 3/8-inch (approx.) hole drilled through the slab. If necessary, advance the drill bit 2 to 3 inches into the sub-slab material to create an open cavity.
- Install the tubing inlet to the specified sampling depth below the slab, not to exceed 2 inches.
- Seal the annular space between the hole and tubing using 100% beeswax or another inert, non-shrinking sealing compound such as permagum.

9.2.2 Sub-Slab Vapor Sample Collection

Sub-slab vapor samples will be collected by following the steps outlined below.

- Purge the tubing using a vacuum pump or gas-tight syringe (~60 cc). Calculate the volume of air (volume = $\pi r^2 h$) in the tubing and purge one to three tubing volumes prior to sample collection at a rate no greater than 0.2 liter per minute (lpm).
- Use an evacuated Summa® passivated (or equivalent) canister to collect the sub-slab vapor sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be batch certified as clean by the laboratory.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.
- Connect the tubing from the sub-slab vapor sampling probe to the flow controller.
- Completely open the valve on the canister. Record the time that the valve is opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.

- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical).
- Complete the NYSDOH building survey and chemical survey form.
- Stop sample collection after the scheduled duration of sample collected, but when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).
- For temporary probes, remove the probe and seal the slab hole with cement. Repair flooring, if any.

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

9.2.3 Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the soil vapor probe seal and assess the potential for introduction of ambient air into the soil vapor sample. A tracer gas evaluation should be conducted on all soil vapor probes. After the initial round of sampling and with the approval of the regulating agency, the use of tracer gas may be reduced to a minimum of 10 percent for permanent and semi-permanent probes if the initial round results showed installations with competent seals.

The following tracer gas evaluation procedure uses in-field tracer gas measurements and tracer gases (e.g., helium) that can be measured by portable detectors.

- Retain the tracer gas around the sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. A tracer gas detector will be attached to the valve fitting at the bottom of the chamber to verify the presence of the tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >50%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract soil vapor at a rate of no more than 0.2 lpm. Purge the tubing using the pump. Calculate the volume of air in the tubing and probe and purge one to three tubing/probe volumes prior measuring the tracer gas concentration.
- Use the tracer gas detector to measure the tracer gas concentration in the pump exhaust.
- Record the tracer gas concentrations in the chamber and in the soil vapor sample. If the evaluation indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement of the sample collection. A nondetectable level of tracer gas is preferred; however, if the evaluation indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

9.3 Indoor Air Sample Collection

This set of procedures outlines the general steps to collect indoor air samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sampling locations and other indoor air requirements (inventory, etc.).

Indoor air samples will be collected by following the steps outlined below:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Record weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and indoor temperature and humidity at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Identify sampling location(s) on a floor plan that also identifies locations of HVAC equipment, chemical storage areas, garages, doorways, stairways, sumps, drains, utility perforations, north direction, and separate footing sections
- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the outdoor air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory.
- Place the canister at the sampling location. The sample should be collected from breathing height (e.g., 3 to 5 feet above ground). Either mount the canister on a stable platform or attach a length of inert tubing to the flow controller inlet and support it such that the sample inlet will be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.

- Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical). During monitoring, note the vacuum pressure on the gauge.
- Complete the NYSDOH building survey and chemical survey form.
- Stop sample collection after the scheduled duration of sample collection, but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15.

9.4 Ambient Air Sample Collection

This set of procedures outlines the general steps to collect ambient air samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations and sampling duration.

The following procedures will be followed for the collection of ambient air samples:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Select a location upwind of the building or other area that is being evaluated. If possible, select a location upwind or near the HVAC air intake for the building being sampled.
- Record weather information (i.e., temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the ambient air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory.
- Place the canister at the sampling location. If the sample should be collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet will be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.
- Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.

- Photograph the canister and the area surrounding the canister.
- Document on a field form an outdoor plot sketch that indicates the building being sampled, streets, sampling location, location of potential outdoor air sources, north direction and paved areas. Also record pertinent observations such as odors, readings from field instrumentation, and significant activities in the vicinity that result in air emissions.
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical). During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15.

References

1. *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, New York State Department of Health, October 2006.
2. *Draft Standard Operating Procedure for Soil Vapor Intrusion Evaluations at National Grid Sites in New York State*, National Grid, March 2008.

10. Sediment Sampling Procedure

The following standard sediment sampling procedure is applicable to the collection of representative sediment core samples from the Gowanus Canal. This procedure may be varied or changed as required, dependent upon site conditions and equipment limitations. Any deviation from this standard will be documented in the field notebook and in the final report.

10.1 Sampling Methods

Location, equipment, and sampling situations will dictate the applicable method of sample collection for each point. Sediment sampling will generally accomplished through the use of one of the following samplers or techniques:

- Ponar/Shipek Grab Sampler
- Vibracore Sampler
- Remote Sampler
- Sonic or GeoProbe® Drill Rig and Sampler as specified in Section 4.4
- CPT Drill Rig as specified in Section 4.4

These samplers and sampling techniques will likely result in the collection of representative sediment samples from the Gowanus Canal.

10.2 Sample Interferences

Proper sampling procedures will be used to collect samples in accordance with this SOP to prevent cross contamination and improper sample collection. Common causes of sample interferences are listed below to ensure that the samplers can avoid potential sample collection problems.

1. Cross Contamination: Eliminated or minimized through the use of dedicated or disposable sampling equipment where appropriate. Where the use of dedicated or disposable sampling equipment is not possible or practical, the equipment will be decontaminated in accordance with the SOP for Decontamination of Field Sampling Equipment located in Section 11.

2. Improper Sample Collection: Typical improper sample collection techniques include:
    - Improper decontamination of sampling equipment.
    - Use of sampling equipment or sample containers that are not compatible with the contaminants of concern or the laboratory analytical method.
    - Sample collection in an obviously disturbed or non-representative area.

10.3 Equipment/Apparatus

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- Vibracore Sampling Rig
- Ponar/Shipek Sampler
- Stainless Steel Sampling Tools
- Laboratory Provided Sample bottles
- Resealable plastic bags
- Ice
- Coolers, packing material
- Chain of custody records, custody seals
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Tape measure
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal protective equipment (PPE)
- Global positioning system (GPS)

10.4 Pre-Sampling Procedures

10.4.1 Sample Location

A GPS navigation system will be used to identify and record sample location coordinates. The base station will be located on land based survey control point tied into the New York State Plane coordinate system. If required, the proposed locations may be adjusted based upon access and obstructions.

10.5 Sample Collection

10.5.1 Ponar/Shipek Sampler

Surficial sediment samples will be collected from the upper 6 inches (approximate) using a Ponar or Shipek type grab sampler. Both of these sampling devices have the advantages of being relatively easy to handle and operate, readily available, moderately priced, and versatile in terms of the range of substrate types they can effectively sample. In addition, both of these grab samplers provide sufficient sample volume (7.5 or 3 cubic liters, respectively) to allow sub sampling for multiple analytes.

Careful use of grab samplers is required to avoid problems such as loss of fine-grained surface sediments from the bow wave during descent, mixing of sediment layers upon impact, lack of sediment penetration, and loss of sediment from tilting or washout upon ascent

The sampling procedure is as follows:

1. Prior to sample collection, the grab sampler will be decontaminated.
2. When deploying the grab sampler, the speed of descent should be controlled, with no "free fall" allowed. In deep waters, use of a winching system is recommended to control both the rate of descent and ascent.
3. The sampler will be carefully lowered the last few feet to minimize dispersal of fine material due to a sampler-induced shock wave.
4. At the time of the sample collection, the sample location will be surveyed with GPS survey equipment.
5. After the sample is collected, the sampling device should be lifted slowly off the bottom, and raised to the surface at a slow and steady rate.
6. Sediments in direct contact with sides or teeth of the grab sampler will be excluded from samples to prevent potential contamination from the grab sampling device when possible.
7. Prior to sampling directly from the grab sampler, the overlying water will be removed by opening the jaws of the ponar slightly and allowing the water to drain. If the overlying water is turbid, then the suspended solids will be allowed to settle, if possible, prior to draining.

8. Where sampling directly from the sampler is not possible or feasible, the sampler will be slowly opened over a sample platform. The sampler will be placed such that the sample may be deposited with minimal disturbance.
9. Photograph the sample in color with a camera. Place a small label with sample field Identification (ID) number and approximate depth so that it appears in each frame.
10. Sediments will be described in accordance with the soil description procedure listed above in Section 5.
11. Place sediment samples into pre-cleaned laboratory provided jars for the appropriate analyses as determined in the work plan. Label each jar with the unique grab sample identification number and depth of the sample.
12. Place the sample containers into plastic sealable bags or bubble wrap and place them in an iced cooler until transfer shipment to the analytical laboratories. Add sample to the chain of custody form.

If the above sampling protocols are followed, it will minimize the effects of typical disadvantages to Ponar or Shipek samplers such as possible shock wave and loss of very fine grained surface deposits, potential for water column contamination, and nearby down current sediment re-deposition. The potential does exist for larger materials such as twigs and stones to prevent jaw closure that will result in collection of unacceptable sample. In areas with significant debris in sediment, collection of a representative sediment surface sample may not be possible due to method and equipment limitations.

10.5.2 Vibracore Sampler

A Vibracore Sampler will be used to collect samples at depth that maintain a representative vertical profile of the sediment stratigraphy. The corer is slowly lowered to the substrate and vibrated into the sediments. Vibrations from the core barrel do cause minimal realignment of sediment grains; however, compaction and strata-bending are nearly eliminated.

The sample collection procedure is as follows:

1. The core location will be located via GPS and recorded in boat's navigational software and/or project field book.
2. Measure the water depth using appropriate means, such as a sounding line, marked pole or fathometer.
3. Press and vibrate the core barrel into the sediment until it is inserted 20 feet, or until refusal occurs. Note insertion length in the field book.

4. Retrieve the core barrel containing the sample.
5. With the Lexan sleeve and the barrel held vertically in the boat, drill a hole in the Lexan tube just above the top of the sediment column to drain off water.
6. Cut off the Lexan tube just above the sediment surface and cap both ends.
7. Label the tube lengths with sample station ID codes using a permanent marker.
8. Section the core into five 48-inch sections, capping each end, and ensuring the upper ends are marked with the depth interval.
9. Stow the core sections upright on the boat in a vertical rack.
10. Transport core sections ashore and place in an enclosed vertical rack with ice for processing as soon as possible.

Once on shore, the cores will be transported to the Williamsburg MGP site for processing. Core samples for visual logging and analytical sampling shall be processed as follows:

1. Place core section on the core-processing table and secure with the cutting guides.
2. Using the metal guides, cut the Lexan core liner lengthwise using a router or other vibrating cutter tool with a guide such that the cutting bit penetrates the Lexan liner and does not cut significantly into the sediment core. Rotate the core 180 degrees and repeat the process. Disturbed sediment adjacent to the liner wall should not be sampled, but it is important not to contaminate the undisturbed interior of the core with plastic chips or other debris from the cutting process.
3. Once the liner wall is cut through along opposite sides (top and bottom of the horizontal core), use a 6-foot length of stainless steel wire to separate the core into two half-cylinders. With the core secured on the core processing table, line the wire up along the top saw cut. Draw the wire evenly thought the core vertically until the core is separated.
4. If the core material cannot be separated using the wire, a thin rectangular stainless steel blade should be used to separate the core using a series of vertical cuts along the core's axis. Vertical cutting in discrete steps, rather than "dragging" the blade through the core, insures that the layered structure of the core is not obscured, and that contaminants are not spread across layers. Between each vertical cut, decontaminate the blade as described in Section 11.
5. Arrange the two half-cylinders of the core section side-by-side, with the cut surfaces facing up. Extend a tape measure along them, starting at the original top end of the core.

6. Photograph the core in color with a camera. Insure that the wet surface of the core does not reflect light directly into the camera lens. Photograph the core section in overlapping frames; place a small label with core field ID number so that it appears in each frame. Advance the tape measure appropriately for any additional sections of the same core.
7. Sediments will be described in accordance with the soil description procedure (Section 5).
8. Collect each analytical sample, as pre-determined in the work plan, from the undisturbed core interior with a clean, stainless steel spoon or spatula. Do not sample any obviously "non-sediment" objects in the core interval; bottle caps, broken glass, sticks, large rocks, etc.
9. Place sediment samples into pre-cleaned laboratory provided jars for the appropriate analyses as determined in the work plan. Label each jar with the unique core identification number and depth of the sample.
10. Place the samples containers into plastic sealable bags or bubble wrap and place them in an iced cooler until transfer shipment to the analytical laboratories.

10.5.3 Remote Sampler

A remote sampler will be used to collect surficial sediment samples at shallow depths where either ponar/Shipek or vibracore methods are inaccessible.

The sample collection procedure is as follows:

1. Prior to sample collection, the remote sampler will be thoroughly decontaminated.
2. The remote sampler may consist of a stainless steel or Teflon scoop attached to a telescoping pole or other similar device.
3. The remote sampler is extended to the location of the sediment sample targeted for collection.
4. Once a sufficient volume of material is collected in the scoop, then the sampler should be retrieved slowly to avoid the loss of extremely fine material as the sampler passes thru the water column.
5. The sample is then transferred directly to a pre-cleaned laboratory container.
6. This process may be repeated if additional sample volume is necessary.

10.6 Quality Assurance/Quality Control

QA/QC procedures that apply to the these activities include QA/QC laboratory samples including blind duplicate, MS/MSD samples, and field blank samples. QA/QC samples are detailed in the Final PDI Work Plan and QAPP. Prior to collection of the QA/QC samples, equipment will decontaminated in accordance with procedures described in Section 11.

The following general QA procedures apply:

All data must be documented on field data sheets or within site field notebooks.
All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented as indicated in the QAPP.

References

1. U.S. Environmental Protection Agency, Office of Water, Office of Science & Technology. 2001. *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA-823B-01-002, October 2001
2. State of Ohio, Environmental Protection Agency, Division of Surface Water. 2001. *Sediment Sampling Guide and Methodologies, Second Edition*. November 2001
3. ASTM, 2003. *D4823-95 (2003) Standard Guide for Core Sampling Submerged, Unconsolidated Sediments.* ASTM International, West Conshohocken, PA. August 2003.

11. Equipment Decontamination Procedure

The following equipment decontamination procedure is applicable for use in decontaminating sampling tools used in collection of analytical samples from surface soils, subsurface soils, and groundwater. Equipment decontamination will prevent cross-contamination and maintain analytical sample integrity. This procedure may be varied or changed as required, dependent upon site conditions and equipment limitations. Any deviation from this standard should be documented in the field-sampling book and in the final report.

11.1 Equipment/Apparatus

Equipment needed for decontamination of sampling equipment may include:

- Alconox or non-phosphate soap
- Simple Green
- Methanol
- 10% Nitric acid solution
- De-ionized water
- Decontamination buckets
- Secondary containment vessels
- Plastic sheeting
- Scrub brushes
- PPE

11.2 Equipment Decontamination Procedure

Equipment will be decontaminated in accordance with procedures specified in the Final PDI Work Plan as summarized below. Equipment decontamination procedures are also detailed within the QAPP.

11.2.1 Sampling Equipment and Tools

Prior to sampling, all non-dedicated equipment (i.e., bowls, spoons, bailers, and soil sampling apparatus (i.e. Macro-Core Shoe and split spoon equipment) will be decontaminated as follows.

- Decontamination of sampling equipment and hand tools may take place at the sampling location as long as all liquids are contained in pails, buckets, etc.

- All sampling equipment will be washed with water and a non-phosphate detergent (Alconox, Simple Green, etc.) to remove gross contamination.
- All sampling equipment will then be rinsed with de-ionized water.
- All equipment used to collect samples for VOC and semi-volatile organic compounds (SVOC) analysis will then receive a methanol rinse followed by a de-ionized water rinse.
- All equipment used to collect samples for metals analysis will then receive a 10% nitric acid solution rinse followed by a de-ionized water rinse.
- At no time will decontaminated equipment be placed directly on the ground.
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

11.2.2 Drill Rig and Backhoe Decontamination

A decontamination pad will be constructed of High Density Polyethylene (HDPE) sheeting on a prepared surface sloped to a sump. If possible, the decontamination pad will be constructed onsite, even if work is to be performed offsite. If contaminated soils are encountered offsite, the need for a temporary off-site decontamination pad will need to be evaluated.

The size of the pad shall be sufficient to drive the drill rig on without tearing the sides or bottom of the plastic sheet. Sides of the pad will be bermed so that all decontamination water is contained. Upon completion of all field activities, the decontamination pad will be properly decommissioned. To accomplish decommissioning, all free liquids will be removed from the surface of the HDPE sheeting, including the sump area, and allowed to air dry. The HDPE sheeting will then be cut to manageable size, folded or rolled, and placed in the waste container (roll-off container or 55-gallon drum). The wood timbers used to construct the containment berm will be inspected to ascertain if the material has come in contact with decontamination liquids during use. If they have, the materials will be steam cleaned or disposed in the waste container for subsequent disposal at an appropriate facility. If the materials have not been in contact with decontamination liquids, they may be reused.

Geoprobe® rig drilling implements will be decontaminated with water and a non-phosphate detergent and water rinse. Decontamination will be completed in close proximity to the proposed borings and will be completed over a temporary decontamination pad or plastic containers because of site constraints. The macro-core sampling shoe will be decontaminated in accordance with subsection 10.2.1.

All equipment used in intrusive work including backhoe, drilling rig, augers, bits, tools, split-spoon samplers, and tremie pipe will be cleaned with a high-pressure hot water or steam cleaning unit. The equipment will be broom-cleaned with a wire brush to remove dirt,

grease, and oil before beginning fieldwork and before leaving the project Site upon completion of the last sampling activity. Tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning. Direct contact with the ground should be minimized. The augers, rods, and tools will be decontaminated between each drilling location according to the above procedures. The backhoe bucket, arm, and any other part of the equipment, which may have contacted excavated soil, will be decontaminated between each test pit location. Decontamination water will be containerized on-site prior to disposal.

Unless sealed in manufacturers packaging, monitoring well casing and screens will be steam cleaned immediately before installation. The screen and casing shall then be wrapped in polyethylene plastic and transported from the designated decontamination area to the well location.

11.3 Quality Assurance/Quality Control

There are no specific QA activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site field notebooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

References

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.
2. U.S. Environmental Protection Agency, 1993. U.S. EPA Contract Laboratory Program – Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration. Document ILMO1.0-ILO-1.9, 1993. U.S. Environmental Protection Agency, Washington, DC.

12. Analytical Sample Handling and Transport

Subsurface soils collected will be handled and submitted for laboratory analysis according to the following procedure. The QAPP provides a detail description of sample handling and transport.

1. Samples will be transferred from the sample equipment into suitable, labeled sample containers specific for the laboratory analyses to be performed. Use laboratory-provided, pre-preserved sample bottles for specific analyses. Do not overfill bottles if they are pre-preserved.
2. Secure the sample container with the appropriate cap, place the sample container in a resealable plastic bag or bubble wrap, and place it inside of a sample cooler provided by the laboratory. Use ice to cool the sample cooler to 4 degrees Celsius.
3. Record all pertinent sample identification data in the site database and/or field notebook.
4. Print the completed COC record from the database, sign, and photocopy. If necessary, a hard copy COC may be used in the place of the electronic database. A COC is attached in **Appendix D**. Place the original COC in a resealable plastic bag and affix it to the inside of the top of the cooler/or will transmitted to the laboratory courier upon a sample pick-up.
5. Attach a custody seal to the outside of the cooler prior to shipment/pickup.

13. Investigation-Derived Waste Handling Procedure

13.1 General Waste Handling Procedures

The following procedure provides guidelines for the management of investigation derived wastes. Wastes anticipated to be generated as part of the Fulton Municipal Works MGP RI include the following materials: subsurface soils, groundwater, decontamination fluids, PPE, and miscellaneous investigation-derived field supplies. All wastes will be segregated into sediment and subsurface soil, fluids and PPE/miscellaneous investigation-derived materials. Investigation derived wastes will be placed in a United States Department of Transportation (USDOT)-approved 55-gallon drum, roll-off or tank. Each waste vessel will labeled with a "Non-Hazardous Waste Label" designated with "Pending Characterization."
Information on the label should include:

Generator: National Grid Corporation
Address: Fulton Former MGP Site (address of the parcel listed in the Final PDI Work Plan)

At the end of each day, each waste container should be secured and placed onto the drum containment pad. Each container should be covered and sealed at the end of waste handling activities. The field representative will document the number and type of investigation derived wastes. Investigation -derived wastes will be documented on the waste tracking sheet and provided to the National Grid PM. A waste tracking form is attached in **Appendix E**.

13.2 Investigation Derived Waste Sample Collection Procedure

If required, the field representative will obtain a waste profile sample of soil and fluid investigation derived wastes. A sample will be collected from each of the investigation-derived wastes that require analysis for disposal. Soil wastes will be collected by using shovels, hand auger or other equipment, composited and then placed into laboratory provided sample jars. The waste profile parameters will be provided to the field representative prior to collection of the waste profile sample. Samples will be collected into laboratory-preserved bottles, chilled with ice, and submitted to the laboratory under COC as described in above Section 11.

Reference

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

Appendix A

Daily Activity Report (electronic only)

DAILY ACTIVITY REPORT

Page ___ of ___

DATE:	**Consultant Personnel:**	
PROJECT:	**National Grid Personnel:**	
PROJECT NO.:	**Other Personnel:**	
SITE LOCATION:	**NYSDEC Personnel:**	
	Site Visitors:	

Description of Activities and Summary of Significant Field Observations (Indicate Times as Appropriate)

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Drilling Summary

Completed Boring ID	Completed Well ID	Total Depth of Soil Sampling	Well Screen Bottom Depth	Well Screen Top Depth	Isolation Casing Depths	Other

Summary of Soil Samples Submitted for Laboratory Analyses

Soil Sample ID	Boring ID	Depth Interval	Time Collected	Analyses Requested	Duplicate Sample ID	MS/MSD (yes/no)

Summary of Groundwater Samples Submitted for Laboratory Analyses

Groundwater Sample ID	Well ID	Time Collected	Analyses Requested	Sample Tube Intake Depth	Purge/Sample Flow Rate	Duplicate Sample ID

Appendix B

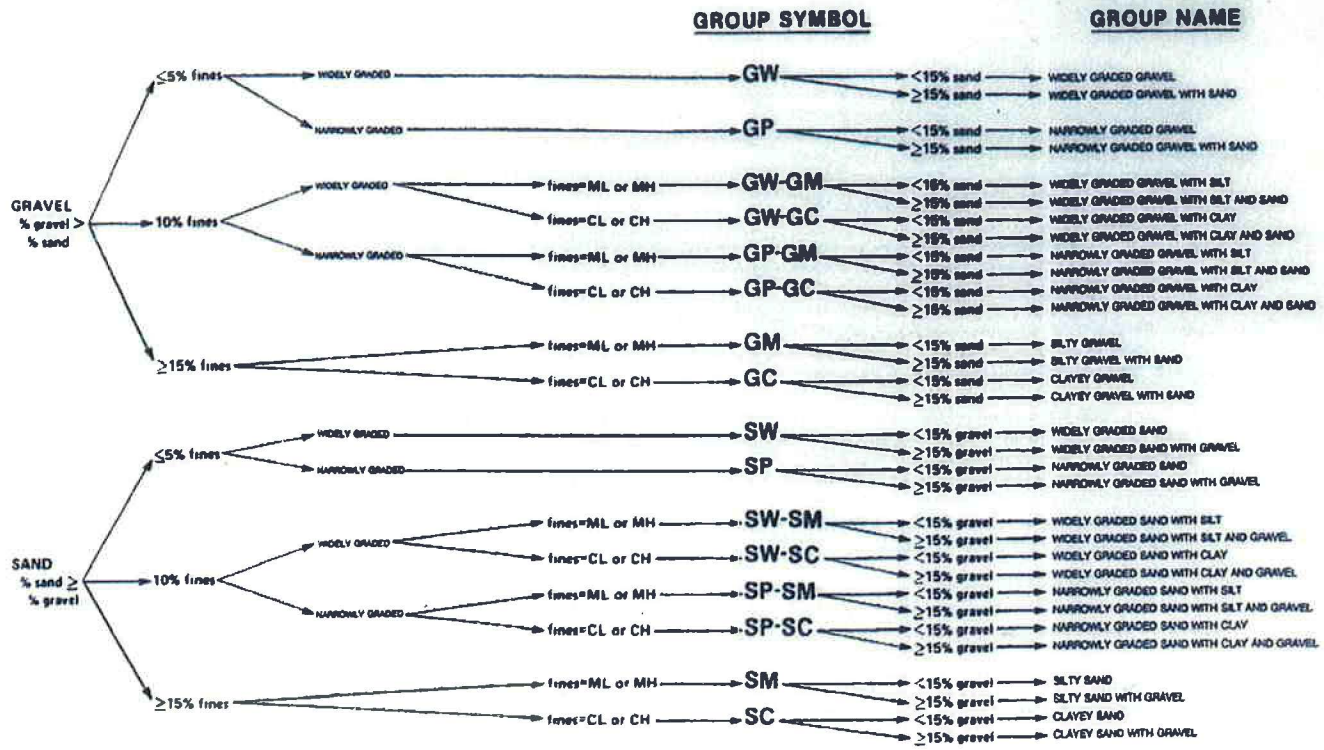
Visual-Manual Description Standards (electronic only)

GEI Consultants

COARSE GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS

FOR SOILS WITH <50% FINES

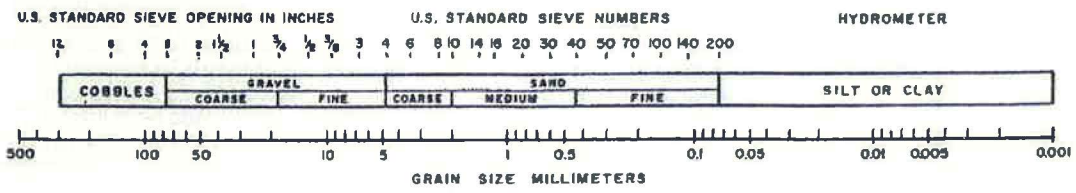


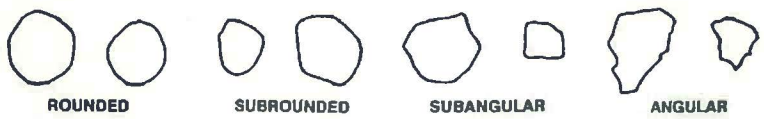
SOIL DESCRIPTION FORMAT

1. GROUP NAME and SYMBOL
2. Structure: stratified, laminated (layers <6 mm thick), lensed, homogeneous
3. Percent gravel, sand, fines (by dry weight), in order of predominance:
   - gravel - fine, coarse, and angularity
   - sand - fine, medium, coarse, and angularity
   - fines - plasticity characteristics
4. Percent cobbles and/or boulders (by volume)
5. Maximum particle size
6. Other - if appropriate - odor, roots, cementation, reaction with HCl, particle shape, moisture condition
7. Color
8. Local or geologic name

EXAMPLES

1. NARROWLY GRADED SAND (SP); mostly fine sand; <5% fines; brown.
2. SILTY SAND WITH GRAVEL (SM); ~60% fine to coarse, subangular sand; ~20% silty fines with low plasticity; ~20% fine, subangular gravel, max. size 10 mm; sample contained ~5% (by volume) subrounded cobbles to 200 mm; gray, Basal Glacial Till.
3. CLAYEY SAND (SC) and WIDELY GRADED SAND (SW); stratified layers ranging from ~6 to 20 mm thick; SC layers consist of fine sand with low plasticity clayey fines ranging from ~20 to 40%; SW layers consist of fine to coarse subrounded sand with <5% fines; SC layers are olive-gray, SW layers are brown; Hydraulic Fill.





TYPICAL SOIL COLORS

STANDARD\GEOLOGY_SOIL_CHARTS.DWG

GEI Consultants

FINE GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS

FOR SOILS WITH ≥50% FINES

GROUP SYMBOL				GROUP NAME
CL	<30% plus No. 200	<15% plus No. 200		LEAN CLAY
		15-25% plus No. 200	% sand ≥% gravel	LEAN CLAY WITH SAND
			% sand <% gravel	LEAN CLAY WITH GRAVEL
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	SANDY LEAN CLAY
			≥15% gravel	SANDY LEAN CLAY WITH GRAVEL
		% sand <% gravel	<15% sand	GRAVELLY LEAN CLAY
			≥15% sand	GRAVELLY LEAN CLAY WITH SAND
ML	<30% plus No. 200	<15% plus No. 200		SILT
		15-25% plus No. 200	% sand ≥% gravel	SILT WITH SAND
			% sand <% gravel	SILT WITH GRAVEL
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	SANDY SILT
			≥15% gravel	SANDY SILT WITH GRAVEL
		% sand <% gravel	<15% sand	GRAVELLY SILT
			≥15% sand	GRAVELLY SILT WITH SAND
CH	<30% plus No. 200	<15% plus No. 200		FAT CLAY
		15-25% plus No. 200	% sand ≥% gravel	FAT CLAY WITH SAND
			% sand <% gravel	FAT CLAY WITH GRAVEL
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	SANDY FAT CLAY
			≥15% gravel	SANDY FAT CLAY WITH GRAVEL
		% sand <% gravel	<15% sand	GRAVELLY FAT CLAY
			≥15% sand	GRAVELLY FAT CLAY WITH SAND
MH	<30% plus No. 200	<15% plus No. 200		ELASTIC SILT
		15-25% plus No. 200	% sand ≥% gravel	ELASTIC SILT WITH SAND
			% sand <% gravel	ELASTIC SILT WITH GRAVEL
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	SANDY ELASTIC SILT
			≥15% gravel	SANDY ELASTIC SILT WITH GRAVEL
		% sand <% gravel	<15% sand	GRAVELLY ELASTIC SILT
			≥15% sand	GRAVELLY ELASTIC SILT WITH SAND
OL/OH	<30% plus No. 200	<15% plus No. 200		ORGANIC SOIL
		15-25% plus No. 200	% sand ≥% gravel	ORGANIC SOIL WITH SAND
			% sand <% gravel	ORGANIC SOIL WITH GRAVEL
	≥30% plus No. 200	% sand ≥% gravel	<15% gravel	SANDY ORGANIC SOIL
			≥15% gravel	SANDY ORGANIC SOIL WITH GRAVEL
		% sand <% gravel	<15% sand	GRAVELLY ORGANIC SOIL
			≥15% sand	GRAVELLY ORGANIC SOIL WITH SAND

SOIL DESCRIPTION FORMAT

1. GROUP NAME and SYMBOL
2. Structure; stratified, laminated, fissured, slickensided, blocky, lensed, homogeneous
3. Plasticity
4. Plasticity characteristics (if performed) - dilatancy, dry strength, toughness at PL
5. Percent gravel, sand; size ranges
6. Other - if appropriate - odor, roots, cementation, reaction with HCl, particle shape, moisture condition
7. Color
8. Local or geologic name
9. Field soil strength measurements:
   Q_p = unconfined compressive strength from pocket penetrometer
   S_v = undrained shear strength from torvane

EXAMPLES

1. LEAN CLAY (CL); homogeneous, medium plasticity, occasional small shell fragments, gray, Boston Blue Clay.
2. SANDY SILT (ML); hetergeneous till structure, nonplastic, ~30% fine to coarse, subangular sand; ~10% angular to subangular fine gravel, max. size 88 mm; brown, Glacial Till.
3. ELASTIC SILT WITH GRAVEL (MH); homogeneous, medium plasticity, medium dry strength, no dilantancy, low toughness; ~20% fine gravel, max. size 10 mm; brown, Q_p = 0.70, 0.75 tsf; S_v = 0.35, 0.40, tsf

TABLE 12 Identification of Inorganic Fine-Grained Soils from Manual Tests

Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot be formed
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

TABLE 11 Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A ⅛-in. (3-mm) thread cannot be rolled at any water content
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

TABLE 9 Criteria for Describing Dilatancy

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing

TABLE 8 Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling
Low	The dry specimen crumbles into powder with some finger pressure
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure
High	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface
Very high	The dry specimen cannot be broken between the thumb and a hard surface

TABLE 10 Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness

Appendix C

Monitoring Well Information (electronic only)

Figure 1

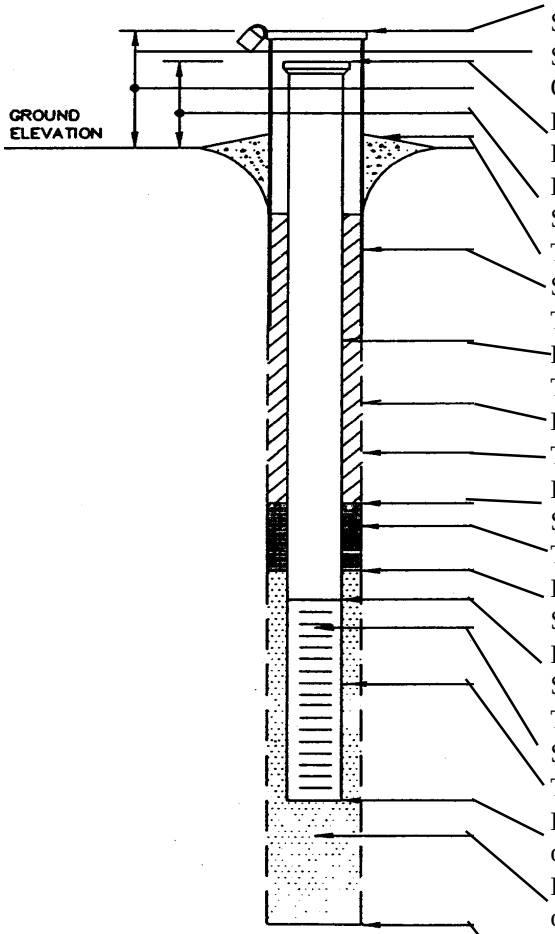
WELL INSTALLATION CHECKLIST

Project Name		Drilling Co.		Boring No.	
Project Number		Drillers		Date Started	
Project Location				Date Completed	
Site Location		Inspector			

Final depth of boring and bore hole diameter	
Depth bottom of sand pack and sand used (e.g. Morie #0)	
Type of casing (e.g. 2-in SCH 40 PVC)	
Depth bottom of screen and screen type (e.g. 10-slot)	
Depth top of screen	
Depth top of sand pack	
Depth top of seal and type of seal (e.g. cement/bentonite grout)	
Type of surface seal	
Well completion (e.g. stickup or flush mount)	

Figure 2
Overburden Monitoring Well Construction Diagram

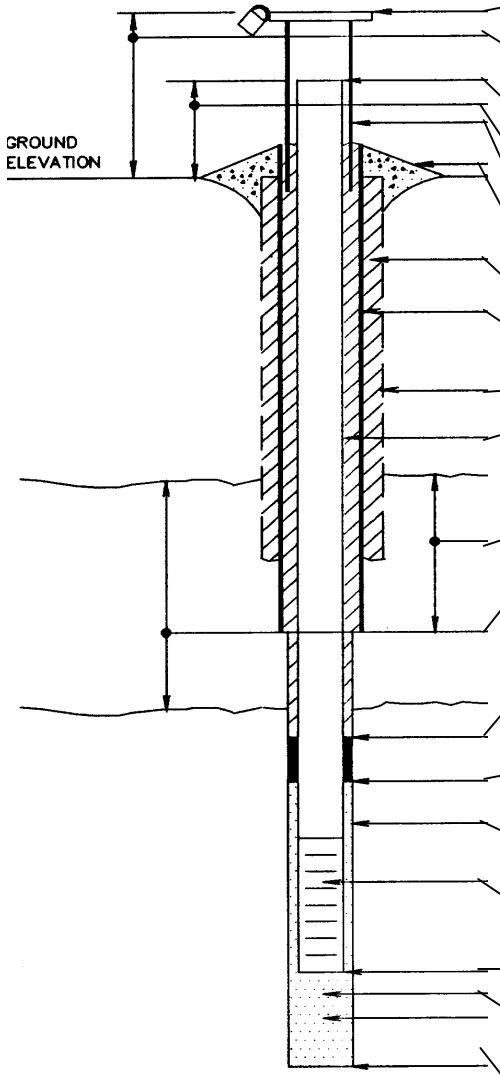
Project		Driller	
Project No.		Drilling Method	
Date		Development Method	
Elevation		Boring No.	
Field Geologist		Well No.	



Elevation of Top of Surface Casing	
Stick Up Casing Above Ground Surface	
Elevation of Top of Riser Pipe	
Riser Pipe Above Ground Surface	
Type of Surface Seal	
Surface Casing I.D.	
Type of Surface Casing	
Riser Pipe I.D.	
Type of Riser Pipe	
Borehole Diameter	
Type of Backfill	
Elevation/Depth Top of Seal	
Type of Seal	
Elevation/Depth Top of Sand Pack	
Elevation/Depth Top of Screen	
Type of Screen	
Slot Size and Length	
Type of Sand Pack	
Elevation/Depth Bottom of Screen	
Elevation/Depth Bottom of Sand Pack	
Type of Backfill Below Monitoring Well	
Elevation/Depth of Hole	
NOT TO SCALE	

Figure 3
Double Cased Monitoring Well Construction Diagram

Project		Driller	
Project No.		Drilling Method	
Date		Development Method	
Elevation		Boring No.	
Field Geologist		Well No.	



Elevation of Top of Surface Casing	
Stick Up Casing Above Ground Surface	
Elevation of Top of Riser Pipe	
Riser Pipe Above Ground Surface	
Surface Casing I.D.	
Type of Surface Seal	
Type of Surface Casing	
Upper Aquifer Casing I.D.	
Borehole Diameter/Depth	
Riser Pipe I.D.	
Type of Riser Pipe	
Type of Backfill	
Depth Casing is Set In Confining Layer	
Approximate Thickness Confining Layer	
Elevation/Depth Top of Seal	
Type of Seal	
Elevation/Depth Top of Sand Pack	
Type of Sand Pack	
Borehole Diameter/Depth	
Type of Screen	
Slot Size and Length	
Elevation/Depth Bottom of Screen	
Elevation/Depth Bottom of Sand Pack	
Type of Backfill Below Monitoring Well	
Elevation/Depth of Hole	

NOT TO SCALE

Groundwater Sample Log Sheet

Client: KeySpan Well Identification: _____

Project Number: _____ Date: _____

Site Name / Location: _____ _____Depth to Water (ftbtoc): _____

Weather: _____

Well PID (ppm): _____

Purging Information

Time	pH	Specific Cond. (mS/m)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (ºC)	Salinity	ORP (Eh) (mV)	Rate (lpm)	Comments (color, odor, etc.)
3@3-5 m.	+/- 0.1	3%	10%	10%	3%		+/- 10 mV		

Approximate Purge Volume:_____

Sampling Information Personnel: _____

Analysis	Number	Size	Type	Preserv.	Sample Collection Sample Name:	Time:

Notes:

Appendix D

Chain-of-Custody (electronic only)

Chain of Custody Record

STL Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Tel: 203-929-8140

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client	Project Manager	Date	Chain of Custody Number 00732
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page _____ of _____
City / State / Zip Code	Site Contact	Lab Contact	
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed)	Special Instructions/ Conditions of Receipt

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
(A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other_____

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Appendix E

Waste Tracking Form (electronic only)

Monthly Tracking Inventory of Former MGP Site Investigation Derived Waste:

Site Name	Address	Project Start Date(dd/mm/yy)	Project Completion Date(dd/mm/yy)	Profile samples collected(Y/N)	Description of Waste On-site			
					55-gal. Drums	Roll-Offs	Frac Tank	Miscellaneous