SFUND RECORDS CTR
2356798

ITSI Gilbane

December 10, 2012

Mr. Simon Loli
BRAC Program Management Office West
Naval Facilities Engineering Command
1455 Frazee Road, Suite 900
San Diego, California 92108

Subject: Final Amendment to Final Work Plan for Radiological Data Gap Investigation at Parcel F, Hunters Point Naval Shipyard, San Francisco, California; Contract Number N62473-11-D-2227, CTO 0002
DCN ITSI Gilbane: 2227-0002-0002

Dear Mr. Loli:

This letter was prepared by ITSI Gilbane Company (ITSI Gilbane; formerly Innovative Technical Solutions, Inc.), as requested by the United States Department of the Navy (Navy) under Performance-Based Multiple Award Contract (PERMAC) II Number N62473-11-D-2227, Contract Task Order (CTO) 0002, and based on the Navy Statement of Work (SOW) dated April 9, 2012. The purpose of this letter is to acknowledge the *Final Work Plan for Radiological Data Gap Investigation at Parcel F, Hunters Point Naval Shipyard, San Francisco Bay, California* (Work Plan; Battelle, Sea Engineering, Inc., and CH2M Hill, August 2011), including appendices, as the guiding document for conducting Phase 2b of the Parcel F Radiological Data Gap Investigation (RAD DGI), with amendments as detailed in this letter and its enclosures.

This letter also serves as an amendment to the existing Final Work Plan which was approved by the overseeing regulatory agencies. This letter is a stand-alone document that describes amendments to the Work Plan for the planned Phase 2b of the Radiological Data Gap Investigation and the addition of 48 radionuclides of concern (ROC) sediment core locations to the scope of work. Only those sections of the Work Plan superseded or amended are discussed in this letter. Any sections of the Work Plan not discussed are unchanged from the Work Plan. The reader should consult the Work Plan for all project activities not discussed in this letter.

Amendments to the Work Plan document itself are addressed in the body of this letter. Amendments to Work Plan Appendix B, Sampling and Analysis Plan (SAP), are included as Enclosure 1. Amendments to Work Plan Appendix C, Accident Prevention Plan, are included as Enclosure 2. Amendments to Work Plan Appendix I, Project Schedule, are included as Enclosure 3.

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Amendments to the Text of the *Final Work Plan for RAD DGI at Parcel F*

Work Plan Section 3.0 (Data Collection and Analysis), Subsection 3.1 (Notification and Permits)

For the purpose of conducting Phase 2b of the RAD DGI, the single paragraph of the Final Work Plan Subsection 3.1 will be superseded by the following paragraph:

> Radionuclide control will be overseen by the Navy Radiological Affairs Support Office (RASO). HPNS, San Francisco, California, is under Nuclear Regulatory Commission (NRC) jurisdiction. ITSI Gilbane will perform the work under its NRC license (NRC license 040-29353-01) and will complete any necessary NRC license notifications and related Memorandums of Understanding (MOUs). Additionally, ITSI Gilbane will provide all radiological controls, postings, maintenance, air monitoring, and any other license requirements necessary for complete handling, sampling, and shipping of potential radionuclides of concern (ROCs). ITSI Gilbane will notify the California Department of Fish and Game (CDFG) that clams (*Macoma nasuta*) will be deployed and retrieved for tissue bioaccumulation assessment.

Work Plan Section 3.0, Subsection 3.2 (Radionuclide Activity Sampling and Analyses), Third Paragraph (Radionuclide Analyses)

The Work Plan states that sediments and tissues will be analyzed for all 20 (primary and secondary) radionuclides of concern (ROCs) listed in Table 3-1, and that these analyses will be performed by New World Technologies (NWT) at its HPNS on-site laboratory. Furthermore, 10 percent of the samples will be sent to TestAmerica Laboratory (TestAmerica) in St. Louis, Missouri, for quality control and confirmation analyses. Since the on-site NWT laboratory at HPNS no longer is in operation, all samples for ROC analyses will be sent to TestAmerica laboratories for analysis of the 20 primary and secondary ROCs.

For the purpose of conducting Phase 2b of the DGI, the first three sentences of the above-referenced paragraph will be replaced by the following:

> *Radionuclide Analyses:* Sediments and tissues will be analyzed for activity from the six primary ROCs listed in Table 3-1 and twelve of the fourteen secondary ROCs listed in the same table. Radionuclide activity analyses for sediments will be performed by TestAmerica Laboratory in St. Louis, Missouri. The test for secondary ROC thorium-230 (Th-230) is not supported by the analytical methods for sediment and tissue listed in Worksheet #19 of the approved SAP (included as Appendix B to the Work Plan). Phase 2a of the RAD DGI did not include analysis of Th-230 in the sediment or tissue samples collected. The standard calibration used by TestAmerica for the approved analytical method for tissue samples (EPA 901.1 Modified for Tissue) does not include secondary ROC lead-210 (Pb-210), and Pb-210 was not analyzed in tissue samples collected during Phase 2a of the RAD DGI. Therefore, Th-230 will not be included in the analytical suite for sediment and tissue, and Pb-210 will not be included in the analytical suite for tissue.

Planned Additional Scope of Work

The additional scope items discussed below are only described in this document. They will not be added to the Work Plan because that document has already been approved by the overseeing regulatory agencies.

Additional ROC sediment cores are planned in this Work Plan Addendum to address three identified data gaps.

1) Delineation of radium-226 (Ra-226) results that exceeded the preliminary Project Action Levels (PALs) at 10 of the 2009 Phase 1 sampling locations identified in Table 3-9 of the *Draft Technical Memorandum for Radiological Data Gap Investigation Phase 2a at Parcel F Submarine Areas* (Battelle, 2012).
2) Collection and analysis of confirmation samples at additional locations to document the absence of radiological contamination in the area of former Piers B and C, which were removed in 2011.
3) Collection and analysis of confirmation samples at additional locations in the vicinity of the Experimental Ship Shielding Area to delineate any potential cobalt-60 (Co-60) contamination in sediment more fully.

Figures 1 through 4 (attached to this addendum) show the four areas of Parcel F (Submarine Area, Berths North Area, Berths South Area, and South Basin Area, respectively) where additional ROC sediment core sampling is planned by ITSI Gilbane (locations are shown as red dots). These figures also show the sampling locations established in the Work Plan that will be implemented during Phase 2b (shown as yellow dots for ROC cores and orange symbols for age-dating cores, Sedflume cores, and clam deployment locations). Previous sample locations implemented during Phase 1 and Phase 2a are shown as gray dots for ROC cores and black symbols for age-dating cores, Sedflume cores, and clam deployment locations.

<u>ROC Core Step-outs; Delineation of Ra-226 Exceedances Identified during Phase 1</u>

The Phase 2a Tech Memo identified ten Phase 1 ROC sediment core locations distributed throughout Parcel F where one or more core segments were found to contain Ra-226 above the preliminary PALs. These sample locations are SA01 and SA05 in the Submarine Area, BN01 in the Berths North Area, BS12 in the Berths South Area, and samples SB04 through SB07, SB09, and SB10 in the South Basin Area. Archived samples from eight of these locations, SA01, BN01, BS12, SB04 through SB07, and SB10 are of sufficient volume for re-analysis. These samples will be submitted to TestAmerica for analysis of the ROCs. Archived samples from location SA05 in the Submarine Area and location SB09 in the South Basin Area were not of sufficient volume for re-analysis. ROC sediment cores collocated with SA05 and SB09 will be advanced to 4 feet below top of sediment. The sample intervals which showed Ra-226 in excess of the PALs in the Phase 1 samples will be analyzed for ROCs. Figure 1shows the Submarine Area with ROC sediment core location SA426 (represented by a red dot) collocated with Phase 1 core location SA05. Figure 4 shows the South Basin area with ROC sediment core location SB246 (represented by a red dot) collocated with Phase 1 core location SB09.

For those locations where the Phase 1 result for Ra-226 above the PALs are confirmed, ITSI Gilbane will advance three step-out ROC sediment cores at locations in a triangular pattern centered on each of the target boring locations listed above, for a total of up to 30 ROC sediment core step-out locations. Each step-out location will be placed about 25 feet from the original target boring. Figure 1 shows the Submarine Area with three planned ROC sediment cores centered on SA05 (locations SA420 through SA422, represented by red dots) and three planned ROC cores centered on SA01 (locations SA423 through SA425, represented by red dots). Figure 2 shows the Berths North Area with three planned ROC cores centered on location BN01 (locations BN319 through BN321, represented by red dots) located in the northern portion of the area. Figure 3 shows the Berths South Area with three planned ROC cores centered on location BS12 (locations BS131 through BS133, represented by red dots) in the southwestern portion of the area. Figure 4 show the South Basin Area with 18 planned ROC cores (SB220 through SB237, represented by red dots) centered on locations SB04 through SB07, SB09, and SB10 represented by gray dots.

If any of the planned step-out ROC sediment cores yield one or more sediment samples with confirmed analytical results for one or more of the primary ROCs above the PAL, then three additional step-out ROC sediment cores will be advanced in a triangular pattern around each ROC sediment core with the PAL exceedance with the step-out locations about 25 feet from the target ROC sediment core.

Confirmation Sampling in the Vicinity of Former Piers B and C, Submarine Area

Figure 1 shows the Submarine Area with 10 planned ROC sediment cores (locations SA410 through SA419, represented by red dots). To select the sample locations, ITSI Gilbane employed a modified version of the stratified random sampling described in Appendix D of the Work Plan. A regular grid of squares 100 feet on each side was superimposed over the area. Locations were chosen randomly in cells not occupied by a previous sample location from Phase 1 or Phase 2a, such that each location was at least 100 feet from the closest adjacent proposed sample. Five locations were subsequently moved in order to target areas adjacent to and directly beneath the former Piers B and C in response to agency recommendations.

Additional Sampling in the Vicinity of the Experimental Ship Shielding Area

Figure 4 shows the South Basin Area, including the Experimental Ship Shielding Area on the far western shore of South Basin, with eight planned ROC sediment cores (SB238 through SB245, represented by red dots) along the shoreline adjacent to the Experimental Ship Shielding Area. When taken together with the ROC sediment cores proposed in the Final Work Plan, the proposed locations result in sample locations spaced approximately 100 feet apart along the shoreline adjacent to the Experimental Ship Shielding Range.

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In summary, this Amendment to the Final Work Plan plans a total of 50 additional ROC sediment core locations. Four samples will be collected from each core and analyzed for 6 primary ROCs and 14 secondary ROCs for a total of 192 additional sediment samples, as shown in the table below.

Additional ROC Sediment Cores and Sample Numbers by Area

Area	Sampling Summary by Type		
	Sediment Cores by Location		
	"Step-Out"	Confirmatory	Core Sections
Submarine Area	6	11	68
Berths North	3	0	12
Berths South	3	0	12
South Basin	18	9	108
TOTAL	30	20	200

Phase 2b will include the 50 new ROC core locations listed above, as well as all sample types, locations and analyses detailed in the Work Plan for Phase 2 but not performed as part of Phase 2a of the Parcel F Radiological Data Gaps Investigation. Scope included in the approved Work Plan to be performed as part of Phase 2b consists of 129 ROC sediment core locations, 3 Sedflume cores, 2 age dating cores, and deployment and recovery of *M. nasuta* clams from 7 locations (5 within Parcel F and 2 reference locations) with associated grab sediment samples and a zero time sample collected after acclimation and before deployment. All sample locations within Parcel F (excluding the 2 clam reference locations and the acclimation area) to be included in Phase 2b are shown on Figures 1 through 4. The reader should refer to the Work Plan for sampling and analysis details not discussed in this letter.

Mobilization and field work for Phase 2b of the Parcel F RAD DGI is scheduled to begin on November 26, 2012. If you have any questions regarding this letter report, please contact me at (925) 946-3263 or kleonard@itsi.com.

Sincerely,

KR Leonard

Ken Leonard, P.G.
Project Manager
ITSI Gilbane Company

ITSI Gilbane

Attachments and Enclosures

Figures

1 Sampling Location Map, Submarine Area
2 Sampling Location Map, Berths North Area
3 Sampling Location Map, Berths South Area
4 Sampling Location Map, South Basin Area

Enclosures

1 Amendments to Work Plan Appendix B, Sampling and Analysis Plan
2 Amendments to Work Plan Appendix C, Accident Prevention Plan
3 Amendments to Work Plan Appendix I, Project Schedule (Parcel F RAD DGI Phase 2b)

FIGURES

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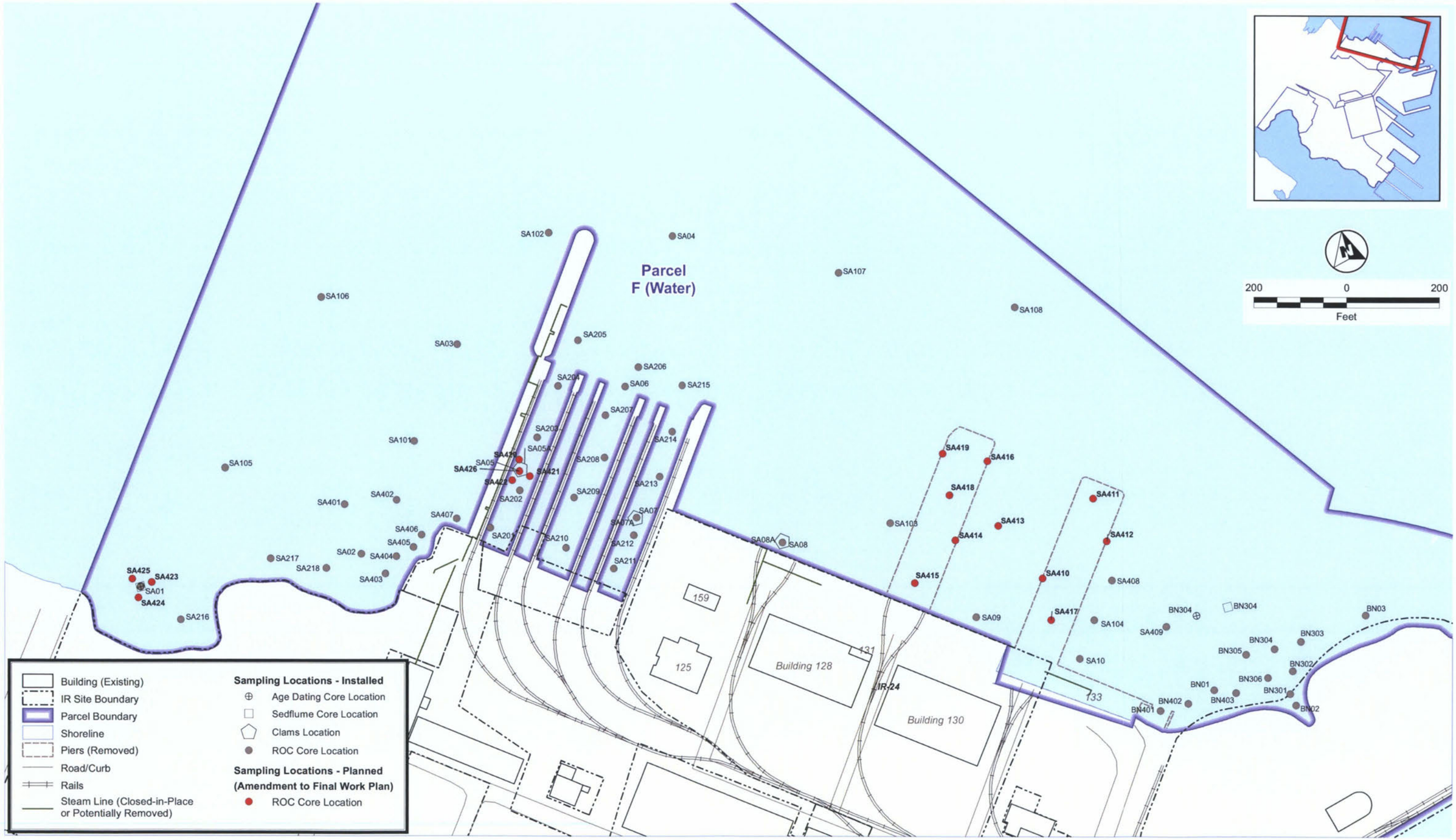

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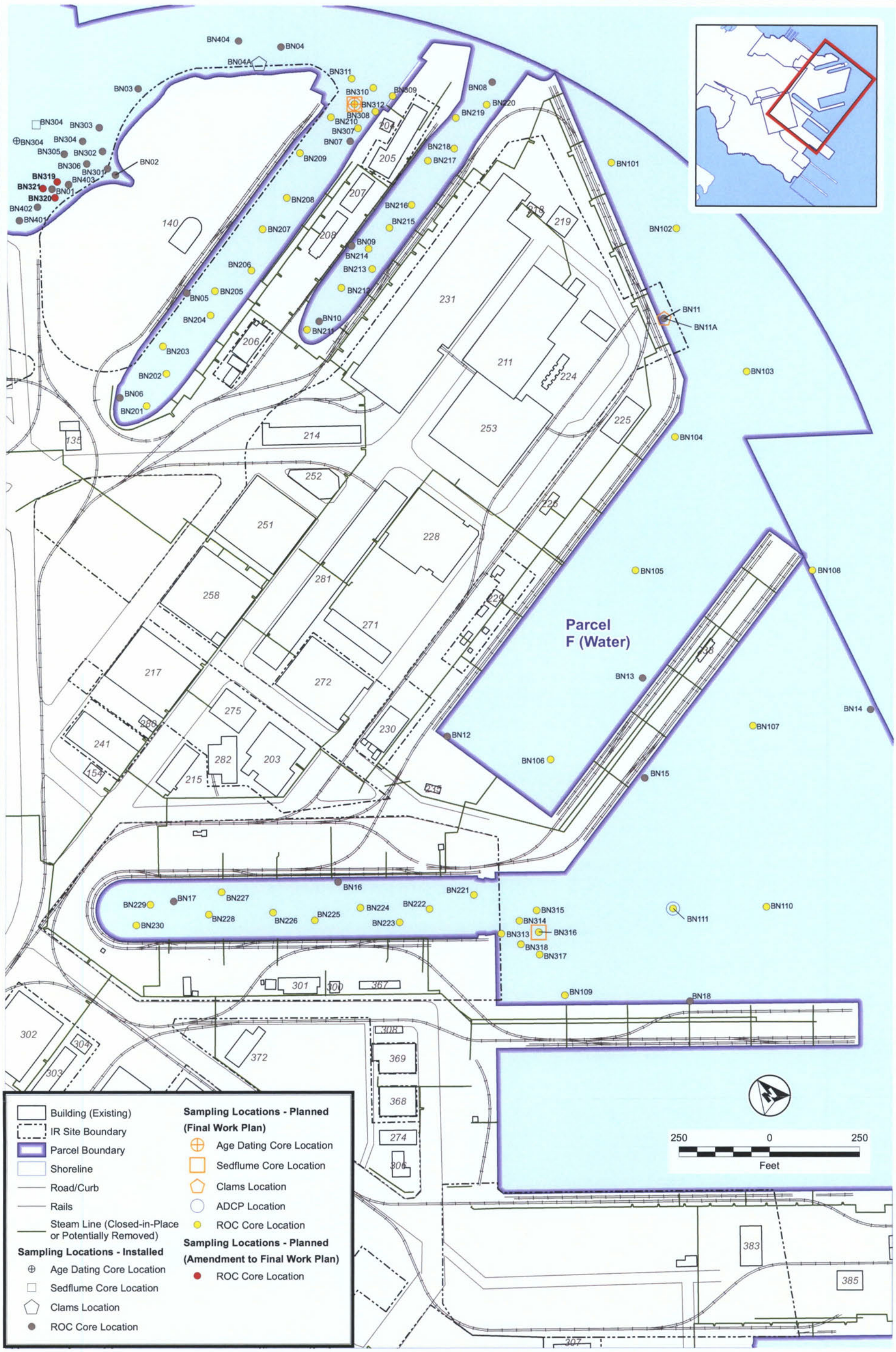
Radiological Data Gaps Investigation, Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 1
Sampling Location Map,
Submarine Area

G:\ArcGIS\Navy\HPS\PROJECTS\Parcel_F\Temp\SubmarineArea_Proposed.mxd 12/5/2012 [16:40 PM] JPARTSCH, ITSI



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Radiological Data Gaps Investigation, Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 2
Sampling Location Map,
Berths North Area

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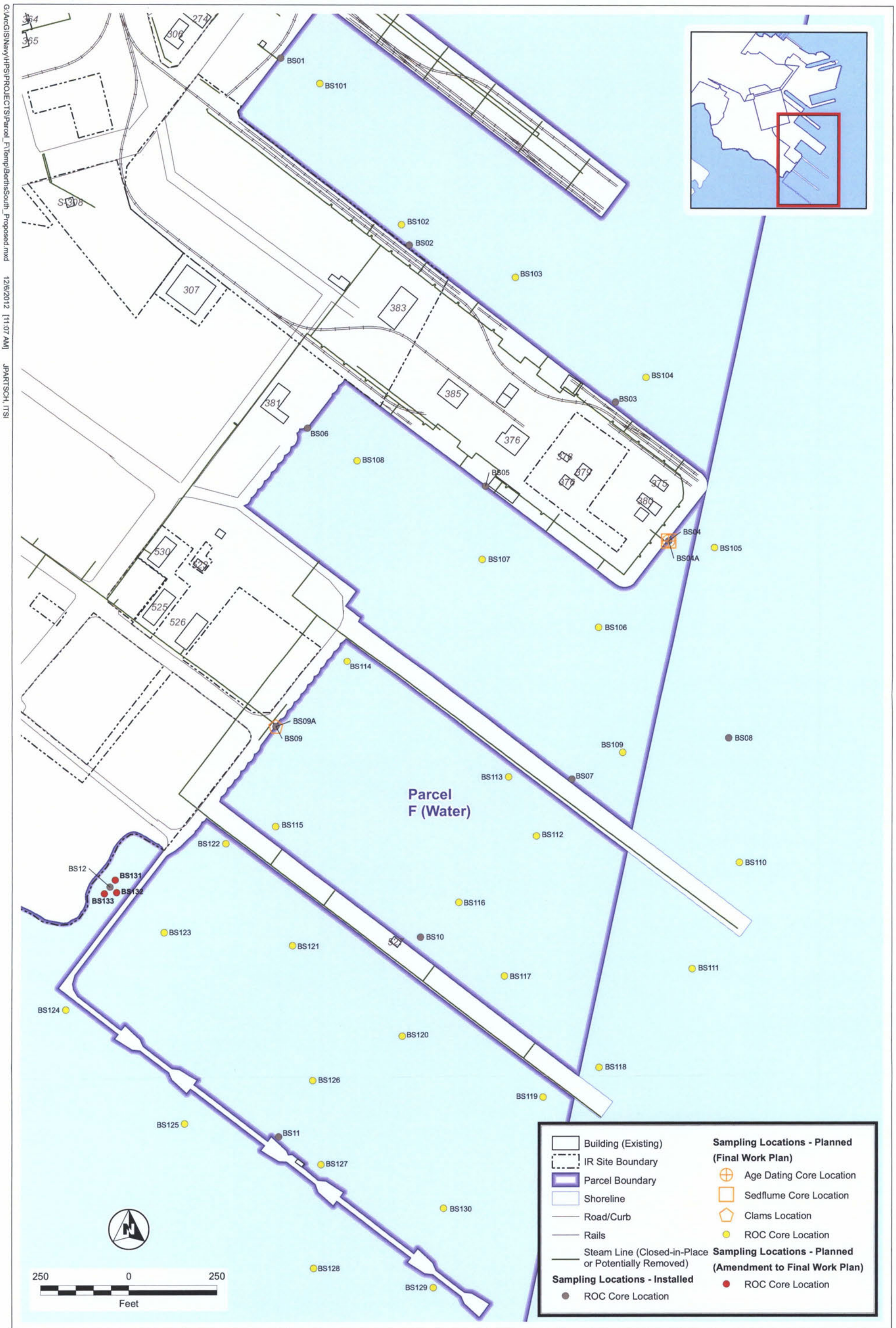

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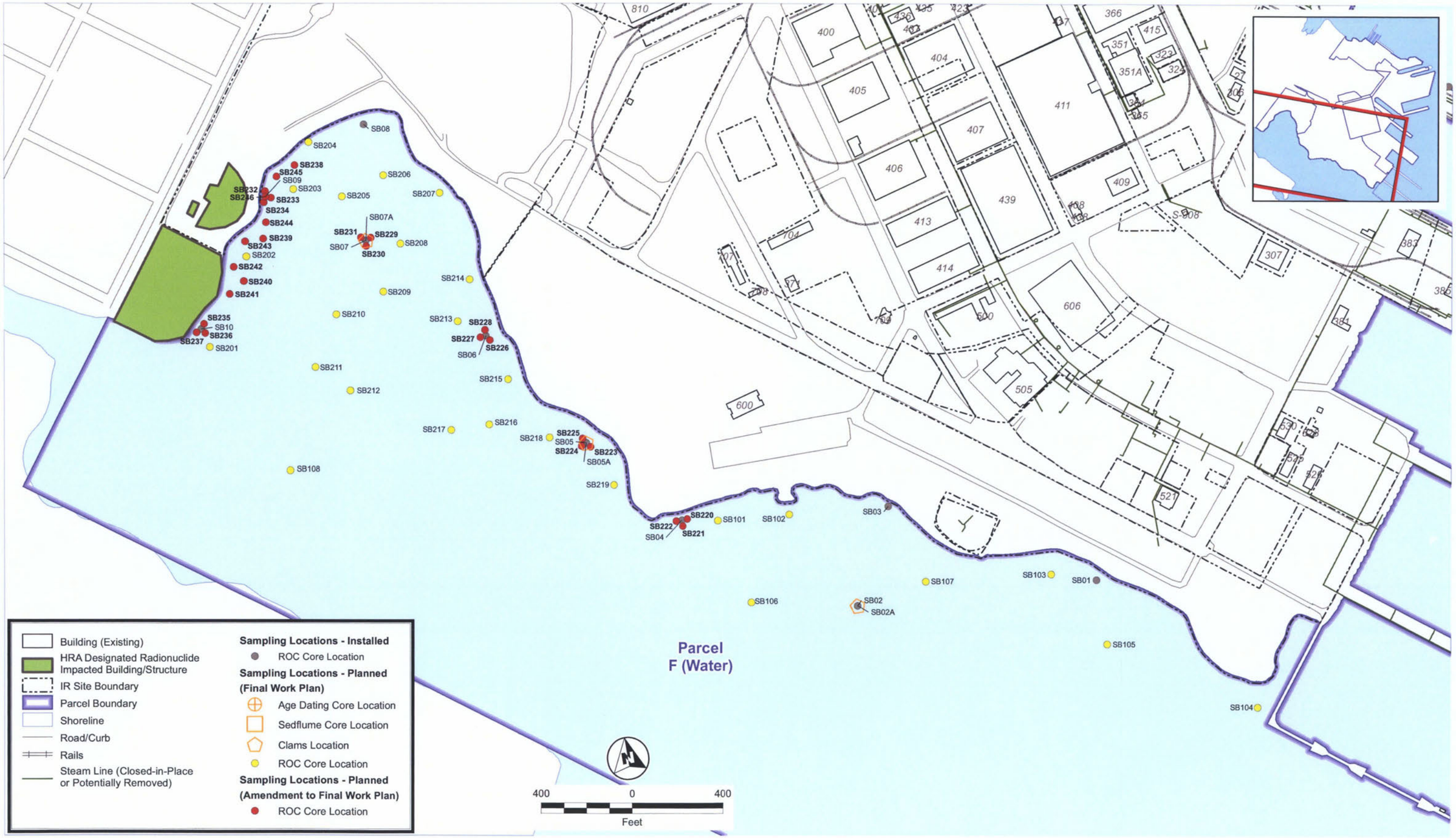
Radiological Data Gaps Investigation. Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 3
Sampling Location Map,
Berths South Area



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Radiological Data Gaps Investigation, Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 4
Sampling Location Map,
South Basin Area

G:\ArcGIS\Navy\HPS\PROJECTS\Parcel_F\Temp\SouthBasin_Proposed.mxd 12/5/2012 [16:39 PM] JPARTSCH, ITSI

ENCLOSURE 1

Amendments to Sampling and Analysis Plan

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November 2, 2012

Mr. Simon Loli
BRAC Program Management Office West
Naval Facilities Engineering Command
1455 Frazee Road, Suite 900
San Diego, California 92108

Subject: Final Amendment to Final Sampling and Analysis Plan for Radiological Data Gap Investigation, Hunters Point Naval Shipyard, San Francisco, California; Contract Number N62473-11-D-2227, CTO 0002

DCN ITSI Gilbane: 2227-0002-0002

This letter is to inform you that for the purpose of conducting the Phase 2b Radiological Data Gap Investigation field work at Hunters Point Naval Shipyard Parcel F, ITSI Gilbane Company (ITSI Gilbane; formerly Innovative Technical Solutions, Inc.) will be adopting the existing Revised Final Sampling and Analysis Plan for Radiological Screening and Data Gap Investigation at Parcel F (Battelle, 2011) (Battelle SAP), with the amendments provided herein. It is the intention of ITSI Gilbane to ensure data consistency and comparability between project phases.

This letter will be used in conjunction with the final approved Battelle SAP. The following sections present changes and addenda; only the components of the approved Battelle SAP that have been altered for the current task are presented here:

I. Global Changes (Global changes are those changes too numerous to provide individually. In those cases where a Worksheet is provided for another reason, these changes have been made.):

   a. References to "Battelle" as the performer of the DGI Phase 2 are replaced by "ITSI Gilbane Company (ITSI Gilbane)."

   b. References to use of the on-site laboratory (New World Technology or Radiological Survey and Remedial Services [RSRS]) in DGI Phase 2 are deleted.

   c. Geochronology samples for Phase 2b of the DGI will be analyzed by Core Scientific International of Winnipeg, Canada. References to "Battelle Marine Sciences" are superseded by "Core Scientific International."

   d. Data validation for DGI Phase 2b will be performed by Validata Chemical Services (Validata) of Duluth, Georgia. Kevin Harmon will be the project manager. References to "Laboratory Data Consultants, Inc. (LDC)," are superseded by "Validata."

e. ITSI Gilbane will be collecting sediment samples with support from our subcontractor, TEG Oceanographic Services (TEG). References to "Battelle and Sea, Inc.," as the collector of sediment cores are superseded by ITSI Gilbane and TEG."

f. References to "field logbooks" are replaced by "field logbooks and/or field log forms."

II. Specific Changes:

a. **Worksheet #2 - SAP Identifying Information**: First Page: Superseded by revised first page of Worksheet #2 found in Attachment A.

b. **Worksheet #3 - Distribution List**: Superseded by revised Worksheet #3 found in Attachment A.

c. **Worksheet #4 - Project Personnel Sign-Off Sheet**: Superseded by revised Worksheet #4 found in Attachment A.

d. **Worksheet #5-3 – Phase 2b DGI Project Organizational Chart: The** new worksheet provided in Attachment A supersedes Worksheet #5-2.

e. **Worksheet #6 – Communication Pathways**: Superseded by revised Worksheet #6 found in Attachment A.

f. **Worksheet #7 – Personnel Responsibilities and Qualification Table**: Superseded by revised Worksheet #7 found in Attachment A.

g. **Worksheet #8 – Special Personnel Training Requirements Table**, second page: Superseded by second page of Worksheet #8 found in Attachment A.

h. **Worksheet #9 – Project Scoping Sessions Participants Sheet**: New Table 9-4, Kick-Off Meeting for DGI Phase 2b (found in Attachment A) is added.

i. **Worksheet #14 – Summary of Project Tasks**:

   i. *Phase 2 DGI Survey Sampling Tasks,* Number 1: Text is superseded by: "Sediment cores will be collected from 220 locations (202 locations in Parcel F and 18 Reference locations). Cores will be subsampled into an average of four intervals per core and analyzed for six primary ROCs (Co-60, Cs-137, Ra-226, Pu-239, Sr-90, and U-235) and 13 secondary radionuclides: Ac-228, Am-241, Bi-212, Bi-214, Eu-152, Eu-154, K-40, Pa-234, Pb-210, Pb-212, Pb-214, Th-234, Tl-208. A subset of samples will be analyzed for total organic carbon (TOC) and particle size. Sediment samples will be collected with either a piston core sampler or a vibracore sampling system." Revised Worksheet page is found in Attachment A.

   ii. SAP Attachment 14-1: Field Sampling Checklist: Superseded by the Field Sampling Checklist found in Attachment A.

j. **Worksheet #15-2 – Phase 2 DGI Reference Limits and Evaluation Table**: Superseded by replacement Worksheet 15-2 found in Attachment A in accordance with the Navy SOW.

k. **Worksheet #16 – Project Schedule Timeline Table**: Superseded by the revised Worksheet #16 found in Attachment A.

l. **Worksheet #17 – Sampling Design and Rationale**

Phase 2b work will consist of the continuation of the Phase 2 work begun by Battelle, with the addition of the new samples described below.

i. Table 17-3: Addended for DGI Phase 2b New Samples by Table 17-3A found in Attachment A.

ii. Worksheet 17-5: Addended for DGI Phase 2b New Samples by Worksheet 17-5A and Figure 17-6A found in Attachment A.

iii. Worksheet 17-6: Addended for DGI Phase 2b New Samples by Worksheet 17-6A and Figure 17-7A found in Attachment A.

iv. Worksheet 17-7: Addended for DGI Phase 2b New Samples by Worksheet 17-7A and Figure 17-8A found in Attachment A.

v. Worksheet 17-8: Addended for DGI Phase 2b New Samples by Worksheet 17-8A and Figure 17-9A found in Attachment A.

vi. Table 17-4: Addended for DGI Phase 2b New Samples by Table 17-4A found in Attachment A.

vii. Attachment #17-1 Summary of Field Sampling Methods, A17-1-4 Sample Preservation, Packaging, and Shipment: Replace this section with the following: "Samples will be packaged and shipped in accordance with the procedures in Battelle SOP 5-210, Packaging and Shipping of Samples. The sediment samples for Ra-226, Cs-137, Pu-239, Co-60, Sr-90, and U-235 will be shipped to the TestAmerica St. Louis, Missouri, laboratory for analysis within 24 hours of collection." The revised Attachment #17-1 is found in Attachment A of this letter.

viii. Attachment #17-1 Summary of Field Sampling Methods, A17-1-7 In-situ deployment and collection of the mollusk Macoma nasuta, first paragraph: Replace the second sentence with: "M. nasuta will be acquired from a commercial supplier (e.g. Aquatic Research Organisms, Inc., Hampton, New Hampshire) and shipped via overnight carrier to HPNS." The revised Attachment #17-1 is found in Attachment A of this letter.

ix. Attachment #17-1 Summary of Field Sampling Methods, A17-1-12 Disposal of IDW, last paragraph: Replace with: "All IDW will be transferred to the HPNS on-site radiological contractor, TPMC-Energy Solutions (TES) with appropriate documentation. TES will dispose of the IDW in accordance with all applicable local, state, and federal regulations." The revised Attachment #17-1 is found in Attachment A of this letter.

x. Attachment #17-2 Forms: Superseded by Attachment #17-2 found in Attachment A.

m. **Worksheet # 18 – Sampling Locations and Methods/SOP Requirements Table:**

i. Table 18-2 Phase 2 DGI Sampling Methods and SOPs: Amended by Table 18-2A Phase 2b DGI Sampling Methods and SOPs found in Attachment A.

n. **Worksheet # 19 – Analytical SOP Requirements Table**: Superseded by revised Worksheet #19 found in Attachment A.

o. **Worksheet #20 – Field Quality Control Sample Summary Table**: Superseded by revised Worksheet #20 found in Attachment A.

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p. **Worksheet # 23- Analytical SOP References Table**: Superseded by revised Worksheet #23 found in Attachment A.

q. **Worksheet # 24 - Analytical Instrument Calibration Table**: Superseded by revised Worksheet #24 found in Attachment A.

r. **Worksheet # 25 - Analytical and Equipment Maintenance, Testing, and Inspection Table**: Superseded by revised Worksheet #25 found in Attachment A.

s. **Worksheet #28-1 - Laboratory QC Samples Table for Sediment Samples**: Superseded by revised Worksheet #28-1 found in Attachment A.

t. **Worksheet #30 – Analytical Services Table**: Superseded by revised Worksheet #30 found in Attachment A.

u. **Worksheet # 32 – Assessment Finding and Corrective Action Responses**: Superseded by revised Worksheet #32 found in Attachment A.

v. **Worksheet #33 – QA Management Reports Table**: Superseded by revised Worksheet #34 found in Attachment A.

w. **Worksheet #35 - Validation (Steps IIa and IIb) Process Table:** Superseded by revised Worksheet #35 found in Attachment A.

x. **Worksheet #36 - Analytical Data Validation (Steps IIa and IIb) Summary Table:** Superseded by revised Worksheet #35 found in Attachment A.

If you have any questions regarding this letter report, please contact me at (925) 946-3263 or kleonard@itsi.com.

Sincerely,

Ken Leonard, P.G.
Project Manager
ITSI Gilbane Company

ATTACHMENT A

Amendments to SAP Worksheets

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SAP Worksheet #2 - SAP Identifying Information

Site Name: Hunters Point Naval Shipyard Parcel F
Site Location: Former Naval Ship Yard at Hunters Point, San Francisco, CA
Contract Name: EMAC
Contract Number: N62473-08-D-8824
Work Assignment Number: 0002

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (United States Environmental Protection Agency [U.S. EPA], 2005) and *U.S. EPA Guidance for Quality Assurance Project Plans, U.S. EPA QA/G-5, QAMS* (U.S. EPA, 2002).

2. Identify regulatory program: CERCLA

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Kick-Off Meeting	3 September 2008
Meeting at BRAC San Diego Office	30 September 2008
BCT Meeting, Oakland, CA	5 May 2009
DGI Phase 2b Kick-Off Meeting	15 August 2012

5. List dates and titles any SAP documents written for previous site work that are relevant to the current investigation: 1) Naval Sea Systems Command (NAVSEA) - Radiological Control Office Pearl Harbor Naval Shipyard & Intermediate Maintanence Facility, Pearl Harbor, HI, Historical Radiological Assessment. Hunters Point Annex Volume 1 Naval Nuclear Propulsion Program, 1999 2) NAVSEA - Historical Radiological Assessment. History of the Use of General Radioactive Materials 1939 - 2003 Hunters Point Shipyard Volume II, 2003.

6. List organizational partners (stakeholders) and connection with lead organization:
Base Realignment and Closure (BRAC) Program Management Office (PMO) West - Lead; Radiological Affairs Support Office (RASO) - document review; Naval Sea System Command Detachment - Site Safety and Health Plan (SSHP) Review; BRAC Closure Team (BCT) - document review; Region IX U.S. EPA - document review; CalEPA DTSC - document review; California Regional Water Quality Control Board (Water Board) - document review; CalEPA Department of Public Health - document review; City of San Francisco Department of Public Health - document review; NOAA - document review; and CalEPA Fish and Game - document review.

7. Lead Organization: NAVFAC Southwest

8. If any required SAP elements and required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusions below:
Not applicable

SAP Worksheet #3 - Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing Address
Simon Loli	Remedial Project Manager (RPM)	BRAC PMO West	619-532-0782	BRAC PMO West 1455 Frazee Road, Suite 900 San Diego, CA 92108 Simon.loli.ctr@navy.mil
Joseph Michalowski	Quality Assurance Officer (QAO)	NAVFAC Southwest	619-532-4125	Naval Facilities Engineering Command 1220 Pacific Highway San Diego, CA 92132-5190 joseph.michalowski@navy.mil
Peter Stroganoff	Resident Officer in Charge of Construction (ROICC)	NAVFAC Southwest	510-521-8626	EFA NFEC 2450 Saratoga St., Suite 200 Alameda, CA 94501 shirley.ng@navy.mil
Laurie Lowman	Radiological Affairs Support	Radiological Affairs Support Office, Naval Sea System Command Detachment	757-887-4692	Radiological Affairs Support Office Naval Sea System Command Detachment Building 1971 NWS P.O. Drawer 260 Yorktown, VA. 23691-0260 laurie.lowman@navy.mil
Craig Cooper	U.S. EPA Project Manager	U.S. EPA	415-947-4148	U.S. EPA 75 Hawthorne Street San Francisco, CA. 94105 cooper.craig@epa.gov
Tom Lanphar (P1) Ryan Miya (P2)	DTSC Project Manager	California EPA Department of Toxics Substances Control (DTSC)	510-540-3776, 510-540-3775	DTSC 700 Heinz Ave., Bldg. F, Suite 200 Berkeley, CA. 94710-2737 rmiya@dtsc.ca.gov
Erich Simon (P1) Ross Steenson (P2)	Water Board Project Manager	San Francisco Regional Water Quality Control Board (Water Board)	510-622-2355, 510-622-2445	San Francisco Water Board 1515 Clay Street, Suite 1400 Oakland, CA 94612 rsteenson@waterboards.ca.gov

SAP Worksheet #3 - Distribution List (Continued)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing Address
Vandana Kohli (P1) Larry Morgan (P2)	Department of Public Health Project Manager	Cal/EPA Department of Public Health	916-324-1378 916-449-2921	Cal/EPA Department of Public Health Environmental Management Branch 1616 Capitol Avenue P.O. Box 997377 Sacramento, CA. 95899-7377 larry.morgan@cdph.ca.gov
Amy Brownell	City of SF Dept. of Public Health Project Manager	City of SF Dept. of Public Health	415-252-3967	City of SF Dept. of Public Health 1390 Market St., Suite 210 San Francisco, CA. 94102 amy.brownell@sfdph.org
Martha Walters	Arc Ecology Representative	Arc Ecology	Not provided	1907 Fifth Avenue San Rafael, CA 94901 rosewalt@aol.com
Karla Brasaemle	U.S. EPA Contractor	U.S. EPA Contractor Tech Law, Inc.	415-281-8730	Tech Law, Inc. 90 New Montgomery St., Suite 710 San Francisco, CA. 94105 kbrasaemle@techlawinc.com
Arvind Acharya	ITSI Gilbane EMAC Program Manager	ITSI Gilbane	925-946-3206	ITSI Gilbane 2730 Shadelands Drive Walnut Creek, CA 94598 aacharya@itsi.com
Ken Leonard	ITSI Gilbane Project Manager	ITSI Gilbane	925-946-3263	ITSI Gilbane 2730 Shadelands Drive Walnut Creek, CA 94598 kleonard@itsi.com
Rich Flynn	Program Chemist	ITSI Gilbane	925-946-3103	ITSI Gilbane 2730 Shadelands Drive Walnut Creek, CA 94598 rflynn@itsi.com

SAP Worksheet #3 - Distribution List (Continued)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing Address
Kristen Carlyon	Project Chemist	ITSI Gilbane	925-946-3180	ITSI Gilbane 2730 Shadelands Drive Walnut Creek, CA 94598 kcarlyon@itsi.com
Tony Olmstead	Field Team Leader	ITSI Gilbane	925-946-3365	ITSI Gilbane 2730 Shadelands Drive Walnut Creek, CA 94598 tolmstead@itsi.com
Mark Blaisdell	Site Health and Safety Officer	ITSI Gilbane	925-946-3137	ITSI Gilbane 2730 Shadelands Drive Walnut Creek, CA 94598 mblaisdell@itsi.com
Ed Palser	Radiological Operations Manager	ITSI Gilbane	505-400-4076	ITSI Gilbane 2730 Shadelands Drive Walnut Creek, CA 94598 epalser@itsi.com
Craig Jones	Hydrodynamics and Sediment Transport Lead	Sea Engineering, Inc.	831-421-0871	Sea Engineering, Inc. 200 Washington St., Suite 210 Santa Cruz, CA 95060 cjones@seaengineering.com
Greg Tracey	Site Characterization & Sediment Transport Expert	SAIC	401-848-4631	Science Applications International Corporation 221 Third Street, Building A Newport, RI 02840 gregory.a.tracey@saic.com

P1= Phase 1 Screening Survey
P2 = Phase 2 DGI

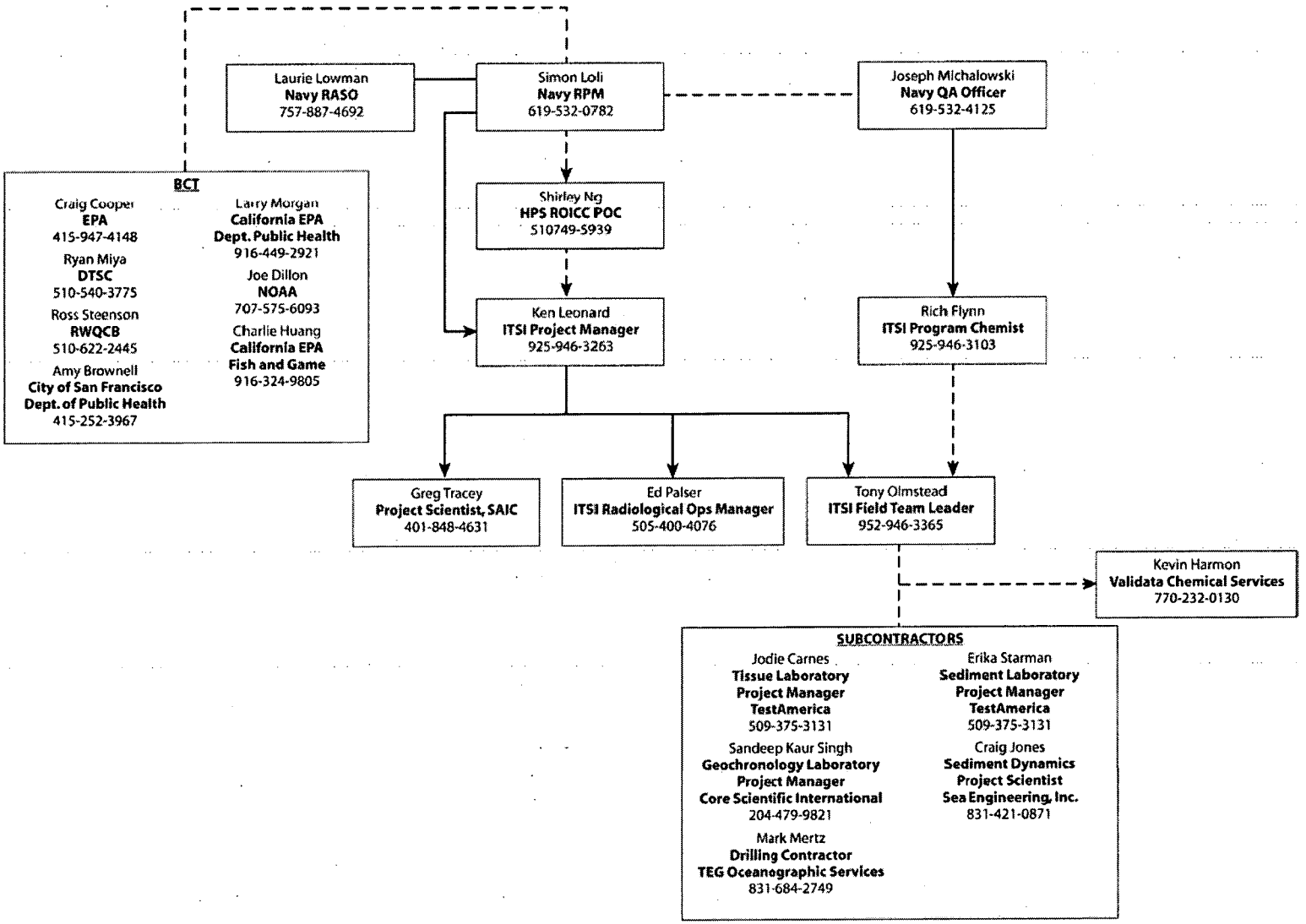
SAP Worksheet #4 – Project Personnel Sign-Off Sheet

The purpose of the sign-off sheet is to document that key personnel responsible have read and understood the SAP prior to performing their duties.

Project Personnel	Organization/Title/Role	Telephone Number	Signature/Email Receipt	SAP Section Reviewed	Date SAP Read
Arvind Acharya	ITSI Gilbane/EMAC Program Manager	925-946-3206			
Ken Leonard	ITSI Gilbane/Project Manager/Oversee Project	925-946-3263			
Tony Olmstead	ITSI Gilbane/ Field Team Leader/Oversee Field Work	925-946-3131			
Mark Blaisdell	ITSI Gilbane/Site Health and Safety Officer	945-946-3137			
Ed Palser	ITSI Gilbane/ Radiological Operations Manager	505-400-4076			
Craig Jones	Sea Engineering/ Environmental-Ocean Engineer/Field Sampling and Sediment Transport Analysis	831-421-0871			
Mark Mertz	TEG Oceanographic Services/Director/Drilling Contractor	831-684-2749			
Kristen Carlyon	ITSI Gilbane/Project Chemist	925-646-3180			
Erika Starman	TestAmerica – St. Louis, MO/Laboratory Project Manager	314-298-8566			
Jodie Carnes	TestAmerica –Richland, WA/Laboratory Project Manager	509-375-3131			
Sandeep Kaur Singh	Core Scientific International/Laboratory Project Manager	204-479-9821			
Kevin Harmon	Validata/Data Validation Project Manager/Oversee Data Validation	770-232-0130			

Note: After all of the signatories have signed, the completed sign-off sheet will be maintained in the project records file at ITSI Gilbane.

SAP Worksheet #5-3 – Phase 2b DGI Project Organizational Chart



SAP Worksheet #6 - Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number and/or e-mail	Procedure (Timing, Pathways, etc.)
Monthly briefing to NAVFAC RPM	ITSI Gilbane Project Manager	Ken Leonard	925-946-3263	Monthly phone call from the PM to the RPM
Regular communication with NAVFAC RPM	ITSI Gilbane Project Manager	Ken Leonard	925-946-3263	Frequent communication between the PM to the RPM during field effort either phone call or e-mail
Daily report to ITSI Gilbane PM and RASO	ITSI Gilbane Field Team Leader	Tony Olmstead	925-946-3365	Daily updates from ITSI Gilbane Field Team Leader to Project Manager and RASO during field sampling
Sample receipt notification	TestAmerica Lab Representative- St. Louis	Erika Starman	314-298-8566	Telephone call and fax or email notification of sample receipt; chain-of-custody review from the Lab Representative to the PM
Sample receipt notification	TestAmerica Lab Representative - Richland	Jodie Carnes	509-375-3131	Telephone call and fax or email notification of sample receipt; chain-of-custody review from the Lab Representative to the PM
Real-time modification of SAP activities (e.g., sample location)	ITSI Gilbane Project Manager	Ken Leonard	925-946-3263	A request detailing sampling locations will be sent via e-mail to the RPM. Approval of the changes will be obtained from the RPM, prior to sampling
SAP Implementation (Field issues requiring corrective action)	ITSI Gilbane Project Manager	Ken Leonard	925-946-3263	PM will communicate with the RPM by either phone call or e-mail within 1 to 3 days, depending on nature of deficiency.
Regular communication with NAVFAC Southwest QA Officer	ITSI Gilbane Program Chemist	Rich Flynn	925-946-3103	Communication via mail to obtain written/formal approval of the planning documents (e.g., SAP) and communication via phone and e-mail to discuss project status and any issues
Regular communication with RASO	ITSI Gilbane Project Manager	Ken Leonard	925-946-3263	Regular communication via e-mail and phone with RASO as laboratory data becomes available

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Simon Loli	RPM	BRAC PMO West	• Final approval for conducting all field activities • Oversight of the overall task order • Approval of selected subcontractors • Execution of contracts • Approval of the release of reports	
Laurie Lowman	Radiological Affairs Support	Radiological Affairs Support Office, Naval Sea System Command Detachment	• Final approval of Licensing • Review, input, and approval of Work Plan and data, reports	
Shirley Ng	ROICC San Francisco Bay Area	NAVFAC Southwest	Responsible for the Health and Safety and ongoing QC activities	
Joseph Michalowski	Navy QAO	NAVFAC Southwest	• Oversight of quality assurance (QA) issues for entire program • Review and approval of SAP, and all other QA/QC documents • Review of design process • Communication with ITSI Gilbane QA Officer • Communication of issues to the Navy RPM • Authority to suspend work if quality criteria are not adequately being met	

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Arvind Acharya	EMAC Program Manager	ITSI Gilbane	• Chief program representative • Oversight of TO 0002 to ensure contract compliance • Control cost, schedule, and quality • Manage all program personnel, subcontractors, and resources • Support NAVFAC Southwest in stakeholder involvement and regulatory negotiations • Ensure compliance with all quality, environmental, health, safety, and security requirements	
Ken Leonard	Project Manager	ITSI Gilbane	• Management of task order contract • Assignment of personnel • Monitoring and control of cost, schedule, and QC • Compliance with regulations • Management of subcontractors • Liaison with Contracting Officer/Contracting Officer's Representative (CO/COR) • Review of the project Site Safety and Health Plan (SSHP) • Ensuring that the field personnel have received appropriate health and safety training for project work	

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Rich Flynn	Program Chemist	ITSI Gilbane	• Approval of QA/QC requirements • Interaction with Navy QAO	
Kristen Carlyon	Project Chemist	ITSI Gilbane	• Review of data • Coordination of data validation	
Mark Blaisdell	Site Health and Safety Officer	ITSI Gilbane	• Primary contact for health and safety in the field • Monitor health and safety procedures during all field construction and operational activities • Conduct daily health and safety tailgate meetings and obtain signatures from attending personnel	
Tony Olmstead	Field Team Leader	ITSI Gilbane	• Lead ITSI Gilbane representative at the field site and primary interface between Project Manager, QA Officer, and field team including subcontractors • Provide critical analysis and interpretation of sediment data. • Ensure effective communication among project management team and all parties participating in field activities • Direct and coordinate all aspects of site work, including subcontractors and their efforts	

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role		Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Kyle Gordon	Field Support	Radiologic Sampling Lead	ITSI Gilbane	• Assist Field Team Leader with all responsibilities in field • Performance of all sampling in accordance with the approved SAP • Calibration and maintenance of field measurement equipment • Completion of field documentation	
Jaime Pena		Radiologic Sampling Tech			
Ed Palser	Radiological Operations Manager		ITSI Gilbane	• Coordinate with Senior Radiological Risk Advisor during the DGI Work Plan development and with radiological field staff field support • Participate in RAB and BCT meetings and project integration meetings with NFECSW, RASO and radiological support coordinator • Support development of the FS Addendum	
Jay Pride	Radiation Safety Officer		ITSI Gilbane	Provide expert consultation and input to the work plan, Technical Memorandum and FS Addendum	
Laura Trybowski	Radiological Quality Control		ITSI Gilbane	• Support DGI Work Plan development and DGI Technical Memorandum and FS Addendum • Provide QC review of radiological data	

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Craig Jones	Hydrodynamics and Sediment Transport Lead	Sea Engineering, Inc.	• Provide field services in the Phase 1 Screening Survey effort • Support Phase 2 DGI Work Plan development, DGI Technical Memorandum and FS Addendum	
Greg Tracey	Site Characterization/ Sediment Transport Expert Consultant	SAIC	• Support the development of a statistically defensible DGI Work Plan and DGI Technical Memorandum • Participate in RAB and BCT meetings	
Jodie Carnes	Laboratory Project Manager/Clam Tissue Radioanalysis	TestAmerica, Richland	Sample preparation and analysis	
Erika Starman	Laboratory Project Manager/Sediment Radioanalysis	TestAmerica, St. Louis	Sample preparation and analysis	
Sandeep Kaur Singh	Laboratory Project Manager/Sediment Age-Dating Analysis	Core Scientific International	Sample preparation and analysis	
Kevin Harmon	Point of Contact for Third Party Data Validation Services	Validata Chemical Services, Inc.	Third-party data validation	

BCT – Base Closure Team
DGI – Data Gap Investigation
FS – Feasibility Study
NFECSW – Naval Facilities Engineering Center Southwest
RAB – Remedial Action Board
RASO – Radiological Affairs Support Office
SAIC – Science Applications International Corporation
SAP – Sampling and Analysis Plan

SAP Worksheet #8 - Special Personnel Training Requirements Table (Continued)

Field team members are trained in the routine field sampling procedures outlined in this plan. Specifically, field team members will have HAZWOPER 40 hour site worker training, one staff will have HAZWOPER Site Supervisor certification, and appropriate staff will be trained on Battelle Standard Operating Procedures (SOPs) for the following field activities: use of a Global Positioning System (GPS) for locating sampling points, sediment grab sample and core sample collection, sample handling, packaging, and shipping.

All personnel performing fieldwork will be provided with general awareness training for radiation. General awareness training provides the worker with a basic knowledge of the hazards, health concerns and protective practices related to radiation and radioactive materials. All personnel handling radioactive material under a Radioactive Material Application will be required to complete *Radiation Worker Training*, ITSI Gilbane Course 100.

Table 9-4. Kick-Off Meeting for DGI Phase 2b

Project Name: Parcel F Radiological Data Gap Investigation Work Plan and Radiological Feasibility Study Addendum, Hunters Point Naval Shipyard, San Francisco, California **Projected Date(s) of Sampling:** November 2012-January 2013 **Project Manager:** Ken Leonard	**Site Name:** Parcel F, Hunters Point Naval Shipyard **Site Location:** Former Hunters Point Naval Shipyard, San Francisco, CA

Date of Session: August 15, 2012
Scoping Session Purpose: DGI Phase 2b Kick-Off Meeting

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Simon Loli	Remedial Project Manager	BRAC PMO West	619-532-0789	simon.loli.ctr@navy.mil	RPM
Keith Forman	Base Environmental Coordinator	NAVFAC BRAC PMO West	619-532-0913	Keith.S.Forman@navy.mil	BEC
Arvind Acharya	Program Manager	ITSI Gilbane	925-946-3206	aacharya@itsi.com	Program Manager
Ken Leonard	Project Manager	ITSI Gilbane	925-946-3263	kleonard@itsi.com	Project Manager
Gail Jones	Senior Geologist	ITSI Gilbane	925-946-3291	gjones@itsi.com	Field Team Leader
Kristen Carlyon	Senior Chemist	ITSI Gilbane	925-946-3180	kcarlyon@itsi.com	Project Chemist
Greg Tracey	Senior Scientist	SAIC	401-848-4631	traceyg@saic.com	Project Scientist

Project Scope and Goals

- Complete the DGI Phase 2 as presented in existing final Work Plan/SAP.
- Add additional confirmation samples in Pier B and C demolition area
- Additional option for borings (90 step-outs) in case of detection
- Add additional confirmation samples in Experimental Ship Shielding Area to confirm absence of Co-60.
- Add confirmation analysis of Radium-226 in sediment to avoid false positives possible by gamma spectroscopy.

Key Work Plan Development Items

- ITSI Gilbane responsible for development of work plan with SAIC peer review. Will be done with minimal changes by acknowledgement of existing plans and procedures
- ITSI Gilbane responsible for Memorandum of Understanding (MOU) and managing field work.
- All data will go to SAIC for preparation of Technical Memorandum.

SAP Worksheet #14 - Summary of Project Tasks (Continued)

Phase 2 DGI Survey Pre-sampling Tasks

Because of the uncertainty regarding the nature and extent of the radionuclide levels within Parcel F, a two phased approach has been developed by Battelle. The first phase is the Phase 1 Screening Survey encompassing all areas of Parcel F that provided information to design this focused, comprehensive Phase 2 DGI. The Phase 2 DGI will provide a strong scientific foundation for the Radiological Technical Memorandum and the Parcel F FS Addendum and any necessary remedial actions. This revised SAP was prepared for the Phase 2 DGI and encompasses the screening results and satisfies the requirements of the FS Addendum.

Phase 2 DGI Survey Sampling Tasks

Five sampling tasks will be completed as part of the Phase 2 DGI:

1. Sediment cores will be collected from 222 locations (204 locations in Parcel F and 18 Reference locations). Cores will be subsampled into an average of four intervals per core and analyzed for six primary ROC (Co-60, Cs-137, Ra-226, Pu-239, Sr-90, and U-235) and 13 secondary radionuclides: Ac-228, Am-241, Bi-212, Bi-214, Eu-152, Eu-154, K-40, Pa-234, Pb-210, Pb-212, Pb-214, Th-234, Tl-208. A subset of samples will be analyzed for total organic carbon (TOC) and Particle Size. Sediment samples will be collected with either a piston core sampler or a vibracore sampling system.
2. Mollusks (the bivalve clam *M. nasuta*) will be deployed *in-situ* for 28-45 days at nine locations at Parcel F. Organisms will be retrieved, rinsed of site mud, and shipped to the laboratory for analysis of the six primary ROC.
3. Five ~120 cm long piston core samples will be collected for geochronology (age dating) at Parcel F. Samples will be sectioned into ~ (60) 2cm sections per core. Ten of the 60 sections per core will be analyzed for Cs-137 and Pb-210; the remaining sections will be archived.
4. Six ~60 cm long Sedflume cores will be collected at Parcel F and tested for sediment stability/erosion properties.
5. One Acoustic Doppler Current Profiler (ADCP) will be deployed at Parcel F for a minimum of one lunar tidal cycle (~28 days) to measure water velocity at multiple levels in the water column.

Swipe samples will be analyzed for radiation (alpha and gamma) with a portable meter on the boat by Battelle staff. Samples will be analyzed for Ra-226, Cs-137, Pu-239 and Co-60, U-235 and Sr-90 at the TestAmerica lab in St. Louis, MO. See Worksheet #17 for sampling design and rationale at each site.

Phase 2 DGI Survey Post-Sampling Field Tasks

Equipment decontamination, IDW characterization and disposal, and surveying tasks will be performed. Navy RASO staff will oversee the radiation decontamination process. Worksheet #17 contains details for post-sampling field tasks. Proper delivery and chain-of-custody documentation of samples will be maintained as required (see Worksheets #26 and #27 for sample handling system and custody requirements).

SAP Attachment #14-1: Field Checklist

ITSI Gilbane Field Sampling Checklist

Site Name: Hunters Point - Parcel F Date:_____

Checklist Completed by: Reviewed by:

_____ _____

Signature Date Initials Date

Samples in proper container/bottle?		Yes ☐	No ☐
Sample containers intact?		Yes ☐	No ☐
Sufficient sample volume?		Yes ☐	No ☐
Was an MS/MSD sample collected today?		Yes ☐	No ☐
Chain of custody (COC) agrees with sample labels?		Yes ☐	No ☐
Placed bagged ice in cooler?	NA ☐	Yes ☐	No ☐
Temperature blank in cooler?		Yes ☐	No ☐
COC signed when received and relinquished?		Yes ☐	No ☐
COC taped to the inside of cooler lid?		Yes ☐	No ☐
Checked that drain plug is taped over and taped up cooler?		Yes ☐	No ☐
Filled out Fed Ex Form and attached to cooler? (Retain copy for records and tracking)	NA ☐	Yes ☐	No ☐
Notified Lab of # of coolers and # samples and tracking #?		Yes ☐	No ☐

Number of Samples Collected today:_____

Number of QA Samples Collected Today: _____

Document any modifications to sampling SOP or problems that occurred:

POC:	Role	Phone Number:
Ken Leonard	Project Manager	925-946-3263 or cell 925-250-8959
Tony Olmstead	Field Team Leader	925-946-3365 or cell 925-250-7875
Ed Palser	Rad. Ops. Manager	505-400-4076

SAP Worksheet #15-2 – Phase 2 DGI - Reference Limits and Evaluation Table
Matrix: Sediment
Analytical Group: Radionuclides in Sediment

Analyte	CAS Number	Project Action Limit Intertidal Zone[1] (pCi/g)	Project Action Limit Subtidal Zone[1] (pCi/g)	Project Action Limit Reference	Project MDLs/MDAs (pCi/g)[2]	Analytical Method QLs (pCi/g)[2]	Analytical Method MDLs/MDAs (pCi/g)[2]
Radium-226	13982-63-3	1 above background[3]	22.4 above background[3]	The ERICA Tool (Brown et al. 2008) and the Battelle Phase 2 DGI Workplan (Battelle 2011)	0.7	NA	0.7
Cesium-137	10045-97-3	1.28	425		0.07	NA	0.07
Cobalt-60	10198-40-0	NA[4]	NA[4]		0.04	NA	0.04
Uranium-235	15117-96-1	4.22	178		0.1	NA	0.1
Strontium-90	10098-97-2	9.37	9.93	The ERICA Tool (Brown et al. 2008) and the Battelle Phase 2 DGI Workplan (Battelle 2011)	0.17	NA	0.17
Plutonium-239	97918-67-7	67.8	68.2	The ERICA Tool (Brown et al. 2008) and the Battelle Phase 2 DGI Workplan (Battelle 2011)	1.29	NA	1.29

(1) PALs based on a risk factor of 10^{-6}; PALs presented are the lowest PAL for all site use and pathway scenarios
(2) The laboratory will ensure that the MDA meets the listed release criteria by increasing sample size or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time.
(3) Background to be determined during the Phase 2 DGI
(4) Cobalt not detected during Phase 1 Screening Survey so Sediment PALs were not calculated. If detected during Phase 2 DGI, PALs will be determined.

Note: The average activity levels of Radium in sediment at the six reference sites will be calculated as part of the Phase 2 DGI study. This level will be used as the background activity, and based on Phase 1 data, this level is predicted to be above 0.4 pCi/g, and thus the onsite laboratory MDL of 1.4 pCi/g and the offsite lab MDL of 0.7 pCi/g will be adequate to assess risk.

NA: not applicable
QL: quantitation limit
MDA: minimum detectable activity
MDL: method detection limit
pCi/g: picocurie per gram

SAP Worksheet #16 - Project Schedule Timeline Table

Activity	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Initiation Date	Anticipated/ Completion Date		
Kick-Off Meeting	ITSI Gilbane/Navy	August 15, 2012	August 15, 2012	None	None
Phase 2B DGI Work Plan (Internal Draft) and SAP Addendum	ITSI Gilbane	August 16, 2012	October 11, 2012	Phase 2B DGI Work Plan (Internal Draft) and SAP Addendum	October 11, 2009
Navy Review of Phase 2B DGI Work Plan (Internal Draft) and SAP Addendum	RASO/Navy	October 12, 2012	October 25, 2012	Navy Comments	October 26, 2012
Phase 2B DGI Work Plan (Draft Final) and SAP Addendum and RTC for both	ITSI Gilbane	October 29, 2012	November 2, 2012	Phase 2B DGI Work Plan (Final) and SAP Addendum and RTC for both	November 5, 2012
Phase 2B DGI Implementation Planning and Procurement	ITSI Gilbane	August 27, 2012	September 24, 2012	None	None
Phase 2 DGI Field Implementation	ITSI Gilbane	November 5, 2012	January 3, 2013	None	None
Laboratory Analysis and Validation	ITSI Gilbane	January 4, 2013	February 4, 2013	None	None
Phase 2B DGI Technical Memorandum (TM) (Internal Draft)	ITSI Gilbane	January 4, 2013	February 14, 2013	Phase 2B DGI Technical Memorandum (TM) (Internal Draft)	February 15, 2013
RASO/Navy Review of TM (Internal Draft)	Navy	February 19, 2013	March 20, 2013	Navy Comments	March 21, 2013
TM (Draft) and RTC	ITSI Gilbane	May 1, 2013	May 14, 2013	TM #1 (Draft) and RTC	May 15, 2013
Agency Review of TM (Draft)	Navy/Regulators	May 16, 2013	June 17, 2013	Navy/Regulators Comments	June 17, 2013
Incorporate Regulator Comments	ITSI Gilbane	June 18, 2013	July 1, 2013	None	None
TM (Final)	ITSI Gilbane	July 2, 2013	July 9, 2013	TM (Final)	July 10, 2013

Table 17-3A. Summary of Phase 2b DGI Proposed Samples with General Rationale

Area	Sample Matrix/ Analysis	No. of Sample Locations		Total No. of Sections[1]	General Rationale
		Areas of Concern[2]	Confirmation[3]		
Submarine Base Area	Sediment ROC (Step-out Locations)	6	1	28	Collect sediment cores for ROC analyses. Three cores each centered in a triangular pattern on previous locations SA01 and SA05 where RA-226 concentrations were detected above the PAL during the Phase 1 Screening Survey.
	Sediment ROC (former Piers B & C)	0	10	40	A radiological survey and removal of Piers B & C was conducted in 2011. Although the Parcel F RAD DGI Work Plan (Battelle, 2011) included two confirmation sampling locations (SA103 and SA104) in the vicinity of the now removed piers, additional confirmation sampling locations are deemed necessary to document the absence of radiological contamination.
Berths - North	Sediment ROC (Step-out Locations)	3	0	12	Collect sediment cores for ROC analyses. Three cores centered in a triangular pattern on previous location BN01 where RA-226 was detected above the PAL during the Phase 1 Screening Survey.
Berths - South	Sediment ROC (Step-out Locations)	0	3	12	Collect sediment cores for ROC analyses. Three cores centered in a triangular pattern on previous location BS12 where RA-226 concentrations were detected above the PAL during the Phase 1 Screening Survey.
South Basin	Sediment ROC (Step-out Locations)	15	4	76	Collect sediment cores for ROC analyses. Three cores each centered in a triangular pattern on previous locations SB04 through SB10 where RA-226 concentrations were detected above the PAL during the Phase 1 Screening Survey.
	Sediment ROC (Experimental Ship Shielding Area)	8	0	32	The Navy has added Co-60 as an ROC in the South Basin area based on Co-60 use on land at the Experimental Ship Shielding Area adjacent to the South Basin. Although the Parcel F RAD DGI Work Plan (Battelle, 2011) included several confirmation samples (such as sampling locations SB202, SB203, SB204), additional confirmation sampling locations are deemed necessary to better delineate any potential Co-60 contamination in sediment.

[1] Average of four sections per core for sediment ROC analyses

Table 17-3A. Summary of Phase 2b DGI Proposed Samples with General Rationale (Continued)

(2) AOC = Areas where radionuclide activity data from the Phase 1 Screening Survey indicated some possibility of exceeding PALs for sediment derived using the ERICA Tool

(3) Confirmatory = Areas where radionuclide activity levels are not likely to exceed sediment PALs.

SAP Worksheet #17-5A – Phase 2b DGI Sampling Design and Rationale for the Submarine Base Area

The Phase 2a Tech Memo identified 10 total Phase 1 ROC sediment core locations distributed throughout Parcel F where one or more core segments were found to contain Ra-226 above the preliminary PALs. These core locations include stations SA01 (2-3 foot sample interval) and SA05 (0-1 foot interval) in the Submarine Base area. The archived sample from station SA01 is of sufficient volume for re-analysis. The archived sample from SA01 will be submitted to TestAmerica for ROC analysis. The archived sample from SA05 was insufficient for re-analysis. Station SA05 will be re-cored and the 0-1 foot sample interval will be analyzed for ROCs. Figure 17-6A shows the Submarine Area with station SA426 (represented as a red dot) collocated with Station SA05

Where a Phase 1 PAL exceedance is confirmed, ITSI Gilbane will advance three confirmatory ROC sediment core locations in a triangular pattern centered on each of the target boring locations listed above, for a total of 6 ROC sediment core step-out locations in the Submarine Base Area. The confirmatory locations will be spaced about 25 feet from the original target boring. Figure 17-6A shows the Submarine Area with three proposed sample locations centered on SA05 (proposed locations SA420 through SA422) and three proposed sample locations centered on SA01 (proposed locations SA423 through SA425).

Additional confirmation sampling will also be carried out in the vicinity of former Piers B and C. Figure 17-6A shows the Submarine Area with 10 proposed ROC sediment core confirmation locations (proposed locations SA410 through SA419).

Numbers and types of samples are summarized in Table 17-3A (above), and sampling coordinates are provided in Table 17-4A.

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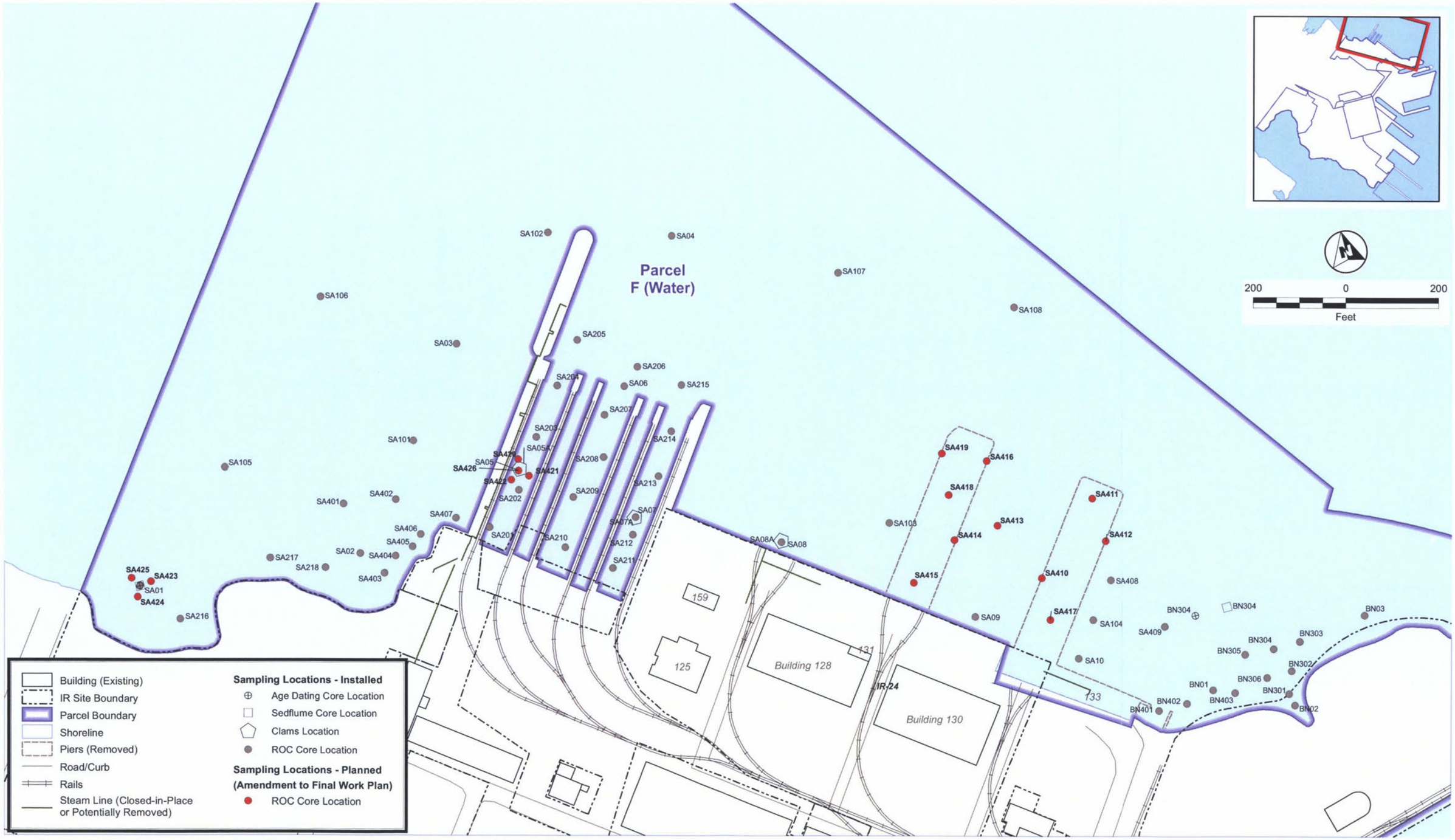

ITSI Gilbane

Radiological Data Gaps Investigation, Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 17-6A
Sampling Location Map,
Submarine Area

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SAP Worksheet #17-6A – Phase 2b DGI Sampling Design and Rationale for the Berths-North Area

The Phase 2a Tech Memo identified 10 total Phase 1 ROC sediment core locations distributed throughout Parcel F where one or more core segments were found to contain Ra-226 above the preliminary PALs. These core locations include station BN01 in the Berths North area. ITSI Gilbane will advance three confirmatory ROC sediment core locations in a triangular pattern centered on the target boring location listed above, for a total of 3 ROC sediment core step-out locations in the Berths North area. The confirmatory locations will be spaced about 25 feet from the original target boring. Figure 17-7A shows the Berths North Area with three proposed sample locations centered on location BN01 (proposed locations BN319 through BN321) located in the northern portion of the area. Numbers and types of samples are summarized in Table 17-3A (above), and sampling coordinates are provided in Table 17-4A.

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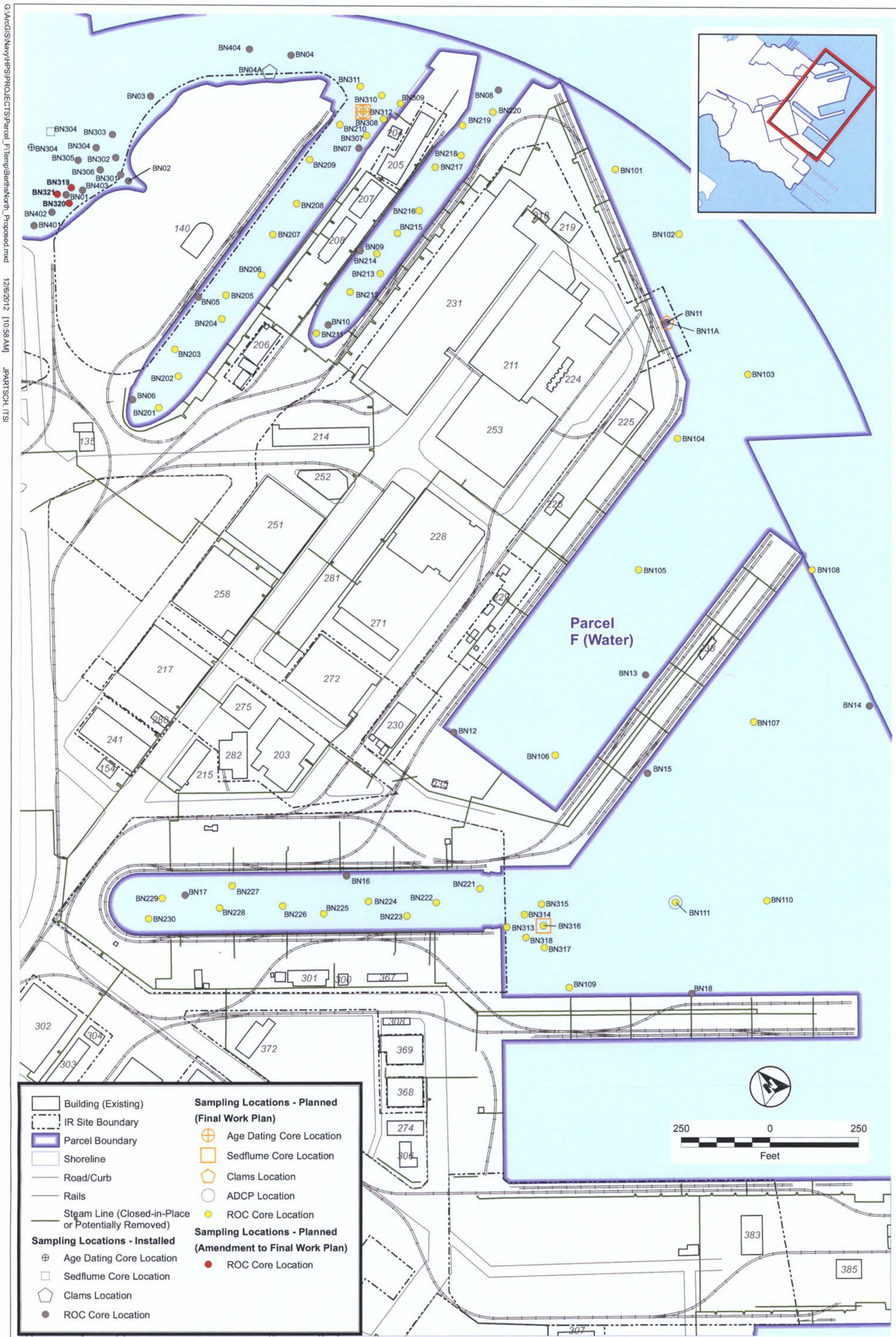

ITSI Gilbane

Radiological Data Gaps Investigation, Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 17-7A
Sampling Location Map,
Berths North Area

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SAP Worksheet #17-7A – Phase 2b DGI Sampling Design and Rationale for the Berths – South Area

The Phase 2a Tech Memo identified 10 total Phase 1 ROC sediment core locations distributed throughout Parcel F where one or more core segments were found to contain Ra-226 above the preliminary PALs. These core locations include station BS12 in the Berths South area. ITSI Gilbane will advance three confirmatory ROC sediment core locations in a triangular pattern centered on the target boring location listed above, for a total of 3 ROC sediment core step-out locations in the Berths North area. The confirmatory locations will be spaced about 25 feet from the original target boring. Figure 17-8A shows the Berths North Area with three proposed sample locations centered on location BS12 (proposed locations BS131 through BS133) in the southwest portion of the area. Numbers and types of samples are summarized in Table 17-3A (above) and sampling coordinates are provided in Table 17-4A.

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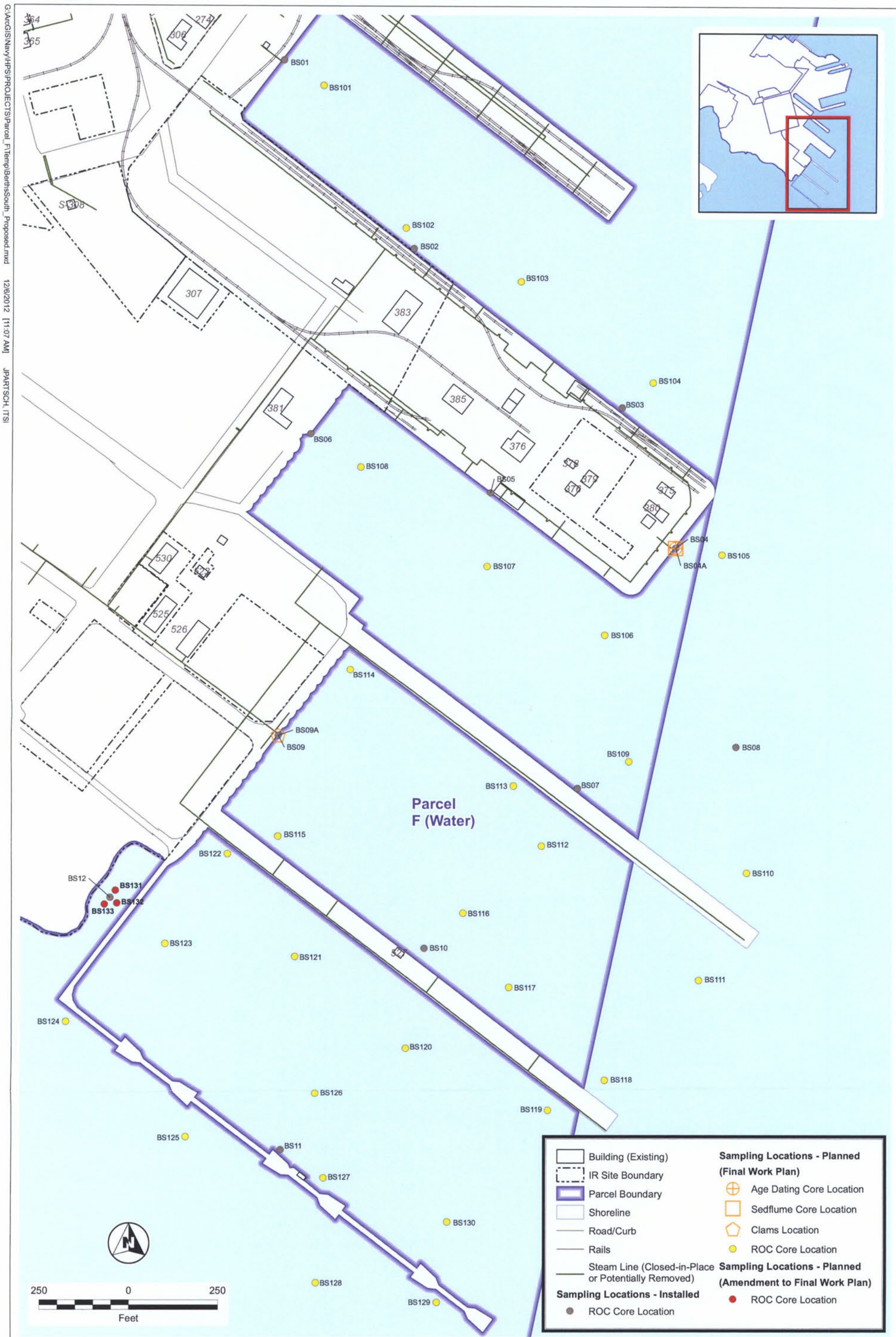

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ITSI Gilbane

Radiological Data Gaps Investigation. Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 17-8A
Sampling Location Map,
Berths South Area

SAP Worksheet #17-8A – Phase 2b DGI Sampling Design and Rationale for the South Basin Area

The Phase 2a Tech Memo identified 10 total Phase 1 ROC sediment core locations distributed throughout Parcel F where one or more core segments were found to contain Ra-226 above the preliminary PALs. These core locations include stations SB04 through SB07, SB09 and SB10 in the South Bay area. All of these core segments were archived with sufficient volume for re-analysis, with the exception of station SB09. The archived core segments from SB04 through SB07 and SB10 will be submitted to TestAmerica for ROC analysis. The location of station SB09 will be re-cored with the depth intervals previously showing exceedance of the PALs for Ra-226 analyzed for ROCs. Figure 17-9 shows the South Basin Area with station SB246 (represented by a red dot) collocated with station SB09.

Where a Phase 1 exceedance of PALs are confirmed, ITSI Gilbane will advance three confirmatory ROC sediment core locations in a triangular pattern centered on each of the target boring locations listed above, for a total of 19 ROC sediment core step-out locations. The confirmatory locations will be spaced about 25 feet from the original target boring.

In order to confirm the absence of Cobalt-60, ITSI Gilbane will also advance eight additional ROC sediment core locations (SB238 through SB245) along the shoreline adjacent to the Experimental Ship Shielding Area on the far western shore of the South Basin area.

Numbers and types of samples are summarized in Table 17-3A (above), station locations are shown in Figure 17-9A, and sampling coordinates are provided in Table 17-4A.

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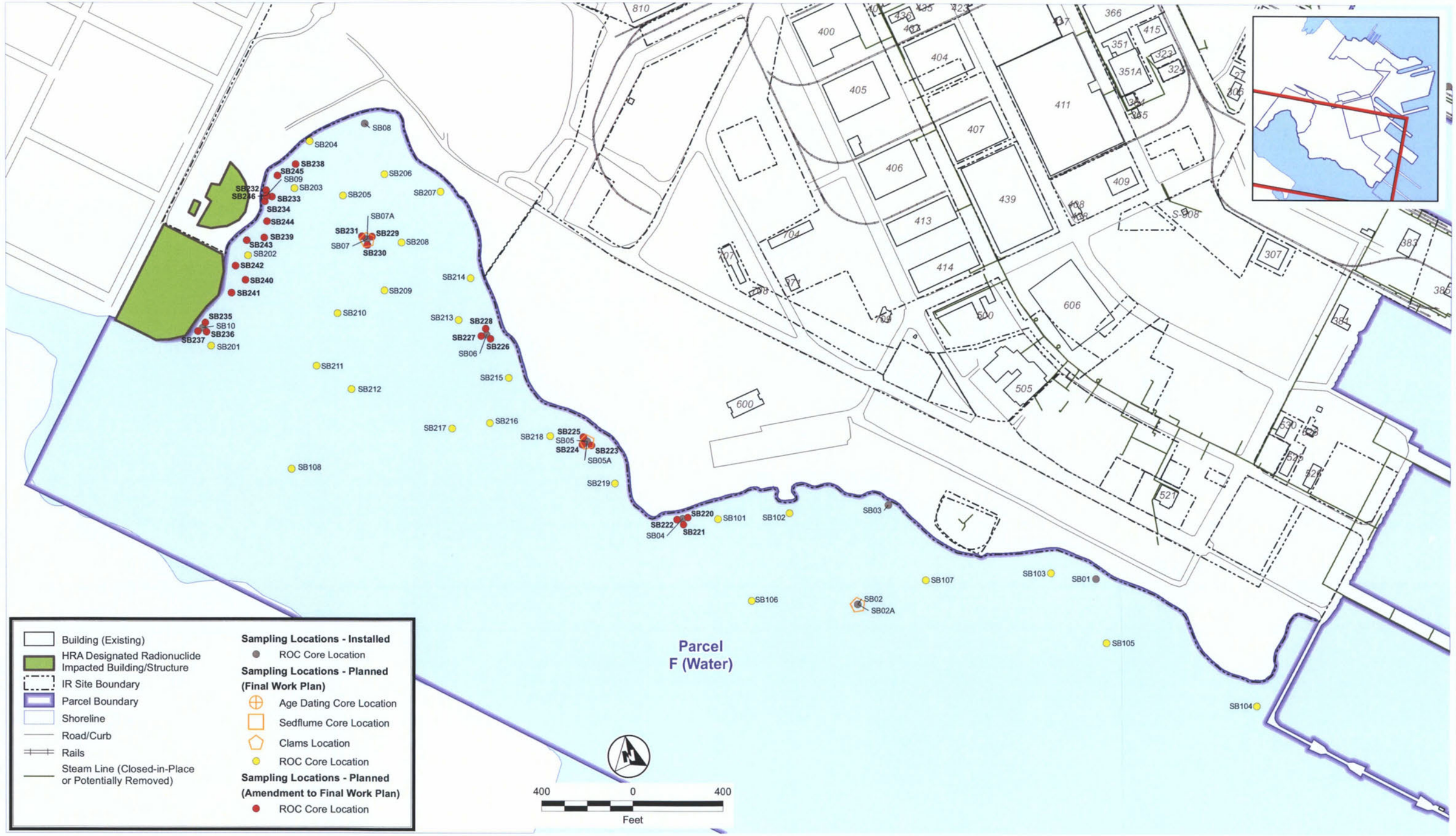

Radiological Data Gaps Investigation, Phase 2b
Parcel F
Hunters Point Naval Shipyard
San Francisco, California

FIGURE 17-9A
Sampling Location Map,
South Basin Area

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Table 17-4A. Station Locations for the Phase 2b DGI

Station ID	Easting	Northing	Sample Type
	CA State Planar, Zone 3 NAD27, US Survey Ft		
SA410	1461706.1	453644.2	ROC Core (Former Piers Area)
SA411	1461856.7	453782.6	ROC Core (Former Piers Area)
SA412	1461861.0	453685.8	ROC Core (Former Piers Area)
SA413	1461642.5	453778.5	ROC Core (Former Piers Area)
SA414	1461545.3	453771.9	ROC Core (Former Piers Area)
SA415	1461436.5	453705.2	ROC Core (Former Piers Area)
SA416	1461656.5	453918.6	ROC Core (Former Piers Area)
SA417	1461700.5	453552.0	ROC Core (Former Piers Area)
SA418	1461558.3	453868.9	ROC Core (Former Piers Area)
SA419	1461566.9	453959.6	ROC Core (Former Piers Area)
SA420	1460670.9	454185.3	ROC Core (Step-out centered on SA05/SA426)
SA421	1460684.1	454144.9	ROC Core (Step-out centered on SA05/SA426)
SA422	1460644.8	454146.3	ROC Core (Step-out centered on SA05/SA426)
SA423	1459833.9	454135.6	ROC Core (Step-out centered on SA01)
SA424	1459797.5	454110.8	ROC Core (Step-out centered on SA01)
SA425	1459794.8	454153.6	ROC Core (Step-out centered on SA01)
SA426	1460664.8	454161.0	ROC Core (Collocated confirmation of SA05)
BN319	1462028.0	453322.1	ROC Core (Step-out centered on BN01)
BN320	1461996.3	453291.2	ROC Core (Step-out centered on BN01)
BN321	1461985.6	453332.0	ROC Core (Step-out centered on BN01)
BS131	1460924.4	448173.7	ROC Core (Step-out centered on BS12)
BS132	1460928.2	448138.0	ROC Core (Step-out centered on BS12
BS133	1460893.2	448134.6	ROC Core (Step-out centered on BS12
SB220	1458434.9	449172.9	ROC Core (Step-out centered on SB04)
SB221	1458410.5	449146.0	ROC Core (Step-out centered on SB04)
SB222	1458385.0	449172.3	ROC Core (Step-out centered on SB04)
SB223	1458070.1	449553.1	ROC Core (Step-out centered on SB05)
SB224	1458032.4	449562.2	ROC Core (Step-out centered on SB05)
SB225	1458041.5	449594.0	ROC Core (Step-out centered on SB05)
SB226	1457715.0	450083.7	ROC Core (Step-out centered on SB06)
SB227	1457677.1	450102.6	ROC Core (Step-out centered on SB06)
SB228	1457702.0	450130.0	ROC Core (Step-out centered on SB06)
SB229	1457280.8	450609.8	ROC Core (Step-out centered on SB07)
SB230	1457253.7	450577.2	ROC Core (Step-out centered on SB07)
SB231	1457238.6	450618.9	ROC Core (Step-out centered on SB07)
SB232	1456866.7	450887.7	ROC Core (Step-out centered on SB09/SB246)

Table 17-4A. Station Locations for the Phase 2b DGI (Continued)

Station ID	Easting	Northing	Sample Type
	CA State Planar, Zone 3 NAD27, US Survey Ft		
SB233	1456886.6	450854.8	ROC Core (Step-out centered on SB09/SB246)
SB234	1456852.7	450840.2	ROC Core (Step-out centered on SB09/SB246)
SB235	1456507.8	450366.3	ROC Core (Step-out centered on SB10)
SB236	1456506.5	450326.6	ROC Core (Step-out centered on SB10)
SB237	1456470.1	450335.0	ROC Core (Step-out centered on SB10)
SB238	1457011.5	450977.3	ROC Core (Ship Shield Area)
SB239	1456822.9	450686.3	ROC Core (Ship Shield Area)
SB240	1456710.5	450519.1	ROC Core (Ship Shield Area)
SB241	1456641.4	450474.2	ROC Core (Ship Shield Area)
SB242	1456678.7	450587.6	ROC Core (Ship Shield Area)
SB243	1456745.5	450688.1	ROC Core (Ship Shield Area)
SB244	1456846.9	450754.4	ROC Core (Ship Shield Area)
SB245	1456925.3	450941.9	ROC Core (Ship Shield Area)
SB246	1456863.0	450862.7	ROC Core (Collocated confirmation of SB09)
RP01	1433432.9	515318.1	*Macoma nasuta* – Reference (Paradise Cove)
RP02	1432803.1	515580.1	*Macoma nasuta* – Reference (Paradise Cove)
RP03	1434162.4	515758.1	*Macoma nasuta* – Reference (Paradise Cove)
RY01	1458201.7	429459.7	*Macoma nasuta* – Reference (Oyster Point)
RY02	1460345.4	429843.0	*Macoma nasuta* – Reference (Oyster Point)
RY03	1461570.5	432224.1	*Macoma nasuta* – Reference (Oyster Point)

BN = Ship Berths North
BS = Ship Berths South
SA = Submarine Base Area
SB = South Basin
RP = Reference Paradise Cove
RY = Reference Oyster Point

Attachment #17-1: Summary of Field Sampling Methods

A17-1-4 Sample Preservation, Packaging, and Shipment

Samples delivered to the onsite laboratory will be packaged and shipped in accordance with the procedures in the Battelle SOP 5-210, *Packaging and Shipping of Samples*. The sediment samples for Ra-226, Cs-137, Pu-239, Co-60, Sr-90, and U-235 will be shipped to the TestAmerica St. Louis, Missouri, laboratory for analysis within 24 hours of collection.

A17-1-5 Sample Containers and Labeling

Sample container, sample size and preservation requirements are provided in Worksheet 19. Contact information for each of the laboratories is provided in Worksheet 30.

Sample containers will be labeled with waterproof, adhesive-back labels. Sample labels will provide sufficient detail to uniquely identify each sediment sample and allow tracking to field activities.

The labeling scheme for sample identification will include the area identifier (SA – Submarine Base Area, BN – Ship Berths North, BS – Ship Berths South, SB – South Basin, RA – Reference Alameda Buoy, RB – Reference Bay Farm, RP – Reference Paradise Cove, RR – Reference Red Rock, RY – Reference Oyster Point, and RZ – Reference Alcatraz), and a location number (e.g. 01).

For example, ID number SA01 represents the sample taken at location 01 in the Submarine Base Area. See Worksheet #18 for specific sample locations and IDs.

Sample container labels must include a unique sample identification number, matrix, collection date, sample collector's name, container number and total number of containers (e.g., 1 of 2, 2 of 2). An example is provided below.

U.S. Navy - Hunters Point Parcel F Phase 2B DGI
ITSI Gilbane Project Number 07225.0002

Sample ID: SA101 **Station ID:** _____

Date: _____ **Time (local):** _____

Matrix: Sed Tissue Water Other **Collector Initials:** _____

Analysis: ROC Sedflume PS/TOC/BD Age Dating Other

Preservative: 4°C Other _____ **Container** ____of_____

ITSI Gilbane **Phone:** 925-946-3100

Attachment #17-1: Summary of Field Sampling Methods (Continued)

A17-1-6 Vibracore Sediment Sample Collection

Sediment vibracore samples will be collected by ITSI Gilbane and TEG from a vessel with an electric vibracore system. Vibracore samples will be collected in drydocks 2 and 3 where sedimentation rates exceed the capabilities of a hand piston core to reach sediments older than 1945, and in water depths >8m where a hand deployed piston core is not effective. The target core depth is 120cm in the deep water areas. Samples will be taken to refusal (drydock bottom) in the drydocks. Factors such as refusal from circumstances beyond the field team's control (e.g. debris or organism interference) may reduce the penetration/retrieval depth.

If possible, cores will be collected at all locations described in Tables 17-2 and 17-3 in this SAP. The system is comprised of an electrically powered vibratory head, coupled to either an aluminum barrel with a polyethylene liner and stainless steel cutter and catcher, or a polycarbonate tube with a polyethylene terephthalate catcher. After retrieval, the core tube is sealed with an appropriate system (twisted bag and tape for polyethylene liners or polyethylene cap for polycarbonate tubes). The core will be screened with equipment and methods described in the APP (ITSI Gilbane,2012). If high water content and mixing has occurred at the surface sediment/water interface, the tubing with sediment is positioned upright undisturbed for ~10 minutes to allow settling of fine particles. After ~10 minutes, the water is drained slowly by puncturing a small hole in the liner at the sediment/water interface. The core length is measured to the nearest 0.1 ft and recorded on the field log form. Cores will be sectioned into one-foot sections (for samples ≤120cm) or into length-dependent sections in cores >120 cm (e.g. the long cores in drydocks 2 and 3). Sediment will be placed into a labeled polyethylene zip closure bag, double bagged, and packed for shipment.

All collection information will be recorded on field log forms (Attachment #17-2).

A17-1-7 In-situ deployment and collection of the mollusk *Macoma nasuta*

The bivalve mollusk, *M. nasuta*, native to San Francisco Bay and a commonly used organism in marine sediment bioaccumulation studies, will be deployed in plastic cages (weighted with stainless steel) by ITSI Gilbane and TEG staff from a vessel, following the Battelle project specific SOP HPNS 001-01. *M. nasuta* will be acquired from a commercial supplier (e.g. Aquatic Research Organisms, Inc., Hampton, New Hampshire) and shipped via overnight carrier to HPNS. Approximately 30 *M. nasuta* will be placed into each cage, and three cages will be deployed at each of the nine target locations within Parcel F and at three of the six reference areas. Organisms from each of the three cages will be combined into one laboratory analytical sample. One field duplicate will be deployed, resulting in a total of ten tissue samples from 30 cages. After receipt from the suppliers, *M. nasuta* will be placed into the 39 cages and hung in the water column at Oyster Point Marina for ~24 hours to allow culling for organisms injured during shipping. After replacing injured or dead *M. nasuta*, organisms will be transported to HPNS or the Reference Areas via boat in their cages. The boat will navigate to a deployment location, and sediment from the location will be collected with a modified Van Veen grab sampler. The cages will be filled with sediment and then deployed by gently lowering the weighted cages until they sink into the site sediment. Cages will be marked and have a small surface float attached. Cages will also contain a tag line on the bottom in case the surface float is lost the cage can be retrieved via dragging a grapnel hook.

M. nasuta will be deployed for 28-45 days. Twenty-eight days is the minimum in-situ exposure duration and is considered adequate for steady-state concentrations of metals in mollusk tissue. The added window of forty-five days allows flexibility in scheduling. Since steady state should be reached before 28 days, the additional deployment time, if required, should not affect the results. Cages will be retrieved to the boat and sediment will be rinsed from the cage and organisms. Once the external sediment has been

Attachment #17-1: Summary of Field Sampling Methods (Continued)

removed, *M. nasuta* will be placed into labeled food grade polyethylene zip bags, double bagged, and placed into a cooler with ice. *M. nasuta* will not be allowed to purge their gut to allow a conservative assessment of risk to the environment and humans by including sediment contained in the gut to be included in the radionuclide analysis. Organisms will be shipped under chain of custody to the TestAmerica Richland, WA laboratory. Data will be used to develop a sediment/mollusk radionuclide concentration factor to support the evaluation of risk from radionuclide activity in Parcel F sediments to the environment and humans.

A17-1-8 Geochronology of Sediments

Sediment cores will be collected with a piston core as described in section A-17-1-1. Cores (associated with Sedflume locations will be subsampled into two cm sections and analyzed for the radioisotopes ^{210}Pb and ^{137}Cs. Sediment will be extruded from the core using a piston mounted on a post. The core will be extruded in 2cm increments. Sediment from the outside of the core will be trimmed to remove smeared sediments. The 2cm sections will be placed into food grade polyethylene zip closure bags. Sediment sections will be analyzed or archived as follows:

Core Depth (cm)	Age (assuming 1cm/yr deposition)	Sample Intervals	Core Depth (cm)	Age (assuming 1cm/yr deposition)	Sample Intervals
0 to 2	2008	Sample 1	60 to 62	1948	Archived
2 to 4	2006	Archived	62 to 64	1946	Archived
4 to 6	2004	Archived	64 to 66	1944	Archived
6 to 8	2002	Archived	66 to 68	1942	Archived
8 to 10	2000	Sample 2	68 to 70	1940	Sample 11
10 to 12	1998	Archived	70 to 72	1938	Archived
12 to 14	1996	Archived	72 to 74	1936	Archived
14 to 16	1994	Archived	74 to 76	1934	Archived
16 to 18	1992	Sample 3	76 to 78	1932	Archived
18 to 20	1990	Archived	78 to 80	1930	Archived
20 to 22	1988	Archived	80 to 82	1928	Sample 12
22 to 24	1986	Sample 4	82 to 84	1926	Archived
24 to 26	1984	Archived	84 to 86	1924	Archived
26 to 28	1982	Archived	86 to 88	1922	Archived
28 to 30	1980	Sample 5	88 to 90	1920	Archived
30 to 32	1978	Archived	90 to 92	1918	Archived
32 to 34	1976	Archived	92 to 94	1916	Sample 13
34 to 36	1974	Sample 6	94 to 96	1914	Archived
36 to 38	1972	Archived	96 to 98	1912	Archived
38 to 40	1970	Archived	98 to 100	1910	Archived
40 to 42	1968	Sample 7	100 to 102	1908	Archived
42 to 44	1966	Archived	102 to 104	1906	Archived
44 to 46	1964	Archived	104 to 106	1904	Sample 14
46 to 48	1962	Sample 8	106 to 108	1902	Archived

Attachment #17-1: Summary of Field Sampling Methods (Continued)

Core Depth (cm)	Age (assuming 1cm/yr deposition)	Sample Intervals	Core Depth (cm)	Age (assuming 1cm/yr deposition)	Sample Intervals
48 to 50	1960	Archived	108 to 110	1900	Archived
50 to 52	1958	Archived	110 to 112	1898	Archived
52 to 54	1956	Sample 9	112 to 114	1896	Archived
54 to 56	1954	Archived	114 to 116	1894	Archived
56 to 58	1952	Archived	116 to 118	1892	Archived
58 to 60	1950	Sample 10	118 to 120	1890	Sample 15

Radioisotope (Cs-137 and Pb-210) profile data will be used to provide estimates of sediment accumulation rates over the past 100 years. Age dating results presented in the Parcel F FS indicated the core depth to reach sediments deposited prior to 1945 was less than 90cm in the South Basin and adjacent to Point Avisadero. Data from India Basin indicate greater than 90cm of sediment has been deposited since 1945. Therefore, cores will be collected to approximately 120cm in the Berths North and Berths South areas, and a minimum depth of six feet in the India Basin area. The depth and degree of vertical mixing of surface and subsurface sediments through physical and biological processes will be characterized using radioisotope profile data and existing information on the composition and abundance of benthic fauna at HPNS (BioSystems Analysis, Inc., 1994). If necessary, archived sections can be analyzed for further resolution of sediment age calculations.

A17-1-9 Sedflume Core Sample Collection

Sedflume cores will be collected as described in the SEI Sedflume Quality Assurance Project Plan document (Attachment 17-4). A summary of the field collection methods is provided below.

Core tubes are inserted into a thin aluminum sleeve. The neck of the sleeve is a 10 by 15 cm outer tube, while the main body is a rectangular barrel with dimensions such that the 10 by 15 cm core tube fits tightly into the barrel.

The assembled coring sleeve is lowered to the sediment bed by a pole. Appropriate methods are determined for the specific vessel and water depth encountered. Pressure is applied to the top of the coring pole to push the core and tube into the sediment. The coring sleeve is then pushed as far as possible into the sediment bed. The target maximum depth is 60cm. The achieved penetration will vary due to the characteristics of the sediment. The coring sleeve is then brought back up and lifted onto the boat deck and the barrel lifted off the core tube. A plug is slid up into the core tube to act later as a piston, and the core is then capped. Sediment cores varying in length from 25-60 cm are obtained by this method.
Cores will immediately be visually inspected for length and quality and screened for ROCs. Cohesive sediments that show signs of disturbance during the coring process will be discarded and another core will be taken from that site. Acceptable cores will be capped and stored on deck, returned to shore, and then transported to the SEI Santa Cruz laboratory for testing. At the laboratory, sub-samples will be taken from the core for bulk property analysis will be placed in appropriate sized containers, labeled, sealed, and preserved until analysis at the laboratory. Dr. Craig Jones will be responsible for corrective action regarding sample method requirements.

All collection information will be recorded on field log forms (Attachment 17-2).

Attachment #17-1: Summary of Field Sampling Methods (Continued)

A17-1-10 ADCP Current Meter Operations

Water column velocities will be measured with an RDI Acoustic Doppler Current Profiler (ADCP) Workhorse Model 1200 kHz or 600 kHz or similar. ADCP meters measure current speed and direction at pre-programmed intervals in the water column. Data are collected and stored internally. The meter is placed on the bottom and has four acoustic 'beams' that look up and measure water born particle movements based on doppler shifts in returns from the acoustic signals.

Sampling frequency for the ADCPs will be maximized for the expected 28 day deployment duration and memory capacity. The expected data collection program will collect water column profile data every one second, and averaged over a five minute interval. The result is a five minute time-average of water current profiles. A second option is a burst averaging setup. Every 15 minutes, a five minute time-average of the current profile will be collected. Data will be collected from just above the bottom to the bay surface in depth sections of approximately 0.5 m deep. In 10 meter deep water, this would provide data from approximately 18-19 depths (the bottom 1-2 meters are not able to be measured). The meter will be deployed for from 4-6 weeks. The meter will be deployed on a base, and from the base a slightly buoyant line (aka 'tag line') will be attached to a secondary float. The meter will be recovered by dragging a grapnel hook drug from a vessel and catching the 'tag line' and then recovering the meter, bottom frame, and secondary anchor to the vessel.

The ADCP is programmed and operated as described in the RDI manual, "WorkHorse Monitor, Sentinel, Rio Grande, and Mariner Acoustic Doppler Current Profiler Technical Manual". After deployment, data is retrieved from memory and data are initially processed with ADCP software (e.g. WinADCP). Data will undergo standard RDI QA/QC analysis and refinement prior to processing in the sediment transport efforts.

All collection information will be recorded in field notebooks and electronic deployment parameters will be backed up onto separate media the day of deployment.

A17-1-11 Decontamination

Decontamination will be performed on all field equipment to avoid cross-contamination between samples and to ensure the health and safety of field personnel. The following sequence will be used to clean equipment and sampling devices prior to and between each use:

(1) Wash with Liquinox™ detergent and site water and clean with a brush.
(2) Rinse with site water.
(3) Rinse with distilled water.
(4) Place/store the sampling equipment on a clean surface.

The SOP by which all equipment will be decontaminated can be found in Attachment B.

A17-1-12 Disposal of IDW

Generation of IDW will be minimized to the greatest extent possible. Handling of IDW is limited to the proper disposal of sampling equipment, personal protective equipment (PPE), contaminated sediment, and decontamination liquids. Handling of IDW will supervised by the Radiation Safety Technician (RST). General procedures are as follows:

Attachment #17-1: Summary of Field Sampling Methods (Continued)

- Staff shall ensure that secondary containment is used for the transfer of any unsealed radioactive material outside of radiologically restricted areas. This will prevent the spread of contamination outside of restricted areas.

- The RST will survey the outside of all radioactive material containers prior to removal from storage, radioactive waste cans, or posted contaminated areas. Transfer to a radiologically clean secondary container is an acceptable alternative. Survey, in the context of this recommendation, generally refers to frisking with a radiation detection instrument, but also includes collecting smears where warranted.

- Personnel shall periodically perform smears and/or direct frisk (if possible) of work areas while work is in progress in addition to performing periodic hand and foot frisking.

- Personnel with open skin wounds will not work with unsealed radioactive material without an adequate waterproof covering on the wound (as determined by Radiation Safety).

- Items that have been used in radiologically restricted areas will not be released for unrestricted use until they have been verified by Radiation Safety to meet the established release criteria. Only Radiation Safety is authorized to release materials or items for unrestricted use.

All IDW will be transferred to the HPNS on-site radiological contractor, TPMC-Energy Solutions (TES) with appropriate documentation. TES will dispose of the IDW in accordance with all applicable local, state, and federal regulations.

Attachment #17-2 – Forms

ITSI Gilbane

Project #:		**Vessel:**	
Project Name:	*HPS Parcel F*	**Chief Scientist:**	
Location:	*HPS, San Francisco*	**Date:**	
Client:	*US Navy*		

Station ID:		**Time On Station:**		**Attempt:**	**Feet**
Station Descriptor:		**Date:**		1 **Total Penetration:**	
Core Sample ID:		**Northing (ft):**		**Recovery:**	
Logged by:		**Easting (ft):**		**Time of collection:**	
Collection Mechanism:		**GPS Accuracy:**		2 **Total Penetration:**	
Coordinate System:	CA State Planar/Zone3/NAD27/USFt	**Water Depth (ft):**		**Recovery:**	
		Tide (ft):		**Time of collection:**	
		Time Off Station:			

As Sampled depth below mudline (ft)*	Lithology - Include USCS code	Type	Color	Consistency	Maximum particle size	Odor	Sample IDs	Comments
1								
2								
3								
4								

Comments:

Page ____ of ____

Attachment #17-2 – Forms (Continued)

ITSI Gilbane

Daily Log Form

Date:	Recorder:	Project #:
Start Time (local):	Stop time (local):	
Sampling Area(s):		
Weather Conditions:		
Sampling Activities (by Station):		
Comments:		
Field Personnel:		
Health and Safety Issues:		

Field Team Leader Review and Approval _____

Attachment #17-2 – Forms (Continued)

ITSI Gilbane

USNAVY HPNS PARCEL F PHASE 2 RADIONUCLIDE DGI

DGPS DAILY LOG

Project No.	Date:	Recorder:
DGPS (make/model/SN):	Coordinate System and units:	

Primary dGPS Check	
Time of check (local):	DGPS Estimate of Accuracy (PDOP):
Benchmark or Reference Point ID:	Benchmark or Reference Point Established By:
Established Latitude/Northing:	Established Longitude/Easting:
Measured Latitude/Northing:	Measured Longitude/Easting:
Instrument Measured Displacement (meters):	
Displacement Acceptable? (≤5 m): YES NO	

Secondary dGPS Check	
Time of check (local):	DGPS Estimate of Accuracy (PDOP):
Benchmark or Reference Point ID:	Benchmark or Reference Point Established By:
Established Latitude/Northing:	Established Longitude/Easting:
Measured Latitude/Northing:	Measured Longitude/Easting:
Instrument Measured Displacement (meters):	
Displacement Acceptable? (≤5 m): YES NO	
Field Activities / Comments / Observations:	

Field Team Leader Review and Approval _____

Attachment #17-2 – Forms (Continued)

ITSI Gilbane

USNAVY HPNS PARCEL F PHASE 2 RADIONUCLIDE DGI

SEDIMENT GRAB SAMPLING LOG

ITSI Gilbane Project No.	Date:	Recorder:
Station ID:	Time On Station: (local)	Time Off Station: (local)
Northing (CA Planar/Zone3/NAD27/USFt)	Easting (CA Planar/Zone3/NAD27/USFt)	DGPS Accuracy Estimate:
Sample Time: (local)	Grab sample depth (in):	Vessel:
Water depth (ft):	Sampler type:	Sampling Staff:

Sediment (in)	Sample Description	Sample Type (check)	Sample ID
0-6	Color: Black Dark Gray Gray Brown Other: Type: Cobble Gravel Sand (coarse med fine) Silt Clay Wood chips Shells or Shell Hash Other: Odor: None Slight Moderate Strong Petroleum H2S Other: Misc: Biota _____ Detritus _____	Radionuclides Grain Size TOC	

Grab Number (A= Accepted; R = Rejected

***Codes: DB** = Debris Interference; **DS** = Disturbed Surface; **NS** = No Sediment in sampler; **OP** = Over Penetration; **OT** = Other*

1	2	3	4	5	6	7	8	9	10

Field Activities / Comments / Observations:

Field Team Leader Review and Approval _____

Attachment #17-2 – Forms (Continued)

US NAVY HPS PARCEL F PHASE 2 RADIONUCLIDE DGI
MOLLUSK DEPLOYMENT/RETRIEVAL LOG

Station ID:	Project #: G927502

Deployment

Date:	Time (local):	Recorder:

Cage No.	Easting (ft):	Northing (ft):	Direction of Tag Line Deg Mag; from Cage to Weight	Coordinate System:
1				CA State Planar; Zone3; NAD27; US Survey Ft
2				
3				

Water Depth (ft):	Tide (ft)	Water Depth (MLLW; ft):

Comments:

Recovery

Date:	Time (local):	Recorder:
Water Depth (ft):	Tide (ft)	Water Depth (MLLW; ft):

Comments:

Cage Deployment Information

Cage Number	No. Mollusks Deployed	No. Mollusks Recovered	No. Empty Shells	Sample ID
1				
2				
3				

Quality Control Samples

Zero Time	No. of Mollusks:	Sample ID:	Other

Comments:

Field Personnel Deployment:

Field Personnel Recovery:

ITSI Gilbane

Field Team Leader Review and Approval _____

Attachment #17-2 – Forms (Continued)

SEDFLUME SAMPLING DATA SHEET

Sea Engineering, Inc.
Project Number: **Project Title:**

DATE (mm/dd/yy) _____ INITIALS _____ AREA-STATION ID _____

ON STATION (time) _____ WATER DEPTH _____ Ft M Fm

STATION POSITION (NAD 83) Latitude or Northing _____ Longitude or Easting _____

SAMPLER USED (circle one) Vibracorer Gravity Corer Push Corer (size _____) Van Veen Grab Other:

Sampling Area	Sample Type	Minimum Acceptable Recovery
	Sedflume*	30 cm (1 ft)
* Core must have undisturbed surface and no visible fractures in core.		

Attempt Number					
Attempt Start/End Time	/	/	/	/	/
Apparent Penetration Depth (ft or cm)					
Recovery (ft or cm)					
Accepted (yes/no)					
Rejection Code					

Rejection Codes

OP	Overpenetrated	DB	Debris interference	NS	No sediment in sampler
NR	Insufficient Recovery	DS	Disturbed surface	FR	Core has visible fracture in sediments

For Acceptable Sample:	Attach Unique Sample ID here
Visible color change near surface? No Yes at _____cm Photographed ? No Yes	

Comments _____

Reviewed by _____ Date _____

Attachment #17-2 – Forms (Continued)

Sea Engineering Inc.

SURVEY LOG

Project Summary

Project:		Date:
Surveyor/Crew:	DGPS System:	Survey Type:

Horizontal Control

Name:	
Datum:	
Coord Sys:	
Position x / y:	
Position L / L:	
[ ] Transformation confirmation (corps con)	

Vertical Control

Name:	
Datum:	
Elevation:	

Notes:

Hypack v.2.12a Setup Checklist 860-635-1500

Hypack Project Name, Line File, Background File: _____

[ ] Geodetic parameters *(Print out & attach)*
hawaii datum shift file, corpcon method, calculate dx dy dz

Hardware Set-up - GPS:(kinematic.dll; 9600or4800 bau
[ ] Load c:\hypack\sei_hardware*.ini files
[ ] Update: (*50 ms*)
[ ] Sync clock(other than zda pref.), position, heading, spe
[ ] Record raw, quality, message
[ ] Offsets/Latency: *(typ. 0.2 cnav/leica)*

Hardware Set-up - Echo Sounder:(echotrac.dll)
[ ] Update: _____ (*250 ms*)
[ ] Record: *Raw data* *Always*

Surveys (Options):
[ ] Project information - ***Check Project Path***
[ ] Navigation parameters
Event interval (distance): _____

Field Checklist

Computer:
[ ] Time Zone check (*HST, GMT-10*)
[ ] GPS Time Sync
[ ] Sync error in gps window (should be <10ms)

Position:
[ ] Field check horiz. Position (bm, dock corner)
[ ] Latency Field check

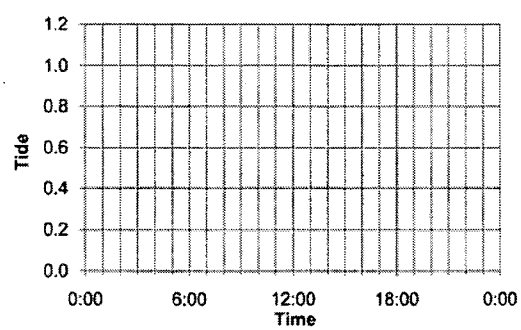
Echo Sounder: measure draft & sound vel. Bar check draft @ 5ft
Bar check vel at 30 or 40ft
[ ] Bar check before [ ] Bar check after
[ ] Boat level during cal & survey [ ] Lead line check
Draft _____ Blanking _____
Sound vel: measure w digibar _____
Typ.: 1490-1540m/s; 4890-5050ft/s for 50-80deg, 35 sal

Tide Information

Time	BM	Reading	Tide

Location: **Honolulu**
Date: Datum:
Field Tide Error Estimate:

TIME	TIDE



share folder\forms\survey log.xls 1202 1202, 0203

Table 18-2A. Phase 2b DGI Sampling Methods and SOPs

Sampling Area	Sample ID Range (not continuous numbering)	Matrix	Sediment Depth (cm below mudline)	Analytical Group	Number of Samples[1] (+ field duplicates)	Sampling SOP Reference
Submarine Area	SA410-SA426	Sediment	0 - 120	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	16	ACES 5-169-03 ACES 5-342-01
Berths North	BN319-BN321	Sediment	0 - 120	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	3	ACES 5-169-03 ACES 5-342-01
Berths South	BS131-BS133	Sediment	0 - 120	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	3	ACES 5-169-03 ACES 5-342-01
South Basin	SB220-SB246	Sediment	0 - 120	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	26	ACES 5-169-03 ACES 5-342-01
Reference Area[2]	RP01-RP03, RY01-RY03	Tissue	0-20	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	7	Battelle HPS 001-01

(1) Field duplicate samples are not collected for sediment due the inherent variability of the sediment matrix. After collection, samples will be sectioned as detailed in Table 17-3A.

(2) Two of the original reference points deployed during the first part of Phase 2 were not recovered. Alternate reference locations from the pool of seven possible in the approved SAP will be deployed and collected.

SAP Worksheet #19 - Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Containers (number, size, and type)	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Sediment	Gamma Spectroscopy (RSRS)	C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry / HPO-Tt-028	250-mL plastic container	250-mL or 500-mL	None	None
Sediment	Gamma Spectroscopy (TestAmerica)	EPA 901.1 Mod Gamma/ST-RD-0102	500-mL plastic container	250-g or 500-g	None	None
Sediment	Alpha Spectroscopy (TestAmerica)	DOE A-01-R Mod Iso-Pu/ST-RD-0210	125-mL plastic container	5 grams	None	None
Sediment	Strontium-90 (TestAmerica)	EPA 905.0 Mod or DOE SR-03-RC Mod Sr-90/ST-RD-0403	125-mL plastic container	5 grams	None	None
Sediment	TOC	ASTM-D-4129/ SOP GEN-ASTM	125-mL wide mouth glass jar	25 grams	Cool, 4 ± 2 ° C	Analyze within 28 days
Sediment	Particle Size	ASTM D422M/ BR-GT-006	500–mL plastic wide mouth jar	500 grams	Cool, 4 ± 2 ° C	Analyze within 6 months
Sediment	Bulk Density	ASTM D2937M/ BR-GT-018	500–mL plastic wide mouth jar	100 grams	Cool, 4 ± 2 ° C	Analyze within 6 months
Sediment	Age-Dating for ^{210}Pb	PB-001	Plastic 125 mL	15 grams	Cool, 4 ± 2 ° C	None
Sediment	Age-Dating for ^{137}Cs	EPA 901.1/CS-001	Plastic 125 mL	150 grams	Cool, 4 ± 2 ° C	None
Swipe	Alpha/beta emitting radionuclides (RSRS)	U.S. EPA Method 9310 or equivalent/ HPO-Tt-029	2 cloth swipes, 1.75 in. diameter	N/A	None	None

SAP Worksheet #19 - Analytical SOP Requirements Table (Continued)

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Containers (number, size, and type)	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Swipe	Alpha/beta emitting radionuclides (TestAmerica)	U.S. EPA Method 9310 or equivalent/ ST-RD-0210	2 cloth swipes, 1.75 in. diameter	N/A	None	None
Tissue	Gamma Spectroscopy	EPA 901.1 Modified for Tissue	Plastic Zip-lock container or equivalent	120 grams tissue	Cool, 4°C ± 2 °C	180 days
Tissue	Strontium-90	EPA 905.0 Modified for Tissue	Plastic Zip-lock container or equivalent	20 grams tissue	Cool, 4°C ± 2 °C	180 days
Tissue	U-235	RP725 Modified for Tissue	Plastic Zip-lock container or equivalent	20 grams tissue	Cool, 4°C ± 2 °C	180 days
Tissue	Ra-226	EPA 903.1 Modified for Tissue	Plastic Zip-lock container or equivalent	50 grams tissue	Cool, 4°C ± 2 °C	180 days
Tissue	Pu Isotopic	RP800 Modified for Tissue	Plastic Zip-lock container or equivalent	20 grams tissue	Cool, 4°C ± 2°C	180 days

N/A – not applicable

SAP Worksheet #20 – Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates[1]	No. of MS /MSDs	No. of Field Blanks	No. of Equip. Blanks[2]	No. of VOC Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Sediment (Phase 1 Screening Survey)	Radionuclides	66 HPS 6 Ref	0	4	0	5	0	0	81
Sediment (Phase 2 DGI)	Radionuclides	157 HPS 18 Ref	0	9	0	12	0	0	700[3]
Sediment (Phase 2b DGI- New)	Radionuclides	50	0	3	0	4	0	0	200
Sediment (Phase 2 DGI)	TOC	14	0	1	0	0	0	0	15
Sediment (Phase 2b DGI - New)	TOC	7							65
Sediment (Phase 2 DGI)	Particle Size	14	0	0	0	0	0	0	14
Sediment (Phase 2b DGI - New)	Particle Size	7							65
Sediment (Phase 2 DGI)	Bulk Density	14	0	0	0	0	0	0	14
Sediment (Phase 2b DGI - New)	Bulk Density	7							65
Sediment (Phase 2 DGI)	Age-Dating	4	0	0	0	0	0	0	4
Clam Tissue (Phase 2 DGI)	Radionuclides	9 HPS 3 Ref	1	1	0	0	0	0	14

(1) Field duplicate samples are not collected for sediment due the inherent variability of the sediment matrix.
(2) Equipment blanks are collected at a rate of one per sampling day, precise number of days is not known.
(3) Four sections per core analyzed (175 Locations * 4 samples/location = 700 samples)

SAP Worksheet #23 - Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
HPO-Tt-028 (Phase 1)	Determination of Gamma Radiation in Various Matrices Using Ortec Ge Gamma Spectroscopy Detection Systems and Gamma Vision-32 Software and Global Value Productivity Add-on from Gamma Vision-32, Rev 0	Screening	Gamma Emitting Radionuclides	Ortec HpGe Gamma Spectroscopy System	RSRS	No
HPO-Tt-029 (Phase 1)	Determination of Gross Alpha and Beta Activity on Smears and Air Sample Filters Using the Protean Gas Proportional Counting System WPC 1050, Rev 0	Screening	Alpha/Beta Emitting Radionuclides	Protean Gas Proportional Counting System WPC 1050	RSRS	No
ST-RD-0102	Gammavision Analysis Rev. 9	Definitive	Gamma Isotopes	Gamma Spectrometer	TestAmerica-St Louis	No
ST-RD-0403	Low Background Gas Flow Proportional Counting (GFPC) System Analysis, Rev. 13	Definitive	Strontium-90	Gas Flow Proportional Counter	TestAmerica-St Louis	No
ST-RD-0210	Alpha Spectroscopy Analysis Rev. 10	Definitive	Alpha Emitting Radionuclides	Alpha Spectrometer	TestAmerica-St Louis	No
RL-GAM-001	Preparation of All Matrices for Analysis by Gamma Spectroscopy, Rev 1	Definitive	Gamma Emitting Radionuclides	HPGe Gamma Spectroscopy System	TestAmerica-Richland	No
RL-GPC-003	Strontium Separation in Environmental Matrices, Rev. 1	Definitive	Strontium-90	Low-background gas-flow proportional counter	TestAmerica-Richland	No
RL-ALP-004	Separation of Uranium by Extraction Chromatography, Rev. 1	Definitive	U-235	Alpha Spectroscopy	TestAmerica-Richland	No
RL-RA-001	Radium-226 and Radium-228 Separation in Radiochemical Matrices, Adapted from EPA Methods 903.1 and 904.0, Rev.1	Definitive	Ra-226	Alpha Scintillation	TestAmerica-Richland	No

SAP Worksheet #23 - Analytical SOP References Table (Continued)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
RL-ALP-001	Determination of Actinides by Extraction Chromatography, Rev. 2	Definitive	Pu Isotopic	Alpha Spectroscopy	TestAmerica-Richland	No
GEN - ASTM	Carbon, Total Organic in Soil Rev.6	Definitive	TOC	Coulometric	CAS	No
BR-GT-006	Particle Size Analysis, Rev. 6	Definitive	Particle Size	NA	TestAmerica-Burlington	No
BR-GT-018	Density in Soils by Drive Cylinder Method, Rev. 5	Definitive	Bulk Density	NA	TestAmerica-Burlington	No
PB-001	Method for Determination of Pb-210 in Sediments using an EG&G Octet Alpha Spectrometer, Rev. 2	Definitive	Age-Dating	Alpha Spectroscopy	Core Scientific International	No
CS-001	CS-137 Measurement in Sediment Core Sections by Gamma Spectrometry Using a GEM HPGe (High Purity Germanium) Coaxial Detector, Rev. 3	Definitive	Age-Dating	Gamma Spectroscopy	Core Scientific International	No

SAP Worksheet #24 - Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
EG&G Ortec Beryllium Window HPGe Gamma Spectroscopy System (RSRS)	Ortec Gamma Vision-32 A66-B32 Operations Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	-recalibration -instrument maintenance -notify lab manager	Laboratory Manager	HPO-Tt-028
Protean Gas Proportional Counting System WPC 1050 (RSRS)	IPC 9025 Operations Manual, Protean Instrument Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	-recalibration -instrument maintenance -notify lab manager	Laboratory Manager	HPO-Tt-029
Gas Flow Proportional Counter (TestAmerica)	• Plateau generation and/or verification • Discriminator setting • Initial long background count • Mass attenuated efficiency calibration • Eight source dual/single calibration curves	Annual	• Plot efficiencies vs masses • Calculate equation of curve – degree ≤3 • Remove outliers >15% deviation from theoretical values but not more than 20% of total points • Calculate coefficient of determination (R^2). R^2 must be ≥0.9 • Verify calibration with second source standard count – must be within 30 percent of true value and mean across all detectors <10%	• Recalibrate • Instrument maintenance • Consult with Technical Director	Group Leader	ST-RD-0403 RL-GPC-003

SAP Worksheet #24 - Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer (TestAmerica, Core Scientific International)	1. Energy calibration 2. Full width at half-maximum (FWHM) calibration	1. Annual 2. Annual	For Energy and FWHM calibration: • Within 0.5% or 0.1KeV for all calibration points • Within 8% for all calibration points • Verify with second source that always contains at least Am-241, Co-60, and Cs-137 • Must be ± 10%D for each nuclide	• Recalibrate • Instrument maintenance • Consult with Technical Director	Group Leader	STD-RD-0102 RL-GAM-001 CS-001

SAP Worksheet #24 - Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Alpha Spectrometer (TestAmerica, Core Scientific International)	1. Energy calibration 2. Efficiency calibration and background check 3. Subtraction spectrum, 4. Pulser check and background check	1. Monthly 2. Monthly 3. Monthly 4. Daily	1. Three isotopes in 3-6 MeV range all within ± 40 KeV of expected value 2. >20% 3. Ultra Low Level: < 2 CPM Low Level: < 2-4 CPM Routine Level: < 4-10 CPM High Level: < 10-20 CPM 4. Pulser energy, peak centroid, peak resolution, peak area, calibration and background must pass statistical "boundary" out-of-range test	• Recalibrate • Instrument maintenance • Consult with Technical Director If background check is > 20 CPM, then detector requires maintenance	Group Leader	ST-RD-0210 RL-ALP-004 PB-001
Liquid Scintillation Counter (TestAmerica)	QA check; Background and efficiency verification for C-14 and H-3; review daily control data	Daily	within 3 sigma of established baselines and stable baselines for C-14 and H-3 efficiencies	Recalibrate Consult with Technical Director	Group Leader Analyst	ST-RD-0302 RL-RA-001

SAP Worksheet #24 - Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Coulometric (CAS)	ICAL min 3 point ICV +/- 20% Linear R > 0.995 Quad R >0.995	Every 10 Samples	CV ±20% of expected value	Perform and document corrective action	Lab Analyst	GEN-ASTM

SAP Worksheet #25 - Analytical and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity/ Testing Activity/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
EG&G Ortec Beryllium Window Gamma Spectroscopy System (RSRS) (Phase 1)	Clean cave; fill LNO2/physical check/physical activity	Weekly	Acceptable background	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	HPO-Tt-028,
	QA check/Background check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	HPO-Tt-028,
	QA check/Source check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	HPO-Tt-028,
	QC check/sample duplicates	Once per batch or every 20 samples	lowest activity is within twenty percent of the highest activity	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	HPO-Tt-028,
Protean Gas Proportional Counting System WPC 1050 (RSRS) (Phase 1)	QA check/alpha source check/check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	HPO-Tt-029,
	QA check/beta source check/check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	HPO-Tt-029,
Protean Gas Proportional Counting System WPC 1050 (RSRS) (Phase 1) (Continued)	QA check/Background blank/check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	HPO-Tt-029,

SAP Worksheet #25 - Analytical and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity/ Testing Activity/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
	QA check P10 gas supply	Daily	Adequate	Resupply	Lab Manager	HPO-Tt-029,
Gas Flow Proportional Counter (TestAmerica)	1. Clean instrument, physical check 2. Inspect windows 3. QA check, background source count	1. Daily 2. High counts and/or background 3. Daily	1. None applicable 2. No physical defects 3. Within 3 sigma of 20 day population	• Recalibrate • Instrument maintenance • Consult with Technical Director	Analyst	ST-RD-0403 RL-GPC-003
Gamma Spectrometer (TestAmerica, Core Scientific International)	1. Clean cave; fill dewar with N_2; physical check 2. QA check ; background source count	1. Weekly 2. Daily	1. Acceptable background 2. Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult with Technical Director	Analyst	ST-RD-0102 RL-GAM-001 CS-001
Alpha Spectrometer (TestAmerica, Core Scientific International)	Clean planchette holders; physical check	Monthly	Acceptable background and calibration efficiencies	• Recalibrate • Instrument maintenance • Consult with Technical Director	Analyst	ST-RD-0210 RL-ALP-004 PB-001
Liquid Scintillation Counter (TestAmerica)	Clean dust and debris from sample deck; physical check Photon multiplier tubes cleaned by manufacturer; physical check	Monthly Annually	For all maintenance activities: within 3 sigma of established baselines and stable baselines for C-14 and H-3 efficiencies	Recalibrate Instrument, perform maintenance Consult with Technical Director	Group Leader Analyst	ST-RD-0302 Rev 10, RL-RA-001

SAP Worksheet #28-1 – Laboratory QC Samples Table for Sediment Samples (Continued)
Lab: TestAmerica

Matrix: Sediment
Analytical Group: Gamma Isotopes
Analytical Method/SOP Reference: EPA 901.1 Mod Gamma/ST-RD-0102

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Within in-house limits	b	Analyst	Accuracy	Ra-226: 73-107% Th-232: 82-126%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	b	Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28-1 – Laboratory QC Samples Table for Sediment Samples (Continued)

Lab: TestAmerica

Matrix: Sediment
Analytical Group: Isotopic Plutonium, Alpha Emitter
Analytical Method/SOP Reference: DOE A-01-R Mod Iso-Pu/ST-RD-0210

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	b	Analyst	Accuracy/ Precision	Pu-238: 80-127% Pu-239/240: 81-129% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	d	Analyst	Accuracy/ Precision	Pu-238: 75-110% Pu-239/240: 82-113% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	e	Analyst	Accuracy	Pu-242: 30-110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	b	Analyst	Precision	RPD ≤40% and/or RER ≤1

SAP Worksheet #28-1 – Laboratory QC Samples Table for Sediment Samples (Continued)

Lab: Core Scientific International

Matrix: Sediment
Analytical Group: Age-Dating for ^{210}Pb
Analytical Method/SOP Reference: PB-001

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1/batch	<5% of check sample counts	reanalyze	Lab Analyst	Accuracy	<5% of check sample counts
Check Sample	1/batch	±30% Recovery	Flag and/or reanalyze	Lab Analyst	Precision	±30% Recovery
Duplicate	1/batch	±30% RPD	Flag and/or reanalyze	Lab Analyst	Accuracy	±30% Recovery

SAP Worksheet #28-1 – Laboratory QC Samples Table for Sediment Samples (Continued)

Lab: Core Scientific International

Matrix: Sediment
Analytical Group: Age-Dating for ^{137}Cs
Analytical Method/SOP Reference: CS-001

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Check Sample	1/batch	±30% Recovery	reanalyze	Lab analyst	Precision/Accuracy	±30% Recovery
Duplicate	1/batch	±30% RPD	Flag and/or reanalyze	Lab analyst	Duplicate	±30% RPD

SAP Worksheet #30 – Analytical Services Table

Matrix	Analytical Group	Sample Location/ID Numbers	Analytical Methods/SOP References	Data Package Turnaround Time	Laboratory (Name and Address, Contact Person and Telephone Number)	Backup Laboratory (Name and Address, Contact Person and Telephone Number
Sediment (Phase 1 – Screening Data)	Radionuclides	See Worksheet #18	Gamma emitters: C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry /SOP RCHL-A-05 Sr-90: DOE Method Sr-01/Sr-02 or equivalent/ SOP RHCL-A-07 Alpha Emitters: Department of Energy (DOE) HASL-300 Method or equivalent / SOP RCHL-A-08	15 business days	Paul Wall, New World Technology Inc., 415-216-2731 Lab POC: Tetra Tech 200 Fisher Ave San Francisco, CA 94124 Bill Dougherty 415-216-2731	GEL Engineering, LLC 2040 Savage Road Charleston, SC 29407 843-769-7378 Joe Coffey, Ext. 4996
Sediment (Phases 2b)	Radionuclides	See Worksheet #18 TestAmerica	TestAmerica Gamma Emitters: EPA 901.1 Mod Gamma/ST-RD-0102 Sr-90: EPA 905.0 Mod or DOE SR-03-RC Mod Sr-90/ST-RD-0403 Alpha Emitters: DOE A-01-R Mod Iso-Pu/ ST-RS-0210	20 business days	Erika Starman, TestAmerica, 13715 Rider Trail North, Earth City, MO, 63045 314-298-8566	Debbie Fazio ALS Environmental 225 Commerce Drive Fort Collins, CO 80524 970-689-0630

SAP Worksheet #30 – Analytical Services Table (Continued)

Matrix	Analytical Group	Sample Location/ID Numbers	Analytical Methods/SOP References	Data Package Turnaround Time	Laboratory (Name and Address, Contact Person and Telephone Number)	Backup Laboratory (Name and Address, Contact Person and Telephone Number
Sediment	TOC and PSD	See Worksheet #18	ASTM D-4129/GEN ASTM ASTM-D-422M/BR-GT-006 ASTM D2937M/BR-GT-018	20 business days	Erika Starman, TestAmerica, 13715 Rider Trail North, Earth City, MO, 63045 314-298-8566 (TOC will be subcontracted to CAS; PSD to TestAmerica Burlington by TestAmerica St. Louis)	Debbie Fazio ALS Environmental 225 Commerce Drive Fort Collins, CO 80524 970-689-0630
Sediment	Age Dating	See Worksheet #18	MSL-C-012 and EPA 901.1/MSL-C-013	20 business days	Sandeep Kaur Singh Core Scientific International 154 Red Lily Road Winnipeg, Manitoba, Canada, R3X 0G1 204-479-9821	Erika Starman, TestAmerica, 13715 Rider Trail North, Earth City, MO, 63045 314-298-8566
Tissue	Radionuclides	See Worksheet #18	TestAmerica Gamma Emitters: EPA 901.1 Mod Gamma/ST-RD-0102 Sr-90: EPA 905.0 Mod or DOE SR-03-RC Mod Sr-90/ST-RD-0403 Alpha Emitters: DOE A-01-R Mod Iso-U/ST-RD-0210	20 business days	Jodie Carnes TestAmerica 2800 George Washington Way Richland, WA 99354 509-375-3131	Debbie Fazio ALS Environmental 225 Commerce Drive Fort Collins, CO 80524 970-689-0630

Note: All analytical laboratories will be certified by NELAC and the State of California (where certification for the analyte is possible) and approved by the Navy.

SAP Worksheet #32 - Assessment Finding and Corrective Action Responses for DGI Phase 2b

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Org.)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Internal Laboratory Assessment	Report to detail analysis deviations	Laboratory Director at TestAmerica-St Louis, TestAmerica-Richland, Core Scientific International	within 1 week of sample analysis	Documented in the lab report	QA Manager at TestAmerica-St Louis, TestAmerica-Richland, Core Scientific International	2 weeks
SAP implementation (field issues)	Non-Routine Occurrence Report; Nonconformance Report; Corrective Action Report	ITSI Gilbane PM, ITSI Gilbane Program Chemist, Navy RPM, (DON [if issue is major]); Navy QAO, (DON) (NAVSEADET RASO [if issue is radiological]), Regulatory agencies if issue is major	48 hours to 5 days, depending upon nature of deficiency	Corrective Action Report Form	ITSI Gilbane Program Chemist, ITSI Gilbane Project Chemist, Navy RPM, (DON), as required	48 hours to 5 days, depending upon nature of deficiency

SAP Worksheet #32 – Assessment Finding and Corrective Action Responses for DGI Phase 2b (Continued)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Org.)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
SAP implementation (laboratory issues)	Laboratory case narrative; Laboratory variance request; Non-Routine Occurrence Report; Nonconformance Report; Corrective Action Report	ITSI Gilbane PM, ITSI Gilbane Program Chemist, Navy RPM, (DON [if issue is major]); Navy QAO, (DON) (NAVSEADET RASO [if issue is radiological]), Regulatory agencies if issue is major	48 hours to 5 days, depending upon nature of deficiency	Corrective Action Report Form (major deficiencies); otherwise, corrective action is documented on the original deficiency document	ITSI Gilbane Program Chemist, ITSI Gilbane Project Chemist, ITSI Gilbane PM, Navy RPM, (DON), as required	48 hours to 5 days, depending upon nature of deficiency
Field Sampling Technical Systems Audit	Field Change Request; Non-Routine Occurrence Report; Nonconformance Report; Corrective Action Report	ITSI Gilbane PM, ITSI Gilbane Program Chemist, Navy RPM, (DON [if issue is major]); Navy QAO, (DON) (NAVSEADET RASO [if issue is radiological]), Regulatory agencies if issue is major	24 hours to 5 days, depending upon nature of deficiency	Corrective Action Report form (major deficiencies); otherwise, corrective action is documented on the original deficiency document	ITSI Gilbane PM, Navy RPM, (DON), as required	Critical deficiencies-response within 5 days; all other findings-15 days from report
Data Verification	Data verification report to detail deviations from SAP and project requirements	Ken Leonard, Project Manager, ITSI Gilbane	3 weeks after data submittal	Corrective action is documented in writing in the project records	Kristen Carlyon, Project Chemist, ITSI Gilbane	1 week

SAP Worksheet #32 – Assessment Finding and Corrective Action Responses for DGI Phase 2b (Continued)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Org.)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Data Validation	Data Validation Report to detail deviations from SAP and project requirements	Ken Leonard, Project Manager, ITSI Gilbane	3 weeks after data submittal	Corrective action is documented in writing in the project records	Kristen Carlyon, Project Chemist, ITSI Gilbane	1 week

SAP Worksheet #33 - QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Sampling Audit – Phase 1	Once during sampling	9-19 Feb, 2009	Field Team Leader, Battelle	Project Manager, ITSI Gilbane
Data Review Report– Phase 1	Once after all data generated and reviewed	19 Mar, 2009	QA Officer, Battelle	Project Manager, ITSI Gilbane
Data Usability Report– Phase 1	Once after all QA management and data usability have been completed. The results of the Phase 1 Screening Survey will be included in the Phase 2 Data Gap Investigation Work Plan.	10 Apr, 2009	Project Manager, Battelle	Dane Jensen, BRAC PMO West; Laurie Lowman, Navy RASO Tom Lanphar, DTSC; Erich Simon, Water Board, Mark Ripperda, U.S. EPA, Vandana Kohli and Amy Brownell, Dept. of Public Health
Field Sampling Audit– Phase 2	Once during sampling	1-29 July, 2011	Field Team Leader, Battelle	Project Manager, Battelle
Data Review Report– Phase 2	Once after all data generated and reviewed	15 October, 2011	QA Officer, Battelle	Project Manager, Battelle
Data Usability Report– Phase 2	Once after all QA management and data usability have been completed. The results of the Phase 1 Screening Survey will be included in the Phase 2 Data Gap Investigation Work Plan.	1 November, 2011	Project Manager, Battelle	Simon Loli, BRAC PMO West; Laurie Lowman, Navy RASO Ryan Miya, DTSC; Ross Steenson, Water Board, Mark Ripperda, U.S. EPA, Larry Morgan, Dept. of Public Health

SAP Worksheet #33 – QA Management Reports Table (Continued)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Data Quality Assessment Report	Once as Appendix to Final Tech Memo for Phase 2b DGI.	July 10, 2013	Project Chemist, ITSI Gilbane	Simon Loli, BRAC PMO West; Laurie Lowman, Navy RASO Ryan Miya, DTSC; Ross Steenson, Water Board, Mark Ripperda, U.S. EPA, Larry Morgan, Dept. of Public Health

SAP Worksheet #35 - Validation (Steps IIa and IIb) Process Table for DGI Phase 2b

Steps IIa/IIb	Validation input	Description	Responsible for Validation (name, org.)
IIa	Analytes	Ensure that the required analytes were reported as specified in methods, procedures or contracts.	Lab Manager at, TestAmerica-St Louis, TestAmerica-Richland, Core Scientific International, Data Validator, Validata
IIa	Chain-of Custody	Examine traceability of the data from time of collection through reporting. Examine COC records against methods, procedures or contracts.	Lab Manager at, TestAmerica-St Louis, TestAmerica-Richland, Core Scientific International, Data Validator, Validata
IIa	Sampling Methods and Procedures	Ensure that sampling methods were followed and any deviations were documented.	ITSI Gilbane Field Team Leader, Data Validator, Validata
IIa	Sample Handling	Ensure that sample handling, receipt and storage procedures were followed and any deviations were documented.	ITSI Gilbane Field Team Leader, Data Validator, Validata
IIa	Analytical Methods and Procedures	Ensure that the required analytical methods were used and any deviations were noted.	Lab Manager at, TestAmerica-St Louis, TestAmerica-Richland, Core Scientific International, Data Validator, Validata
IIa	Data Qualifiers	Determine that laboratory data qualifiers were defined and applied as specified in methods and procedures.	Lab Manager at, TestAmerica-St Louis, TestAmerica-Richland, Core Scientific International, Data Validator, Validata
IIa	Standards	Determine that standards were traceable and met the method requirements.	Lab Manager, TestAmerica Data Validator, Validata
IIa	Step IIA Validation Report	Summarize deviations from methods, procedures or contracts. Include qualified data and explanation of all data qualifiers.	Lab Manager at, TestAmerica-St Louis, TestAmerica-Richland, Core Scientific International, Data Validator, Validata
IIb	Sampling Plan	Determine whether the SAP was executed as specified (e.g. the number, location and type of field samples were collected and analyzed as specified in the SAP).	ITSI Gilbane Project Manager, ITSI Project Chemist
IIb	Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and sample handling (e.g. techniques, equipment, temperature, preservatives etc.)	ITSI Gilbane Field Team Leader
IIb	Holding Times	Ensure that samples were analyzed within holding times specified in methods, procedures or contracts and any deviations were documented.	ITSI Gilbane Project Chemist, Data Validator, Validata

Steps IIa/IIb	Validation input	Description	Responsible for Validation (name, org.)
IIb	Field Duplicates	Compare results of field duplicates with criteria in the SAP and document any deviations.	Data Validator, Validata
IIb	Project Quantitation Limits	Determine that quantitation limits were achieved as outlined in the SAP.	ITSI Gilbane Project Chemist
IIb	Performance Criteria	Evaluate QC data against project-specific performance criteria (e.g. precisions, accuracy, representativeness, comparability, completeness and sensitivity).	ITSI Gilbane Project Chemist
IIb	Step IIb Validation Report	Summarize outcome of comparison of the data to method performance criteria in the SAP.	ITSI Gilbane Project Chemist

Validata: Validata Chemical Services

SAP Worksheet #36 - Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Sediment	Radionuclides, TOC, PSD, Age-Dating	U.S. EPA CLP Functional Guidelines, LDC SOPs, NAVFAC SW EWI#1, and EPA Level III and IV guidelines	Data Validator, Validata
IIb	Sediment	Radionuclides, TOC, PSD, Age-Dating	In accordance with NAVFAC SW EWI#1, and EPA Level III and IV guidelines	Data Validator, Validata, Battelle QA Officer
IIa	Tissue	Radionuclides	U.S. EPA CLP Functional Guidelines, LDC SOPs, NAVFAC SW EWI#1, and EPA Level III and IV guidelines	Data Validator, Validata
IIb	Tissue	Radionuclides	In accordance with NAVFAC SW EWI#1, and EPA Level III and IV guidelines	Data Validator, Validata, ITSI Project Chemist

Validata: Validata Chemical Services
Note: Data Validation will be conducted according to the Navy's EWI #1. The validation strategy for this project is 80% Level III and 20% Level IV.

EPA Level 4 Data Validation

EPA Level 4 data validation is a full validation that will be performed on the Phase 2 summary and raw data packages for analyses of sediment and tissues analyzed by EPA and non-EPA methods. The data reviewer will request any missing information from the laboratory and copy the client's project chemist when missing information is requested. The data reviewer will validate all components of the data package even when an individual QC element has been rejected. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.

Data summary packages provided by the contract laboratory should consist of sample results and quality assurance and quality control (QA/QC) summaries, and all raw data associated with the sample and QA/QC results.

Level 4 Data Validation Elements

The QC elements to be reviewed for Level 4 validation are listed below.

Radiochemistry Analyses

- Holding times
- Initial calibration
- Continuing calibration
- Blanks
- Tracer/ Carrier recovery
- Matrix spike recovery
- Duplicate sample RPD

- Laboratory control sample recovery
- Analyte quantitation and detection limits
- System performance
- Overall assessment of data in the SDG

EPA Level 3 Data Validation

EPA Level 3 data validation is a more cursory validation that will be performed on the Phase 2 summary (i.e., no raw data) packages for analyses of sediment and tissues analyzed by EPA and non-EPA methods. The data reviewer will request any missing information from the laboratory and copy the client's project manager when missing information is requested. The data reviewer will validate all components of the data package even when an individual QC element has been rejected. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.

Data summary packages provided by the contract laboratory should consist of sample results and quality assurance and quality control (QA/QC) summaries, and all raw data associated with the sample and QA/QC results.

Level 3 Data Validation Elements

The QC elements to be reviewed for Level 3 validation are listed below.

Radiochemistry Analyses

- Holding times
- Initial calibration
- Continuing calibration
- Blanks
- Tracer/ Carrier recovery
- Matrix spike recovery
- Duplicate sample RPD
- Laboratory control sample recovery
- Reporting limits
- Overall assessment of data in the SDG

All data validation procedures will be in accordance with EPA National Functional Guidelines.

ATTACHMENT A-1

Laboratory Standard Operating Procedures

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**********	APPROVED DOCUMENT	**********
COPY # 1	**Location: Radionuclide Laboratory**	**Date Approved:** Dec02/2011 **Approved by:Sandeep Singh**

Cs-137 Measurement in Sediment Core Sections by Gamma Spectrometry Using a GEM HPGe (High-Purity Germanium) Coaxial Detector

Scope: Cs-137 is most easily measured by counting the gamma emissions at 661.6 KeV that are emitted in 85.2% of the decays. The gamma radiation is relatively strong and therefore penetrates through several centimeters of sediment material with little attenuation.

Unit control copy #1 of this method is stored in the "Radio chemistry standard operating procedures" binder located in book shelf #1, room "Radionuclide Laboratory". Unit control copy #2 of this method is stored in the "Radio Nuclide Methods" binder located in room "Data processing center".

Background Information:

The Cs-137 fallout record is relatively well documented, this man-made radionuclide has been widely used as a dating tool for geological events since the first nuclear detonation, (i.e. 16 July 1945; RITCHIE and McHENRY, 1990). Although this date marked the beginning of radio nuclide fall out, it was not until 1952 when the first high-yield thermonuclear detonation was performed in the atmosphere that traces of fallout radio nuclides were observed in soils worldwide. The most important period in the radio nuclide fallout record was atmospheric nuclear bomb testing between 1961 and 1962. During those 2 years alone , almost 200 megatons total yield was detonated in the low altitude atmosphere. This relatively brief event accounted for about 60% of all atmospheric detonation yields between 1945 and 1975 (CARTER and MOGHISSI, 1977). The 1961-1962 signal of a fallout maximum, particularly Cs-137 is widely observed to be imprinted in lake and coastal sediment layers deposited during those 2 years; it is thus very useful time marker.

Overview:

The shape and placement of the sample in relation to the detector is very important and significantly affects the counting efficiency. Consequently, the position and size of the sample and calibration standard should be identical. However, in actual practice, the sample size is often variable and therefore a set of calibration standards of various sizes need to be employed. In our laboratory we use four different NBS spiked clay standards to establish the relationship between efficiency and sample size. This allows us to estimate counting efficiency for samples that have a different size than our standards.

References Documentation:

1. SOP for Material Reception
2. GEM HPGe (High-Purity Germanium) Coaxial Detector's Manual
3. SOP for the Handling of Analytical Standards
4. SOP for energy calibration of GEM HPGe (High-Purity Germanium) Coaxial Detector . Appendix section 1
5. Quality issues. Appendix section 2
6. Sample history. Appendix section 3
7. Supporting test method. Appendix section 4

Required Training:

1. The use of electronic balances
2. Material reception
3. Sample login system (Appendix section 5)
4. Whimis training

1.0 Sample Preparation

Laboratory samples should be representative of the original product and stored to maintain sample integrity.

1.1 When preparing the sample, note down the type of matrix like peat, clay or sand in Be-7-Cs-137 notebook.

1.2 A wet sample is well mixed in the original sample container. **If Pb-210 is also to be measured, a subsample must now be removed for determination of bulk density.** This requires about 3 ml of sample and is described in the standard operating procedure for lead-210 analysis. A second subsample for Pb-210 analysis (equivalent to about 0.5 g dry weight) is also required. If sample material is in short supply (< 10 g dry weight), the bulk density measurement should be performed first, and then the dry material resulting from this measurement can also be used for Cs-137 analysis. In this way the entire sample can be used for Cs-137 analysis (which is nondestructive), and a portion of this later used for Pb-210 analysis.

1.3 Wet sediment is transferred into a new plastic Petri dish that has been properly labelled on both bottom and lid . The original sample container can be rinsed with DI water to ensure nearly complete transfer of the sediment into the dish. The sample in the dish is dried at 60 C for at least 12 hr in an oven.

1.4 For samples that are in lumpy form, blend the sample until a homogeneous mix is obtained. Some samples contain big twigs, stones unable to grind. Remove the left twigs and stones from mix after grinding.

1.5 Cut the Aluminum foil into round pieces, fold the edge of round pieces to make a pancake shape. Label this pancake shape foil with sample I.D. Empty pancake is weighed to the nearest mg. and note down this weight in Be-7-Cs-137 notebook. Compress the sample into pancake form using Hydraulic jack . Put the compressed sample in pancake foil and measure the height of sample. Then measure the weight of sample + pancake foil and note down this weight in Be-7-Cs-137 book. The weight of the sample (g) is calculated as the difference between the empty and full pancake foil weight. If the sample height is greater than 100 mm from the very bottom of the foil after tamping, then enough sample is removed from the vial to ensure that the final height does not exceed 100 mm. The excess sample is returned to the Petri dish in which it was dried .

1.6 Dry samples are heated at 60C in an oven in the original container, then treated as for wet samples as described above starting at section 1.4. If there is excess material, return it to the original sample container.

1.7 All operations concerning the preparation of samples for Be-7 analysis are to be recorded in the current Be-7-Cs-137 lab notebook. This includes sample identifications, descriptions, reception date and weights, lab sample serial

numbers, drying times and temperature, True and Live counting times and dates, Net and Gross counts of Be-7 peak at 477 Kev, analyst name, observations and comments.

2.0 Apparatus

2.1 GEM HPGe (High-Purity Germanium) Coaxial Detector appendix section 6

2.2 Pestle & mortar.

2.3 Hydraulic Jack. Appendix 7

2.4 Computer equipped with software capable of collecting and processing data.

2.5 Balance - capable of weighing to 40.0 g with resolution 1.0 mg.

2.6 Aluminum foil.

2.7 Precision scientific oven.

2.8 Apparatus to compress sample in pancake form.

2.9 Plastic petridish.

2.10 Dewar to fill Liquid nitrogen. Appendix 8

3.0 Radioisotope standard reference material:

3.1 Cs-137 reference standard (Spiked clay) Appendix 9

3.2 Cs-137 working standards (Spiked clay) Appendix 10

3.2.1 Cs-137 working standards (Spiked clay) weight 32g, height 10 mm.
3.2.2 Cs-137 working standards (Spiked clay) weight 24g, height 7.5 mm
3.2.3 Cs-137 working standards (Spiked clay) weight 15g, height 5 mm
3.2.4 Cs-137 working standards (Spiked clay) weight 9g, height 3 mm

4.0 Procedure of Analysis:

4.1 Counting of sample by GEM HPGe (High-Purity Germanium) Coaxial Detector

(1) All information concerning the sample being counted on the GEM HPGe (High-Purity Germanium) Coaxial Detector needs to be recorded in the current GEM HPGe (High-Purity

Germanium) Coaxial detector log book. This information should include the date in which the sample was counted, name of the technician running the spectrometer, client name, sample name, type of sample (ex; peat moss, gravel, sand etc.), sample weight (grams), sample height (mm), time in, time out, true counting time of detector, live counting time of detector, gross and net area of the Cs-137 peak.

(2) Loading a Sample or Calibration Standard into the GEM HPGe (High-Purity Germanium) Coaxial Detector : First put on a pair of work gloves, so as not to come into contact with the lead shielding. There are handles on the side of the lead shielding to grab hold of. Then, very carefully remove the top of the lead shielding.

*Note: Use extreme caution when removing and putting the lead shielding back on the GMX 25% detector.

Once you have removed the lead shielding, make sure there is no debris in the detector. Double check to make sure the sample you are counting is the correct sample recorded in the GEM HPGe (High-Purity Germanium) Coaxial Detector detector log book. Before placing the sample in the GEM HPGe (High-Purity Germanium) Coaxial Detector detector, clean the bottom of the pancake sample with a soft tissue so that it doesn't contaminate the inside of the detector. Place the sample as close to the center of the detector as you can.

**Note: Do not apply any pressure or excessive weight when placing the sample on top of the GEM HPGe (High-Purity Germanium) Coaxial detector . This detector contains coaxial germanium crystals which can be easily damaged.

Carefully place the lead shielding plate on top of the GEM HPGe (High-Purity Germanium) Coaxial Detector .

**Note: Please ensure that no Cs-137 standards or high activity samples are within 10 feet of the GEM HPGe (High-Purity Germanium) Coaxial Detector because they might increase the background counts.

(3) Starting the software application: In the Windows Start Up screen there is an icon called Gamma Vision v5.0. Double click on this icon with the left button on the mouse to start the program. Once you are in Gamma Vision v5.0, click on **Acquire** with the left mouse button, scroll down the list and click once on **Start**.

(a) The **Acquisition presets** should appear. You should find a real time in seconds, a live time in seconds, ROI peak counts, and an ROI integral count. The only **Acquisition preset** which needs to be entered is live time at an 80,000 second counting period. By setting the detector live time to 80,000 seconds, it will only count as high as this setting unless the detector is manually stopped before this count time preset. Once this has been done click **O.K.**

(b) The **Sample description** should appear. Make sure to start typing in the upper left most corner of the description box. It is common place at Core Scientific Internationalto include the client name,

sample name, sample depth (if given), weight (in grams), and height (in mm). Once this is done click on **O.K.**

(c) The **Sample quantity** should now appear. The **Sample quantity** should be set a 1.0 g in the value box. If this is not the case then enter that value with the keyboard and click **O.K.**

(d) The **Date** and **Time** should now appear. The current **Date** and **Time** will need to be entered into the computer via the keyboard. Once this is done click on **O.K.**

(3) GEM HPGe (High-Purity Germanium) Coaxial Detector is Running: The GEM detector should be counting the sample at this point.

(4) Stopping Count and Retrieving Data: To stop the GEM detector from counting at any time, click on the **Stop** button which is located near the top of the left hand side of the screen. This will automatically stop the detector from counting. You will then need to record all of the necessary data into the current GEM detector log book at this point. This information should include the time out (when the sample stopped counting), true time, live time, the gross and net area of the Cs-137 peak. To find the gross and net area of the peak, you will need to double click on the peak with the left mouse button. This will give you the gross and net area of the peak of interest.

*Note: The isotope Cs-137 peak can be found at 661.6 KeV.

To move to a different peak, you can use the following buttons:

(1) arrow left or arrow right.

(2) page down for left / or page up for right.

(3) ROI arrow left or ROI arrow right (these functions are located at the lower right hand side of the screen). There is an energy scale at the bottom of the screen which allows you to distinguish gamma emitters by energy in KeV.

Saving the file requires you to move the cursor with the mouse to **File** at the top left corner of the screen. Click once on **File**, scroll down the list and click once on **Save file** with the left mouse button. This will prompt you to all of the existing spectrum file folders in Gamma Vision v5.0. Click on the current clients file folder and save the file in that folder with an appropriate file name.

Once the sample profile has been saved, you will need to go to the **Acquire menu** at the top of the screen. Scroll down the menu and click on **Clear** with the left mouse button. This will clear the current counting memory of Gamma Vision v5.0.

(5) The next sample can then be loaded into the GEM detector.

(6) Then go to the **Acquire menu** again, scroll down and click on **Start** with the left mouse button once and repeat the procedure over again.

4.2 Data Analysis

Data are processed by the EXCEL workbook. All the data from a single core should be placed in the same workbook. The activity of each section (DPM/g) and the standard counting errors are calculated in one of the sheets. The calculated activities include corrections for the 85.2% branching ratio of Cs-137. There is also a spreadsheet that will plot the Cs-137 activity data as a function of depth in the core.

Included in a sheet are data for NBS spiked clay standards that are used to calculate the counting efficiency as a function of sample height in the sample vessel. An energy calibration should be performed every second week, and an efficiency calibration done monthly using the largest standard.

The activity of Cs-137 is determined from the gamma spectrum obtained by counting the sample on the GEM HPGe (High-Purity Germanium) Coaxial Detector. The Cs-137 peak occurs at 661.6 KeV.

$$\text{Activity}_{(Cs\text{-}137)} = \{(Cs - Bkg) \div (BR_{Cs} \times Eff_{137} \times Pwt)\} \times (1/e^{-t})$$

where:

$\text{Activity}_{(Cs\text{-}137)}$ = activity of Cs-137 at time of sampling (Bq./g)

Cs = counts per second (cps) in 661.6 KeV peak

Eff_{137} = counting efficiency for Cs-137 at 661.6 KeV (sample geometry included)

= decay constant for Cs-137 (in days)

t = elapsed time (in days) between sampling and counting

BR_{Cs} = branching ratio for Cs-137 (85.2%)

Pwt = sample weight (in grams)

Bkg = Cs-137 background

4.3 Calculations using EXCEL

*Note: The same calculation methods are employed with a GEM & GMX 25% detector.

Start a new workbook in EXCEL . You will need to make the following columns in order as they should appear from left to right:

(a) Sample name
(b) Day sample counted
(c) Month sample counted
(d) Year sample counted
(e) Integral net Cs-137 peak (net area)
(f) Counting error 1 STD (counts)
(g) Count time (seconds)
(h) Dry sample weight (grams)
(I) Sample thickness (mm)
(j) CPM/g (counts per minute per gram)
(k) Efficiency for gammas fractional
(l) Gammas per minute per gram
(m) DPM/g (disintegrations per minute per gram)
(n) Approximate error DPM/g
(o) Activity pCi/g (picocurie per gram; *Note: picocurie = 1×10^{-12} Ci)
(p) Detector used (Germanium (GEM) detector; GMX 25% detector)

*Note: Columns a to I do not contain any sample calculations. They are columns in which vital data must be entered in order to proceed to calculate columns j to n.

Setting Up the Sample Calculation Columns

(1) Column j which is CPM/g is calculated in the following way:

CPM/g = {(integral net Cs-137 peak) / (count time (in sec.))} x {60 / (dry sample weight (in g))}

(2) Column k is calculated first by determining the efficiency for gamma fractional of the four Cs-137 standards. By determining the efficiencies of the four Cs-137 standards we can then determine efficiencies for gammas fractional of the different sample sizes. We calculate the efficiency for gammas fractional for each sample by substituting the sample thickness (in mm) into a polynomial fit of order 2 determined from four Cs-137 standards.

The efficiency for gammas fractional (for each Cs-137 standard) is calculated the following way:

Efficiency for gammas fractional = CPM/g / (959 x (exp(-0.0228x((((Year sample counted - 1978.05) x 12) + Month sample counted - 1) / 12))))

Once all of the efficiencies for gammas fractional have been calculated for each Cs-137 standard, you will need to make a plot of counting efficiency of gammas fractional versus sample thickness (in mm). Highlight the four Cs-137 standard efficiencies for gammas fractional, then hold the **Ctrl**

button and simultaneously highlight the sample thickness (mm). Then go to the **chart icon** at the top of the screen, and click on it once with the left mouse button. Once you have done this, your mouse cursor should have a "+ sign" with a small graph chart at the bottom right hand corner of the "+ sign". This allows you to drag and drop the graph anywhere you like on the EXCEL worksheet. Click once with the left mouse button to place the graph in the worksheet. You should then be prompted to chart wizard step 1 of 5. At this stage chart wizard gives you the **Range** variables of all the data you highlighted for graph plotting purposes.

*Note: The first column that you highlight becomes the data plotted on the y-axis, and the second column becomes the data plotted on the x-axis of your Cs-137 graph ("keep this in mind").

If the **Range** variables are correct, click on **Next**. Then click on **XY(scatter)**, and click on **Next**. You will then be prompted to select a format for the **XY(scatter)** chart, click on number **3**, and click on **Next**. You will now be at step 4 of 5 in chart wizard. You should see a pictorial sample of your graph at this point, with the following commands:

(1) Data Series: Rows / Columns (*Note: please select columns)

(2) First [1] (arrow up / arrow down) Column(s) for x data (*Note: select 1)

(3) First [0] (arrow up / arrow down) Row(s) for legend text (*Note: select 0)

Once this has been completed, click on **Next**. You will be at step 5 of 5 in chart wizard. At this stage you can add a label for chart title, x-axis, and y-axis. It is recommended that you apply the chart labels at this stage so as not to forget later.

*Note: Appropriate graph labels are as follows:

(1) Chart Title: Cs-137 Counting Efficiency of Gammas Fractional vs. Sample Thickness (mm)
(*Note: state which detector you used in the graph title.)

(2) Y-axis: Counting Efficiency for Gammas Fractional

(3) X-axis: Sample Thickness (mm)

You will now need to insert a polynomial fit to the Cs-137 graph. This can be done by clicking on any one of the four data points with the left mouse button until all four points are highlighted in a square black boarder and a yellow dot in the middle. Click the right mouse button once and a **menu list** should appear on your screen. Scroll down the **menu list** and click on **Insert Trend Line** . . . .You will then be prompted to **Trend Line**, with two user options: (1) **Type** and (2) **Options**. Click on the **Type** tab, and select polynomial fit, and set the order at **2**. Once this has been completed, click on the **Options** tab, and select **Automatic: Liner (Series 1)** under the heading **Trend Line Name**. Then under the heading **Forecast,** make sure to set forward and backward to **0** units each. Click on **display equation on chart** and **display R-squared value on chart**. You will need the

displayed equation from the graph of Cs-137 standards to be able to estimate the counting efficiencies of gammas fractional for samples that have a different size than our Cs-137 standards.

*Note: It may be appropriate to delete the legend that appears on the right hand side of the graph. This will allow you to better position the graph and include the polynomial equation and R-squared value.

A polynomial equation of order 2 will yield the following expression:

$y = +/- ax^2 +/- bx^2 +/-c$

where: x = the sample thickness (in mm)

(3) Column l which is Gammas per minute per gram is calculated in the following way:

Gammas per minute per gram = {(CPM/g) / (Efficiency of gammas fractional)}

(4) Column m which is the DPM/g is calculated the in the following way:

DPM/g = {(Gammas per min. per gram) / (0.852)}

*Note: The value 0.852 is the branching ratio (85.2%) for Cs-137.

(5) Column n which is the Approximate error DPM/g is calculated in the following way:

Approximate error DPM/g = {(Counting error 1 STD) / (Integral net Cs-137 peak)} x (DPM/g)

(6) Column o which is the Activity (pCi/g) is calculated in the following way:

Activity (pCi/g) = {(DPM/g)} / 2.21

Saving Data Calculations

You will need to save the EXCEL worksheet in the appropriate client folder and give the worksheet an appropriate file name to be able to distinguish what the data is.

Reference :

1 Report of calibration U.S. Department of Commerce, National Bureau of Standards, Washington, D.C. 20234

2 R.W. DURHAM and S.R. JOSHI 1980 The Pb-210 and Cs-137 profiles in sediment cores from Lakes Matagami and Quevillon, northwest Quebec, Canada.CAN. J. Earth Sci. Vol 17, 1746-1750.

3 MICHEL POURCHET and JEAN F. PINGLOT Cesium-137 and Lead-210 in Alpine lake sediments: measurements and modelling of mixing processes. Journal of Geophysical research. Vol. 94, NO. C9, Pages 12,761-12,770, September 15, 1989.

4 Marine Radioecology, Final report of the Nordic Nuclear Safety Research Project EKO-1, June 1998.

5 Gamma Emitters in the Environment by Energy, HASL August 1978.

6 ANOND SNIDVONGS, GARY M. McMURTRY, STEPHEN V. SMITH Pb-210 and Cs-137 in sediments and soils of Tomales Bay Watershed, Northen California , Department of Oceanography, Univ. of Hawaii at Manoa Hololulu, HI 96822, U.S.A. Aug 1992.

7 ROBERT F. ANDERSON, SHERRY L. SCHIFF, and RAYMOND H. HESSLEIN Determining sediment accumulation and mixing rates using Pb-210, Cs-137, and other tracers: Problems due to postdepositional mobility or coring artifacts. Canadian Journal of Fisheries and Aquatic Sciences. Volume 44, Supplement 1, 1987. Pages 231-250.

8 W. PENNINGTON, R.S. CAMBRAY, E.M. FISHER Observations on lake sediments using fallout Cs-137 as a tracer. Reprint from Nature, Vol. 242, No. 5396, pp 324-326, March 30, 1973)

9 Friedlander, Kennedy & Miller 1964. Nuclear and Radiochemistry-2nd Edition.

Appendix Index

Section	**Description**
A1	SOP for energy calibration of GEM HPGe (High-Purity Germanium) Coaxial Detector .
A2	Quality issues.

A3 Sample history

A4 Supporting test method

A5 Cs-137 sample login system.

A6 GEM HPGe (High-Purity Germanium) Coaxial Detector . Equipment and set up.

A7 Hydraulic jack

A8 Liquid nitrogen fill.

A9 Radioisotope Cs-137 standard reference (Spiked clay)

A10 Radioisotope Cs-137 working standard – (Spiked clay)

Examples of the following forms:

a)	SOP for energy calibration of GEM HPGe (High-Purity Germanium) Coaxial Detector .
b)	Quality issues.
c)	Sample history
d)	Supporting test method
e)	Cs-137 sample login system.
g)	GEM HPGe (High-Purity Germanium) Coaxial Detector, Equipment and Set up.
h)	Hydraulic jack
i)	Liquid nitrogen fill.
j)	Radioisotope Cs-137 standard reference (Spiked clay)
k)	Radioisotope Cs-137 working standard – (Spiked clay)

Appendix Section A1

A1 Energy calibration of GEM HPGe (High-Purity Germanium) Coaxial Detector .

Note: We do calibration of GEM and GMX detector every month to find out efficiency of detectors. There are four Cs-137 standards that we use at Core Scientific International to estimate the counting efficiency for samples that have a different height and weight. They are as follows:

(1) NBS Cs-137 STD, weight = 32.0 g, height = 10.0 mm
(2) NBS Cs-137 STD, weight = 24.0 g, height = 7.5 mm
(3) NBS Cs-137 STD, weight = 15.0 g, height = 5.0 mm
(4) NBS Cs-137 STD, weight = 9.0 g, height = 3.0 mm

Background Information

The calibration of the system defines these three relations:

(1) Spectrum channel numbers to energy

(2) FTHM (full width half maximum) of the peak and energy

(3) Spectrum count rate and activity in becquerels or other units
he data collected are in counts / unit time / channel and, to be most useful, these data need to be converted to activities (which is decays-per-unit time at a given energy). The calibration parameters do this conversion.
It is important that the calibrations, both energy and efficiency, be done correctly because the calibration results will affect all analyses employing them. The energy calibration data is used to define the energies of the peaks in the spectrum. If incorrect, the calculated energies will not correspond to the correct library entry and the peak may be incorrectly identified.

Getting Started

*Note: The same procedures apply for both the GEM and GMX 25% detector(s) because they are both set up with Gamma Vision v5.0 software in each PC.

The calibration functions are seen in the **Calibrate** menu. The energy calibration of the spectrum in the Detector and the efficiency calibration of the spectrum in the Detector are only available if the Detector is not acquiring data. If there is no energy calibration, then all choices except **Energy** . . . and **Recall Calibration** . . . are gray. If there is an efficiency calibration, then there is a check mark by **Efficiency** . . . Graphs of the calculated fits, and the tables of the input values, fits and differences are shown for the three relationships.

Manual Calibration

If there is no energy calibration, the energy of one or two known peaks must be entered. Using the full spectrum window, select a peak in the high energy (channel) part of the spectrum. When this part of the spectrum is visible in the expanded display, move the cursor to the known peak. At this time the centroid of the peak will be calibrated and displayed in the upper part of the calibration input window. Now use the mouse to select the **Energy** = input box enter the energy of this peak. Press **Enter** on the keyboard or click on **Enter** with the mouse. A table and graph will appear on the screen. They can be moved around and sized if they obscure the spectrum.

On the calibration input window are selections to display either the Energy vs. channel or FTHM vs. energy Table and graph. Select the FTHM now, the table shows one value entered and the graph shows a horizontal line. For a single point, the FTHM is assumed to be a constant.

Using the full spectrum window (or the library), select a peak in the low energy part of the spectrum and move the cursor to the centroid of the peak. Again select the Energy input box and enter the energy of this peak. Both the energy function and FTHM function are updated with the new entry. The graphs and tables are displayed so that the progress can be monitored.

At this time the cursor can be positioned using the calibration graphs, calibration, table, the full spectrum window, or the expanded spectrum display. The cursor will show the energy based on the calibration up to this point.

The calibration can be refined by the addition of as many points as desired. Any point can be deleted by selecting that point in the table of values (Energy or FTHM) and clicking on the delete energy button. The fit is updated when a point is removed.

After the desired number of points have been entered, the energy values can be saved by the save table function. The saved tables of values can be used for future calibrations using the same nuclides. The able is in ASCII format and can be changed by the edit table function, or off-line using an ASCII-compatible editor.

To Alter the calibration stored in spectrum file.

To alter the calibration of a sample stored in spectrum file, first select buffer in tool bar and recall the spectrum file (its calibration is automatically loaded), recall the desired calibration through recall calibration option under calibration in Menu bar, (make sure to select spectrum files) Then it will automatically change calibration of sample according to desired calibration.

Standard Operating Procedure

Appendix Section A2

A2 Quality Assurance / Quality Control

Before starting a new batch of samples and after every 10th sample, a system blank is

calculated from the spectra generated by counting an empty 50 x 9 mm polystyrene plastic petri dish for 24 hours on the gamma spectrometer.

Appendix Section A3

A3 Sample History:

A3.1 Sampling date: Sample history incudes sampling date of core.
A3.2 Sample Pre-treatment: Dry samples which we receive for Cs-137 analysis , we need to know sample history like whether there were bulk density performances for samples if these samples are intended to use for Pb-210 analysis as well.
A3.3 Sample Container: Sample container should not be metallic otherwise there will be reaction between Pb and other metal. Sample container should be made up of glass or plastic with teflon line / plastic cap.
A3.4 Sample Holding Time: Dry samples , frozen samples in glass can be hold for unlimited time before analysis.

Appendix Section A4

A4 Supporting Test method:

Appendix Section A5

A5 Cs-137 sample login system.

Appendix Section A6

A6 GEM HPGe (High-Purity Germanium) Coaxial Detector, Equipment and Setup

~ The GEM HPGe (High-Purity Germanium) Coaxial Detector has an available standard efficiency of 18%.

~ Ion-implanted center contact

~ Room-temperature recyclability

~ Streamline cryostat configuration wit hybridized preamplifier

~ EG&G ORTEC high quality HPGe crystal

~ Excellent timing characteristics and peak symmetry.

~ Automatic high-voltage shutdown protects the input FET from damage

*Note: For more detailed information see EG&G ORTEC Instruments Catalog 83/84, pages 60 - 61. Ultra thin ion-implanted entrance window (0.3 microns).

Appendix Section A7

A7 Hydraulic Jack:

Hydraulic jack used for compressing sample , dimensions 24-47.3 cm, capacity 12 tonnes , Brand-Motomaster available at Canadian Tire.

Appendix Section A8

A8 Liquid Nitrogen Fill:

Liquid Nitrogen refilling: All EG&G ORTEC detectors are designed to operate at nearly liquid-nitrogen temperature so as to lower the leakage current and hence the noise of the system.
It will be necessary to monitor the liquid nitrogen consumption of the GMX 25% detector, and to refill the dewar tank on a continuing basis.

*Note: use extreme caution whenever handling liquid nitrogen to ensure employee and workplace safety.

All information concerning the refilling of the GEM HPGe (High-Purity Germanium) Coaxial Detector with liquid nitrogen dewar needs to be recorded in the current liquid N_2 GMX 25% detector log book. This information should include the date and time in which the dewar was filled, the name of the technician, the approximate ~ amount of liquid N_2 added to the dewar, and a calculation of the consumption rate of the detector (number of liters per day).

*Note: It should be noted if the dewar was filled to overflow.

If the dewar has been filled with liquid nitrogen to overflow from the previous and current dewar fill, then we can accurately calculate the consumption rate of liquid N_2.

Appendix Section A9

A9 Certified Reference Cs-137 Standard (Spiked clay)

A9.1 This standard consists of Zinc-65, Yttrium-88, tin-113-indium-113m, cesium-137-barium-137m and cerium-139, as the chlorides, homogeneously distributed in approximately 100 grams of

sieved clay. This standard is intended to be used with nondestructive assay methods.

This standard was prepared by quantitatively spiking the clay with solutions of known activity in such a way as to ensure a homogeneous distribution of radioactivity throughout the sample. Each of the solutions was measured in the National Bureau of Standards calibrated "4π" ionisation chamber, and the corresponding gamma-ray-emission rates were calculated using appropriate nuclear decay parameters.

The gamma-ray-emission rate per gram of the parent radionuclide Cs-137 (half life 30.0 years) at 1200 EST February 1, 1978 was 13.59 γ $sec^{-1}gram^{-1}$. with total uncertainty 4.6 %.

A9.2 Handling precautions for the Gamma-ray emission–rate standard: (Spiked clay)

A9.2.1	Wear protective gloves and a laboratory coat when working with this protective gloves and a laboratory coat when working with this radioactive standard.
A9.2	Gently tap the closed, upright bottle to dislodge any clay that is in the neck area.
A9.3	Open the upright bottle in a hood that is lined with a disposable material.
A9.4	Carefully remove, with dry paper tissues, any clay that remains on the inside of the cap and around the top of the bottle.
A9.5	Keep the bottle upright when in use. After use replace the cap tightly and then wipe the outside of the bottle. Discard the hood liner.
A9.6	Store the bottle in an upright position.

Appendix Section A10

A10 Cs-137 Working standard (Spiked clay)

We do calibration of GMX detector every month to find out efficiency of detectors. Parent Cs-137 standard is compressed in pancake form in the following four heights. These are four Cs-137 working standards that we use to estimate the counting efficiency for samples that have a different height and weight. They are as follows:

(1) NBS Cs-137 STD, weight = 32.0 g, height = 10.0 mm
(2) NBS Cs-137 STD, weight = 24.0 g, height = 7.5 mm
(3) NBS Cs-137 STD, weight = 15.0 g, height = 5.0 mm
(4) NBS Cs-137 STD, weight = 9.0 g, height = 3.0 mm

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**********	APPROVED	DOCUMENT	**********
COPY #1	**Location: Radionuclide Laboratory**	**Date Approved: Approved by:Sandeep Singh**	Aug08/11

Method for the determination of Pb-210 in Sediments using an EG&G Octet Alpha Spectrometer

Scope: This method is applicable to sediments, sand and clay. The detection limit of this method is 0.10 DPM/g (0.0017 Bq/g) for about an 8 hour counting period and a 0.5 g sample mass.

Unit control copy #1 of this method is stored in the "Radio chemistry standard operating procedures" binder located in book shelf #1, room "Radionuclide Laboratory". Unit control copy #2 of this method is stored in the "Radio Nuclide Methods" binder located in room "Data processing center".

Background Information:

This method determines Pb-210 in sediment, sand, clay (dry weights 0.05-0.5g) via its grand daughter polonium-210. The polonium is converted to chloride and distill from sediment/sand/clay and distilled from the sediment/clay/sand at 500 C in a simple distillation apparatus. The Po-210 is distillate is digested in a nitric acid medium, converted back to the chloride salt, plated out onto silver, and then counted by alpha spectroscopy. The recovery is monitored by concurrently measuring the activity of a Po-209 spike added at the beginning of sample processing.

Interferences:

Dioxides of polonium and other volatile polonium organic compounds.

References Documentation:

1. SOP for Chemical Reception
2. SOP for Material Reception
3. Ortet Octet Alpha Spectrometer's Manual
4. SOP for Automatic Pipettes
5. SOP for Milli-Q
6. SOP for the Handling of Analytical Standards
7. SOP for calibrate EG&G Octete detectors. Appendix section 7
8. Quality issues. Appendix section 10
9. Sample history. Appendix section 13
10. Supporting test method. Appendix section 14
11. Glassware cleaning procedure Appendix section 15

Required Training:

1. The use of electronic balances
2. Chemical reception
3. Material reception
4. Sample login system (Appendix section 9)
5. The use of automatic pipettes
6. Whimis training
7. Using the Milli-Q system

Operations:

1.0 Sample Preparation

Laboratory samples should be representative of the original product and stored to maintain sample integrity.

1.1 When preparing the sample, note down the type of matrix in Pb-210 notebook (sediment/sand/clay).

1.2 For sediment samples that are in lumpy form, blend the sample until a homogeneous mix is obtained.

1.3 All operations concerning the preparation of sediment samples for Pb-210 analysis are to be recorded in the current Pb-210 lab notebook. This includes sample identifications, descriptions, reception date and weights, lab sample serial numbers, volume of bulk density vessel , drying times and temperature, spiking volumes and dates, spike preparation date, digestion times and dates, plating times and dates , counting times dates, counting times and dates, Po-209 and Po-210 counts , analyst name , observations and comments.

2.0 Apparatus

2.1 EG&G Octet Alpha Spectrometer. Appendix section 6

2.2 Digestion apparatus: Aluminum hot block capable of heating and maintaining samples in test tubes (20 mm X 50 mm) at 110°C .

2.3 Pestle & mortar.

2.4 11" x 22" hotplate with controller and 11" x 11" hotplate with controller.

2.5 Computer equipped with software capable of collecting and processing data.

2.6 500 mL and 250 ml graduated measuring cylinders.

2.7 Milli-Q water system or equivalent.

2.9 Automatic pipettes capable of dispensing 1ml.

2.10 Balance - capable of weighing less than 50 mg with resolution 0.1 mg.

2.11 Balance - capable of weighing to 15.0 g with resolution 1.0 mg.

2.12 Sterling silver planchettes (Dimension 16 mm X 12 mm X 0.5 mm) Appendix section 11

2.13 Glassware : Berzelius 300 ml tall glass beaker, 150 ml medium glass beaker, 30 ml small glass beaker, watch glasses (Bigger size 9 cm X 9 cm and small size 5 cm X 5 cm), glass rods (16 cm long). The supplier of these glassware is Anachemia Science. Catalog No. for 300 ml tall glass beaker is 010-008-03,

	Catalog No	Glassware
2.13.1		
2.13.2	010-008-03	300 ml tall glass beaker
2.13.3	011-085-12	150 ml medium glass beaker
2.13.4	011-085-06	30 ml small glass beaker
2.13.5	040-247-03	50 mm watch glasses
2.13.6	010-969-03	90 mm watch glasses

2.14 Plastic funnel (diameter 7.5 cm) with plastic straws (6.5 mm diameter X 140 mm).

2.15 Furnace capable of heat 6 test tubes at ~ 500 C

2.16 Transformer to get constant heat during evaporation of digestate overnight and during plating.

2.17 Pyrex Glass wool . Anachemia catalog # 010-344-01 Appendix 12

2.18 Pyrex test tubes (20 mm X 150 mm). Anachemia catalog # 001-956-020

2.19 Teflon vial, glass marble and plastic watch glass for measuring bulk density of samples.

2.20 Drill press for etching test tubes .

2.21 Plastic petridishes . Anachemia catalog # 022-946-18

2.22 Long hot plate (11" X 22") with temperature controller and medium hot plate (11" X 12") with temperature controller.

2.23 Rubberized paint- Motomaster 47-7936-2 from Canadian Tire.

3.0 Reagents

Note: Preparation instructions for the reagents are included in the Appendix.

All reagent details are recorded on log sheets – examples of these sheets are contained in Appendix Section 8.

The name in italics beside the reagent indicates the form in the Appendix into which the details for that reagent are recorded.

The supplier of these chemicals are Anachemia Science. Our account number with Anachemia Anachemia Science is 300148. The phone # of local Anachemia Science is 661-6734.

3.1 Concentrated nitric acid (HNO_3), reagent ACS. .*(Chemical Reception)* Anachemia catalog # AC 6525

3.1.1 Nitric acid (1.5 N) Appendix section 1

3.2 Concentrated hydrochloric acid (HCL), reagent ACS.*(Chemical Reception)* Anachemia catalog # AC 4955

3.2.1 Hydrochloric acid (1.5 N) Appendix section 2

3.3 L-Ascorbic acid *(Chemical Reception)*

3.3.1 Reductant solution L- Ascorbic acid (1.5 N) Anachemia catalog # AC-0879 Appendix section 3

3.4 Commercial grade Methanol.*(Chemical Reception)*

3.5 1000 DPM/ml Certified Reference Po-209 Standard. *(Chemical Reception)* Appendix section 4a.

3.6 Po-209 working standard – (20 DPM/ml) Appendix section 4b

3.7 Glassware Rinsing Solution *(Dilute Nitric Acid)* Appendix section 5

4.0 Procedure

4.1 Determination of bulk density (Dry weight per wet cc)

In order to calculate a sediment accumulation rate, the bulk density of each section in the core must be known or estimated. If possible we prefer to measure these directly by determining the dry weight of a fixed volume of wet sediment from each section.

From a well mixed wet core section, accurately fill a small plastic or glass container (of known volume) with wet sediment. Wash, with DIH_2O, the contents of the container into a pre-weighed clean petridish and then dry the material in an oven to constant weight at 60 C (at least for 48 hours). The dry weight of the material divided by the volume of the container is the bulk density of the core

section (usually expressed as g dry weight/wet cc). If there is little sample material, it may be necessary to perform Po-210 analysis on this dry sample and therefore the bulk density vessel should be cleaned well in between samples.

4.2 Weighing the dry sediment into the pyrex test tubes.

4.2.1 Samples are usually processed in lots of 10.

4.2.2 Sediments should be air dried at 60 C and then ground to granulated sugar like consistency or finer. Before drying, be certain that an aliquot of each wet sediment section has been put aside for bulk density analysis or that such data are already available.

4.2.3 Number the (20 mm X 150 mm) Pyrex test tubes with permanent marker and place them all in the oven at 60 C in a tube rack. The numbers are in series, between 0 - 1000, starting with the first available unused number after the previous set of analyses. After they have reached oven temperature, remove one tube at a time and immediately weigh it to the nearest mg. Record the empty tube weights.

4.2.4 Clean ten 7.5 cm diameter plastic funnels, with plastic straws (6.5 mm Diam. X 140 mm) attached, using a compressed air hose.

4.2.5 Insert the funnel and attached straw into the test tube (the sediment should be delivered to the bottom of the tube only, not stuck to the sides) and place the test tube into a small plastic beaker for stability.

4.2.6 Tare the balance with this funnel attached straw into the test tube a small plastic beaker on the pan, then spoon the sediment into the middle of the funnel until the balance reads approximately 0.500 g $\forall$ 0.010 g. Smaller masses of material are allowable if there is not enough sample available . We have used as little as 50 mg of sample for analysis.

4.2.7 Raise the end of the straw ~ 1 cm off the bottom of the test tube, and let thand let the sediment pour out. Gently tap the funnel with the spoon while holding it immobile to get the last of the sediment out of the funnel.

4.2.8 Put the test tube back in the test tube rack and repeat until the required number of samples have been dispensed. The rack of test tubes containing samples is then placed back in the oven at 60 C to dry for at least 12 hr. The tubes are then removed singly and immediately weighed to the nearest mg. The full tube weights are recorded. The difference between empty and full tube weights represents the mass of dry sample being processed.

4.3 Checking for Carbonates:

4.3.1 Working in a fumehood, use the 12 N HCl (ACS grade) to check for carbonates.

Add the HCl dropwise to the sediment, waiting after every drop to check for CO_2 formation (bubbling).

4.3.2 If CO_2 does form, add as many drops of HCl as needed until no more CO_2 forms (no more bubbling). Add the HCl slowly enough so that the bubbling does not travel up the test tube more than ~ 2 cm. Make a note in the ^{210}Pbnotebook of any samples containing carbonates.

4.4 Spiking and drying down the samples

4.4.1 After the samples are checked for carbonates, spike them with the prepared^{209}Pospike solution (20 DPM/ml). Check the autopipette with distilled water on the balance to ensure the pipette is delivering exactly 1.00 ml amounts (+/- 0.005 ml).

4.4.2 When you are satisfied the pipette is accurate and precise, dispense 1.00 ml of the spike solution onto the sediment at the bottom of the tube. The pipette tip should be ~ 2 cm above the sediment at the bottom of the tube. Take care when inserting the pipette tip into the test tube not to touch the sides of the tube with the tip.(All the samples belongs to same core should be spiked using same spike solution. So make sure before preparing spike solution that it is enough for spike to all samples belong to same core.

4.4.3 When all the test tubes have been spiked, add an extra ~ 1 ml 12N HCl to each tube. Set the test tubes into the aluminum block on the small hotplate and place the metal apron around the outer tubes to ensure a steady temperature for drying down.

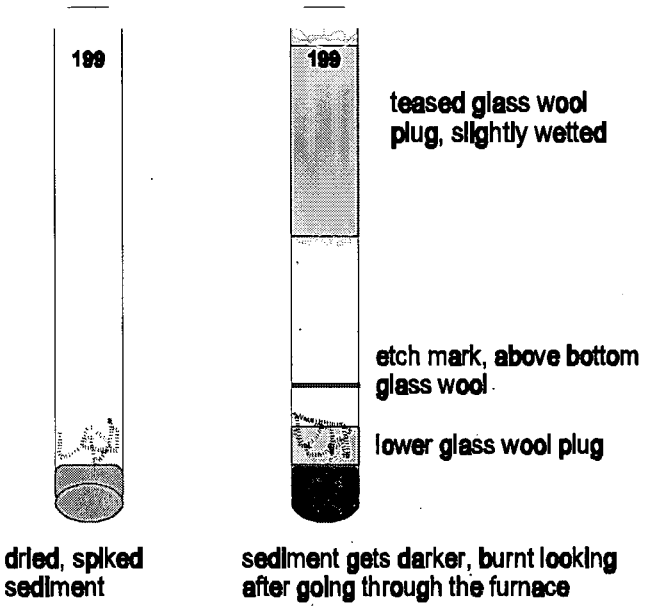
4.4.4 Set the temperature for ~ 200 degrees c on Thermolyne 1900 hot plate and leave the tubes to dry down overnight. They should <u>not</u> be actively boiling but a slow release of HCl vapour should be seen from the top of the testtubes.

4.5 Sample Distillation -Putting the test tubes through the furnace:

4.5.1 A 1 - 2 cm plug of Pyrex glass wool is cut and pushed into the bottom of each spiked, dried tube using a glass stirring rod. If the glass rod touches the side of the test tube at any point on the way down, it is thoroughly wiped off with a dry tissue to prevent cross-contamination of the samples.

4.5.2 A second 5 - 7 cm plug of Pyrex glass wool is cut and teased, then folded. This is then wetted with DIH_2O and pushed into the test tube, forming a longer plug at the top of the tube.

4.5.3 The tubes are then placed in the furnace and the temperature is carefully checked. When a very faint red glow is visible, the tubes are timed for 1hour. Check the tubes often to be sure that the test tube glass is not melting and then welding onto the glass furnace lining.



4.5.4 After the tubes have cooled, etch them above the lower glass wool plug using the Carborundum cutoff wheel mounted in the drill press.

4.6 DIGESTION

4.6.1 All beakers and funnels have been soaked in 2 N HCl for at least six hours, then rinsed with tap water prior to use.

4.6.2 Each etched test tube is placed in a numbered large (600 ml low form & 300 ml tall form) beaker. Wearing heavy protective gloves and safety glasses, wet the test tube along the etch mark under a small stream of water, then break off the tube end. The mud end is disposed of into waste can provided for this purpose. Place the top end back into the large beaker.

4.6.3 Using a glass stirring rod, push the glass wool out of the tube and into the large beaker. Avoid touching the glass rod to the sides of the tube while doing this. If it does happen, wipe the stirring rod very thoroughly with a dry tissue to eliminate any chance of cross-contamination of the samples.

4.6.4 Flatten the glass wool and spread it out along the bottom of the beaker, using the test tube. Place the large beakers on the hot plate in a fumehood, arranging them to ensure the watch glasses (used as covers) will not touch.

4.6.5 Add 30ml of concentrated HNO_3 (ACS) to each beaker (if less than 30ML of nitric acid is used beaker containing samples will dry before the 3 hour digestion is complete). Put the watch glasses on the beakers and heat to a light boil (usual

controller setting on large hot plate is 300C TO 350 F Temperature, if using transformer, 93 AC volts should be used). At this point start timing for 3 hours or until the liquid is colourless (sometimes longer than 3 hours).

4.7 Drying down the digested fluid:

4.7.1 Working in a fumehood, use ~ 2 ml 1.5N HNO_3 to rinse the watch glass into the large beaker. Place a glass stirring rod inside the test tube and pull the tube partway out of the beaker. Rinse the test tube with ~ 2 ml 1.5N HNO_3 and then dispose of the test tube in the sink.

4.7.2 Pour the acid and the glass wool out of the large beaker into the medium (150 ml) beaker through a 7.5 cm diameter plastic funnel that is sitting in the smaller beaker. Compress the glass wool in the funnel with the stirring rod to get as much acid into the medium beaker as possible. Rinse the large beaker 3 times with ~ 2 ml 1.5N HNO_3, each time pouring the rinse acid onto the glass wool in the funnel and compressing the glass wool with the stirring rod to remove the acid. Rinse the glass wool, but not the beaker, one more time with ~ 2 ml 1.5N HNO_3. Express the acid from the glass wool and then dispose of the glass wool, funnel, and beaker in the sink.

4.7.3 Heat the medium beakers on a 11"x11" hot plate, evaporating to dryness using 59 Volt AC supplied by variac transformer . Evaporatoin is usually done for overnight. When completely evaporated, there should be no moisture left on the bottom or sides of the beakers. A thin film of sediment on the bottom is expected. If evaporating overnight, the setting should be low (~ 200 degrees Fahrenheit). If evaporating under supervision during the day, the setting may be adjusted somewhat higher (~ 275 degrees Fahrenheit), but the acid should NEVER boil and the beaker should be removed from the heat when dry. Exceeding these temperatures may cause loss of isotope by volatilization when the beaker is dry.

4.8 Plating

4.8.1 Make an ascorbic acid solution <u>(1.5 g ascorbic acid in 107 ml DIH_2O).</u>

4.8.2 Prepare the planchet (16 mm X 12mm X 0.5 mm Sterling silver, one side covered with ruberized rockerguard paint 47-7936-2) onto which the isotope will plate: Select the desired number of planchets, snip off any protruding edges, and place in a small beaker. Add enough 12N HCl to cover the planchets (first add 12N HCL in small beakers and then add Planchets one by one,) and allow to sit for 5 minutes. Pour the used 12N HCl into the HCl acid bath, being careful not to pour the planchets in with it. Rinse the planchets in the beaker 3 times with DIH_2O, then once with commercial-grade methanol (not the reagent-grade methanol).

4.8.3 Dry the planchets on a folded paper towel and check to see if the glue on the sprayed side is still intact. If the glue is not intact, the planchet cannot be used and more must be cleaned. Using a scalpel, scrape off any dark discolourations (tarnish?) on the smooth side. Number the planchets on the glue side with the appropriate sample number, and place each in a small (30ml), numbered beaker.

4.8.4 Add 20 ml of 1.5N HCl to the medium beakers (fill to the line). Place the beakers on the hot plate and allow to simmer at a low temperture (~175degrees Fahrenheit) until condensation forms on the beaker sides. Swirl the beakers once or twice while simmering to dissolve the sediment. Pour the 1.5N HCl into the small beaker, being careful to observe the beaker number protocol. Rinse the medium beaker 3 times (~ 1-2 ml/rinse) with the prepared ascorbic acid solution, each time pouring the rinsing into the small beaker. Place a watch glass on the beaker when complete.

4.8.5 Repeat this procedure until all the medium beakers have been emptied into the appropriate small beakers.

4.8.6 Arrange all the small beakers in a circle directly over the heating element on a small hot plate 11"x11" and allow the acid to come to a very light boil using 59 Volt AC supplied by variac Transformer. At this point, start timing for 3 hours. If the planchet flips over (number side up), flip it back with a clean glass stirring rod. Watch the contents of the beakers carefully to ensure the correct boiling rate.

4.8.7 After 3 hours unplug the hot plate and allow the small beakers and their contents to cool enough to be handled (increasing the fumehood air flow will speed this up). Pour the acid down the drain and rinse the planchets at least3 times with DIH_2O from a plastic squeeze bottle (necessary to get a force fulburst of water). When the planchet is clean, rinse once more with the commercial-grade methanol. Tip the planchet out onto the clean folded paper towel and check the number on the back to make sure it is still legible after its ordeal. If it is not, renumber it. Carry the folded paper towel to the MCA/alpha spectrometer, and put the planchets in line to be counted.(Planchet should be dry before putting in detector, either planchets should be air dried for 12 hours or dried in oven at 60 C for minimum one hour.)

0

4.9 Sample analysis using the Alpha Spectrometer:

The silver disks are placed into an evacuated counting chamber. The samples are monitored for Po-210 and Po-209 isotopes with a 300 mm^2 surface barrier detector (100 : depletion depth) for a period of 8 hours each (30,000 seconds). The data are then entered into an Excel spreadsheet which plots the activity vs. depth (or cumulative mass) and which also models the data to select the most probable sedimentation accumulation rate. The Po-209 counts allow precise measurements of the overall chemical yield and thereby permits calculation of the specific activity of the Po-210 in the original

sample

4.10 Recoveries:

4.10.1 It is assumed that the Po-209 spike behaves the same as the naturally occurring Po-210 isotope. This is a reasonable assumption for the unsupported Po-210 because the isotope is not bound up in old refractory minerals; it originally entered the sediments as an atom of Pb-210, probably loosely associated with the dust particles. The Pb-210 decays into Po-210, usually within 2 years, and Po-210 should be readily available for leaching with the acid used in this method. In other words, both the natural Po-210 and the added Po-209 should be completely converted to the chloride form upon acid addition, and therefore both should be recovered with equal efficiencies.

4.10.2 The activity of Po-209 added to each sample is known to be 20 DPM. The measured activity of Po-209 in a typical sample might be 3 CPM. The recovery can then be calculated to be 3/20 = 0.15 .The observed activity of Po-210 in the same sample is divided by the recovery factor to determine the actual Po-210 activity of the sample. This result, when divided by the dry weight of the sample analysed, is the specific activity of Po-210 in the sample. Recovery results include chemical yield, detector efficiency and detector geometry; based on detector geometry alone, the recovery would never be expected to exceed about 0.40 .

5.4 Equipment and Setup

5.4.1 The EG&G Octet PC is a PC-controlled integrated Alpha Spectroscopy workstation. The Octet PC is a system comprised of eight complete spectroscopy channels and the MCA (multi channel analyzer) function. Individual control for each spectrometer is via the MASTERO MVA Emulator. Both DOS (MASTERO II) and Windows 3 (MASTERO FOR Windows 3) Emulator software can be used. The MAESTRO for Windows and Windows Workgroups MCA emulation continuously show the currently acquiring spectrum, the current operating conditions, and the available menus. All important operations that need to be performed on the spectrum, such as peak location, ROI insertion, display scaling, and sizing are implemented with both the keyboard and the mouse. Spectrum peak searching, report generation, printing, archiving, calibration, and other analysis tools are available from pull-down menus. A Buffer is maintained in the computer memory to which one spectrum can be moved for display and analysis, either from the MCB (multi channel buffer) memory or form disk.

5.4.2 The Alpha Vision software provides the capability for controlling the MCB hardware, collecting alpha spectra from solid-state detectors, analyzing the results by one of several methods and generating reports. Result database storage and QA (Quality Assurance) functions are built in.

5.4.3 Alpha Vision will run on any IBM compatible computer that supports Microsoft Windows (Version 3.1 or later) in enhanced mode. A minimum of 4 Megabytes (MB) is required; 8 MB or more is recommended. A VGA display and a fixed disk of at least 80 MB capacity are also recommended.

5.4.4 Alpha Vision will control up to 128 individual detectors , either local or networked. Detectors are logically controlled and managed in groups of up to 8 detectors each. Most of Alpha Vision's functions , such as **Start**, **Stop**, and **Clear**, operate on the detector or group selected in the detector status window located in the Alpha Vision workspace.

5.4.5 Each alpha spectroscopy channel includes a vacuum gauge, variable detector bias supply (+ or -), a preamplifier, a shaping amplifier with adjustable gain, pulse stretcher and bias amplifier, a test pulser generator with variable amplitude, and leakage current monitor.

5.4.6 Each pulse generator is adjustable over a range representing 4 to 10 MeV; the bias supply is adjustable over the range from 0 to +/- 100 V. Each detector's bias voltage and leakage current may be read out via the PC.

5.4.7 The MCA (multi channel analyzer) section of the Octet PC consists of an 8-input multiplexer, with individual control of **start/stop/preset**, and a successive-approximation ADC with a fixed conversion time per event of < 15 microseconds and conversion gain range from 64 to 4096 channels. Individual conversion gains and individual digital offsets, with a one channel resolution, are provided on each of the eight electronic channels.

5.4.8 All eight vacuum chambers in each Octet PC are connected to an integral vacuum manifold with a single connector for attachment to an external vacuum pump. This reduces the possibility of vacuum leaks. Each chamber features a manually operated **pump/hold/vent** valve, interlocked to the detector bias for that chamber, so that bias is automatically removed when the chamber is vented. Individual pressure-gauge heads monitor the chamber pressures independently; pressure readout is via the PC.

5.4.9 Vacuum Chambers:

Cast brass, nickel-plated for ease of decontamination.
Maximum sample size: 2.030" (51 mm)

Maximum sample to detector spacing: 44 mm in increments of 4 mm
Maximum detector size: 1200 sq mm
High-performance O-ring seal
Detector connector type: Rear MICRODOT
3-position pump/hold/vent/ valve, front-panel mounted for each chamber.
Vacuum manifold connector on rear is an NW25 ISO-KF
Vacuum pump requirement: A rotary vacuum pump, 6.7 CFM (190 liters/min) displacement, with oil mist trap.

5.4.10 **System Performance:**

Based on use with BU-017-450-100 ULTRA Series detector with a good quality ^{241}Am point source.

Energy Resolution: # 20 KeV (FWHM) with a detector-source spacing equal to the detector diameter.

Detector Efficiency: ∃25% for detector-source spacing of less than 10 mm.

Background: # 1 count/hour (above 3 MeV).

5.4.11 Operating Pump/Hold/Vent Value with Bias Interlock: The Pump/Hold/Vent valve is a 3-position valve. The Pump position connects the chamber to the manifold, the Hold isolates the chamber, and the Vent position connects the chamber to the atmosphere, allowing the door to be opened.

5.4.12 The bias interlock circuit, which is enabled and disabled by a rear-panel switch, has two settings, 100 millitorr and 500 millitorr.

5.4.13 If the bias is left enabled while a chamber is vented or evacuated, then as the pressure passes through the set point of the interlock, the bias will be turned off or on, respectively.

**Note: If a detector is acquiring data as the bias is turned off, the data will be corrupted.

The detector bias interlock provides a safety measure against detector damage.

5.4.14 **Chamber Decontamination:**

Use the following steps to decontaminate an EG&G Octet PC

chamber:

5.4.14.1 Remove the detector from the chamber by rotating it counter-clockwise. The damage to the detector. protective cover supplied with the detector should be in place prior to its removal to prevent

*__Note__: Plastic gloves should be used to prevent contamination of the hands or chamber.

5.4.14.2 Pour the cleaning agent into a clean beaker. Methanol, or water with methanol rinse, can be used as a cleaning agent. Dip a cotton swab or a cotton-covered stick into the agent and gently wipe the internal surface of the chamber to remove any contamination. Avoid contaminating vacuum or vacuum gauge ports. Plug holes if necessary.

When contamination from the surface is visible on the cotton swab, discard and use a clean one in order to avoid returning the contamination to other areas of the chamber.

When the chamber is clean, blow dry with clean nitrogen gas.

Reference :

1 . J.D. EAKINS, and R.T. MORRISON received 19 September 1977. A new procedure for the determination of lead-210 in Lake and Marine Sediments (Environmental and Medical Sciences Division, AERE, Harwell, Didcot, Oxfordshire, England)

2 .Appleby P.G. and Oldfield F. , 1978. The calculation of Lead-210 dates assuming a constant rate of supply of unsupported Pb-210 to the sediment Catena 5: 1-8

3 W.W. FLYNN (Australian Atomic Energy Commission Research Establishment, Lucas Height, N.S.W. (Australia) (Received June 12th, 1968). The Determination of Low Levels of Polonium-210 in Environmental Materials

4 Jules M. BLAIS, JACOB KALFF, R.JACK CORNETT & R. DOUGLAS EVANS. (Received 9 September 1993; accepted 30 July 1994). Evaluation of Pb-210 Dating in Lake sediments using stable Pb, Amborasia pollen, and Cs-137

Appendix Index

Section	**Description**
A1	Reagent Preparation: Nitric acid (1.5 N)
A2	Reagent Preparation: Hydrochloric acid (1.5 N)
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A6	Use of EG&G Octet Alpha Spectrometer for Pb-210 analysis.
A7	SOP for calibrate EG&G Octete detectors.
A8	A list of chemicals requiring *Chemical Reception* log-in sheets.
A9	Pb-210 sample login system.
A10	Quality issues.
A11	Sterling silver planchettes (Dimension 16 mm X 12 mm X 0.5 mm)
A12	Precautions during use of Glass wool.
A13	Sample history
A14	Supporting test method

A15 Glassware cleaning procedure.

Examples of the following forms:

a)	Reagent Preparation: Nitric acid (1.5 N)
b)	Reagent Preparation: Hydrochloric acid (1.5 N)
c)	Reagent Preparation: Reductant solution L- Ascorbic acid (1.5 N)
d)	Certified Reference Po-209 Standard (1000 DPM/ml)
e)	Po-209 working standard – (20 DPM/ml)
g)	Glassware Rinsing Solution. *(Dilute Nitric Acid)*
h)	Use of EG&G Octet Alpha Spectrometer for Pb-210 analysis.
i)	SOP for calibrate EG&G Octete detectors.
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n)	Precautions during use of Glass wool.
o)	Sample history
p)	Supporting test method
q)	Glassware cleaning procedure

Appendix Section A1 Reagent Preparation: Nitric acid (1.5 N)

Add 200 ml of conc nitric acid to 1800 ml S.Q. water in reagent bottle. After addition shake the bottle 4-5 times. Its self life is unlimited & it is stored in clean 2.5 litres glass bottles with tight cap in dark place in cabinet behind the fumehood.

Appendix Section A2 Reagent Preparation: Hydrochloric acid (1.5 N)

Add 250 ml of conc hydrochloric acid to 1750 ml S.Q. water in reagent bottle. After addition shake the bottle 4-5 times. Its self life is unlimited & it is stored in clean 2.5 litres glass bottles with tight cap in dark place in cabinet behind the fumehood.

Appendix Section A3 Reagent Preparation: Reductant solution L- Ascorbic acid (1.5 N)

Weigh 1.0 g L-Ascorbic acid in empty plastic squeeze bottle . Add 70 ml S.Q. water. Shake well to bottle untill ascorbic acid fully dissolved in S.Q. water. Its self life is one day . Parent L-Ascorbic acid bottle should be tight capped and stored in dry place in upper cabinet for chemicals in wet lab to prevent it getting moist.

Appendix Section A4

A4a Certified Reference Po-209 Standard (1000 DPM/ml)

Use 1000 DPM / ml certified reference Po-209 standard. The Po-209 (half life 103 yr) was obtained from Oak Ridge National Lab. The parent solution was made up at Core Scientific Internationalas 1000 DPM/ml activity in 1.5 N HCl and stored in a polyethylene bottle. The activity was assayed by counting an aliquot in a liquid scintillation counter with the window set up to monitor only alpha pulses. Efficiency for alphas by liquid scintillation is generally accepted to be 100 %. Its self life is unlimited. It is stored in plastic bottle with tight cap in dark place in upper cabinet for chemicals in wet lab.

A4b Po-209 working standard – (20 DPM/ml)

The parent solution (1000 DPM / ml) is diluted 1:50 (i.e. add 2.00 ml parent to 98 ml of 1.5 N HCl in a polyethylene bottle) for use as required. [The precise activity of the spike at time of addition is determined by correcting for the radioactive decay of decay of the isotope since its original preparation and assay.] . Its self life is unlimited. It is stored in plastic bottle with tight cap in dark place in upper cabinet for chemicals in wet lab.

Appendix Section A5 Glassware Rinsing Solution. ***(Dilute Nitric Acid)***

Rinse all glassware with 1.5N HNO_3 . All glassware should be soak in 1.5N HNO_3 for at least 6 hours before use.

Appendix Section A6 Use of EG&G Octet Alpha Spectrometer for Pb-210 analysis.

Please follow the outlined step by step procedure in running the EG&G Octet PC Alpha Spectrometer:

There is a current Pb-210 / Po-210 Octet PC Alpha Spectrometer Log Book in which the date and time is recorded, the name of the technician, sample number, Po-209 (Polonium 209) gross area, Po-210 (Polonium 210) gross area, detector number, and the filename. Once all of the necessary data has been entered into the current Log Book, you will need to run the software application **shortcut to octete.exe**.

*Note: the gross area(s) for Po-209 and Po-210 are recorded in the Log Book once the alpha spectrometer has finished a 30,000 second counting period.

*Note: Each detector has been clearly labeled with an individual number ranging from 17 to 24 with blue tape (or 1 to 8, where 17 = 1, 18 = 2, 19 = 3, . . . etc.)

(1) Shortcut to Octete.exe: To start Pb-210 analysis on the EG&G Octet PC Alpha Spectrometer, double click on the shortcut to octete.exe icon in the Windows start up screen. You should immediately see a **Getting Configuration** on the monitor, then you will be quickly prompted to an information screen that is divided into 4 individual boxes. The upper left box monitors the vacuum (in millitorr) verses the detector number. The lower left box monitors the detector leakage (in nA) verses the detector number. The upper right box monitors the voltage verses the detector number. The bottom right box gives the Octet PC status of detectors 1 through 8. Pressing **F9** on the keyboard will prompt the user to another screen which monitors the HV (high voltage) indicating on/off, as well as the energy range (in MeV) for each of the detectors.

*Note: make sure that the HV is off and that the red bias light for each detector is also off.

Once this has been done sample insertion can start. Assuming that the bias interlock is not in use, then inserting a sample into a chamber of the Octet PC is accomplished by turning the chamber valve to the Vent position and opening the door. Slide the sample holder into the slot at the desired height.

*Note: It has been common practice at Core Scientific International to use the upper most slot in each of the detector chambers.

When the sample is in place, close the door, and turn the vacuum valve to Pump.

**Note: It is vitally important to make sure that all of the planchet have had sufficient time to dry before running them on the alpha spectrometer. A 24 hour drying time is more than sufficient. If you wish to speed up this process, the planchets can be dried more quickly in a preheated oven for a few hours. If any of the planchet contain water/moisture they could damage the detectors.

Once a sample has been loaded into each detector, press **F9** on the keyboard to go back to the initial **shortcut to octete.exe** page. At this point you will need to pay close attention to the vacuum (in millittorr) verses detector number. It is common to wait 2 to 5 minutes for the vacuum to reach a satisfactory valve pressure (approximately 40 millitorr or less). Once this has been verified, pressing **F9** will prompt you back to the high voltage and energy range (MeV) screen. Press the **page up** button on the keyboard to turn on the HV (high voltage) bias. The HV indicator should be on (as indicated on the monitor screen) as well the red bias light above the right hand side of each detector door on the MCA (multichannel analyzer).

*Note: Make sure that each detectors high voltage is on as well as each red bias light.

Press **F9** to go back to the initial monitoring screen:

(a) Look at the Voltage (millitorr) verses Detector number to check that they are # 40 millitorr.

(b) Look at the Leakage verses Detector number. (*Note: detector 3, 7, & 8 have a leakage (nA) of approx.– 100. Detectors 1, 2, 4 to 6 have a leakage (nA) of approximately – # 50 (as of April 11/01)).

(c) Look at the Voltage verses Detector. (*Note: detectors 1 & 3 are approximately – 50, while detectors 2, 3, 5 to 8 are approx. ~ 40 (as of April 11/01)).

Once this has been checked and completed, pressing **F10** on the keyboard will exit out of **shortcut to octete.exe** and bring the operator back to Windows start up screen.

(2) Alpha Vision Software: The steps to execute a **General Analysis** are:

(a) Select the detector(s) to be used for the general analysis. Go to the cell, Group 1 and double click it with the left mouse button, this will select and high light detectors 1 through 8 for usage. Once this has been done, click the right mouse button once. A pop-up menu list should appear on

the monitor. Scroll down the menu list and click on **Clear Detectors** with the left mouse button. This command erases the detector spectral data, and also the descriptors (real time, live time, start time, etc.) for the selected detectors. If a group of detectors is selected the Clear command is executed for all of the detectors in the group that are in the **Idle**, **Unload**, or **Error** state. If the operation is successful, the detector changes to **Idle**.

*Note: that the detectors may also be cleared by <**Alt+3**>, an accelerator that duplicates this function.

(b) Once again, acquire the pop-up menu list and press on **Start Analysis**. This command starts a general analysis for the selected detectors which are ready to run. If a group of detectors is selected, data acquisition is initiated for all detectors that are on the **Stopped**, **Idle**, or **Unload** state. If the detector is in the **Stopped** state, it is restarted with its previous analysis parameters.

*Note: The detectors may also be started by <**Alt+1**>, an accelerator that duplicates this function.

A message should appear indicating, prepare the samples and detector chambers for **General Analysis** . Press "**OK**" when ready to begin.

Pressing the **OK** push button brings up the **General Analysis Parameters Dialog Box**. The **sample description** field contains the 63-character sample description which is stored with the spectrum file when data collection is completed.

*Note: the operator should enter the number that is associated with each silver planchet for the sample description. This is stored in the analysis results database.

The **Sample Type** list contains an alphabetical listing of all of the sample types that can be used for **General Analysis**. If the last analysis executed by the detector was a **General Analysis**, the last value used is selected. Otherwise, the first **General Analysis** sample is selected. Make sure that the **Sample Type** list box has Po-210/Po-209 present.

The **Tracer Amount** field contains the amount of tracer added to the sample, expressed in disintegrations per minutes (DPM). It is enabled if the selected sample type is a relative analysis. If the sample indicates that the tracer was added to the total sample, the title of the group box, is **Total Tracer Amount**. If the tracer was added to the aliquot sample, the title is **Aliquot Tracer Amount**. If this field is enabled, the value must not be zero. Make sure that the **Tracer Amount** (DPM) is set at 0.0000.

The **Total Volume** and **Aliquot Volume** fields contain the values entered when the sample was prepared. Since the aliquot to total ratio is used during the analysis, volume units are arbitrary, but they must be the same. The **Volume Units** field allows a units designator to be stored in the database. Alpha Vision supports the following units: kg, g, ml, L, or m^3. Make sure that the **Volume Units** contain none, the **Total Volume** set at 1.0000, and the **Aliquot Volume** set at 1.0000.

The **Sample Collection Date** and **Sample Collection Time** values contain the date and time at which the sample was collected in the field.

*Note: that these values are not the same as the date and time the spectrum data was acquired. Together with the acquisition date and time, elapsed time is calculated by the analysis. The date is read as dd-mm-yy, however we do not use the sample collection date. The time is read as hh:mm:ss, however we do not use the sample collection time either.

Pressing the **Begin** button starts the general analysis. If the associated detector is successfully started, its state icon in the detector status window changes to **Run**. If multiple detectors are to be started, the general analysis parameters are redisplayed for the next detector in the list which is ready to run.

(c) The samples are then monitored for Po-210 and Po-209 isotopes with a 300mm^2 surface barrier detector (100 : depletion depth) for a period of approximately – 8 hours each (30,000 seconds). Once the Alpha Spectrometer has counted the samples for 30,000 seconds, it will automatically stop data collection.

Helpful Short Cut Functions (with the Keyboard) while the Alpha Spectrometer is counting:

<**crtl-F1**>: allows you to view the spectrum of detector 17
<**ctrl-F2**>: allows you to view the spectrum of detector 18
.
.
.
<**ctrl-F8**>: allows you to view the spectrum of detector 24
- button (on the number pad): advances the screen to the Po-209 / Po-210 peaks of interest
+ button (on the number pad): advances the screen to the far left of the screen
Page-up: moves the cursor right in large increments
Page-down: moves the cursor left in large increments
up-arrow: increases the overall height and size of both peaks visually
down-arrow: decreases the overall height and size of both peaks visually
right-arrow: moves the cursor to the right in small increments
left-arrow: moves the cursor to the left in small increments

(3) Once the Alpha Spectrometer has finished counting for a period of 30,000 seconds, you can then determine the gross area of Po-209 and Po-210. There is a **Display** box in the upper right hand corner of the screen, which has **Detector #** and **Buffer**. Click on **Buffer**, then go to the **File** menu, and click once on **Recall**. You will then be prompted to a box called **Recall Spectrum File**. Click on the **Data** folder in the **BBL** main folder.

*Note: BBL's data folder is where the spectrum files are allocated.

Once you are in BBL's data file, the C directory should read: C:\user\alpha\samples\bbl\data. Scroll down the **File Name** box, and click on the file you want to work on.

*Note: as an example the spectrum files are labeled as ALPH1699.CHN(121). The number 1699 refers to the filename, and the number 121 in brackets refers to the given planchet number.

Use the -'ve button (on the number pad) to advance the screen to the Po-209 and Po-210 peaks.
*Note: there is a **Vert** box located on the right hand side of the screen, where you can select **Log** scale or **Auto** scale. Select the **Auto** scale by pressing on it once with the left mouse button.

Once this has been done, you will need to ascribe an **ROI** (Region of Interest) that is associated with each detector. You will need to go to the **ROI** menu list found at the top of the screen, and then click on **Recall** file. You will then need to open the directories in the following order: C:\user\alpha\calib\samples. You should only be concerned with the following files:
det17x44.roi, det18x44.roi, ... , det24x44.roi.
*Note: the files that have the detector # x44.roi are the ROI (Region of Interest) files that you will need to use for each specified detector to determine the gross and net area of each peak.

Double click on the file det17x44.roi with the left mouse button, which will superimpose (or include) the ROI's to the sample spectrum for detector 17.

*Note: Once you have included the ROI's, the peaks will be colored pink. The peak to the left is Po-209 and the peak to the right is Po-210. The center of the Po-209 peak occurs at approximately ~ 4864.28 KeV and for Po-210 it occurs at approximately ~ 5299.28 KeV.

When you click on each peak, there will be a marker, KeV, counts, peak, gross and net area values. You will need to acquire the gross area for each peak and record them in the current Pb-210 / Po-210 Log Book. Once this has be done, open the **File** menu and click on recall. You will be prompted to Warning: Buffer was modified. You will then be asked: Do you want to save **Buffer**? **Yes/No/Cancel**. Click on the **Yes** tab, then you will be prompted back to **Recall Spectrum File** where the same procedure will be done on each of the seven remaining detectors. **1.0**Retrieve the "Mercury Logbook" and fill in the start date in the "Mercury System Log" section.

Appendix Section A7 SOP for calibrate EG&G Octete detectors.

Standard Operating Procedure

The basic steps required to calibrate a single chamber of the EG&G Octet PC and then proceed to count a sample are:

(1) Insert a calibration standard source into the chamber.

(2) Evacuate the sample, turn on the bias, and count the standard.

(3) Perform the energy and efficiency calibration.

(4) Repeat steps 1 - 2 with a prepared sample.

*Note: For quantitatively meaningful results, the sample must be placed at the same distance from the detector as the calibration standard.

Appendix Section A8 **A list of chemicals requiring *Chemical Reception* log-in sheets.**

For Pb-210 analysis, the following chemicals should have individual (*Chemical Reception*) log-in sheets.

a) Nitric acid . Anachemia catalog # AC 6525
b) Hydrochloric acid Anachemia catalog # AC 4955
c) L-Ascorbic acid
d) Methanol
e) Certified Reference Po-209 Standard (1000 DPM / ml)

Appendix Section A9 **Pb-210 sample login system.**

Appendix Section A10 **Quality issues.**

A10.1 Spike Recovery: Counting times are usually 30000 seconds per sample. During that time period approximately 1500 counts should be observed from the internal Po- 209 spike of approx. 20 DPM in each sample. There is variation in the spike count; variations of +/- 60 % are considered acceptable i.e. within the range of 600 - 2400 counts. If a single sample yields a count outside of this range, it should be repeated if enough sample material is available. If multiple samples are out of the range, processing of the core should cease and the situation be evaluated for potential problems. An out of spec. planchet should recounted on another spectrometer system which has been shown to produce 'normal' results. A confirmed out of spec. result indicates that the cause of the problem is chemical. If the recount indicates an 'in spec.' planchet, this indicates an instrumental problem and operation of the original spectrometer should be discontinued until it is repaired. In the event of a chemical problem, material from a previously analysed 'normal' sample should be completely reprocessed to determine if the analytical procedure is functioning correctly. Alternatively, data from other cores, which have subsequently been processed, can be examined to determine if the analytical procedure is in control. If the procedure is seen to be in control, then it is assumed that the problem samples have a difficult matrix that is unavoidable and must be lived with. Consult with the client to determine whether we should proceed. If the analytical procedure is seen to be out of control, cease sample processing until problem is resolved. Spike recovery appears to be related to the temperature of plating. There is good spike recovery (2800-3100 counts in 30000 secs observed from the internal Po- 209 spike of approx. 20 DPM in each sample) if during plating, the solution in the beakers is lightly boiling all the time, and at the end of the plating period, the solution has turned dark brown in colour and colour has become viscous,. For

example see spike recovery in data sheet of swedish lake sediment (SKALSJON with Modelling and Plotting.XLS). Spike recovery was poor (800-1623 counts in 30000 secs observed from the internal Po- 209 spike of approx. 20 DPM in each sample), when there was no continous boiling during plating and at the end of plating solutions were slightly yellowish in colour. For example see spike recovery in data sheet of swedish lake sediments (Burotjarn with Modelling and Plotting.XLS)

A10.2 Duplicate: Duplicate analyses of samples should be done on every tenth sample, provided there exists enough material. The selection of duplicates may have to be based upon which sections contain enough material for 2 analyses. It is referred to perform the duplicates from sections closer to the core surface because the counts will probably be higher and therefore the statistics better. Core processing should cease if deviations from the mean exceed more than 3 SD's in Po-210 calculated activity. Recount the duplicate planchets and if the difference persists, perform an additional duplicate analysis if enough material is available. File "Percent Deviation in Sediment" shows percent deviation in duplicates from mean for Po-210 total activity (DPM/g) .

A10.3 Analytical Blank: Analytical blanks should be performed every 20 samples. These consist of a normal analytical run performed without the addition of any sediment. The Po-209 recovery will almost always be poor in these samples (400 - 1000 counts). They are done to ensure that no contamination of the glassware, planchets, reagents or spiking solution has occurred. The results are not used in any calculations. An accumulation of more than 10 Po-210 counts, after subtraction of detector background, should cause chemical processing to cease and initiate an investigation for contamination problems.

A.10.4 Detector Blank: Detector blanks are done during periods of analysis, between cores or weekly, whichever comes first. They are 30000 sec. counts made by the spectrometers with no sample planchets in place. They will typically show 4 -40 counts in the Po-209 peak and 0 - 4 counts in the Po-210 peak. They are specific to an individual detector and represent contamination of the detector by recoil i.e. periodically some isotope from a sample will be thrown onto the detector during a nuclear decay event. The counts for any detector will very slowly increase with use. The counts are quite constant over a time period of months and therefore a running average of the counts for the last 10 measurements is kept. These average counts are subtracted from every sample count prior to any other calculations.

Appendix Section A11 Sterling silver planchettes (Dimension 16 mm X 12 mm X 0.5 mm)

Silver Planchetts (0.648 inches wide x 0.484 inches length x 0.020 inches thickness) are obtained from Cal Law(1992)Ltd,783 MainStreet, Winnipeg, Manitoba. R2W 3N5 by contacting Jackie Phone #956 0996. The price per planchett is 55 cents.

Appendix Section A12 Precautions during use of Glass wool.

Glass wool is very irritating to the skin, eyes and mucous membranes. It damages the lungs when inhaled. A lab coat with elasticized cuffs, a dust mask, and safety glasses are a necessity. Working in a fumehood.Wipe down the fumehood and counter when finished, as well as any other surface that might have glass wool stuck to it. When etching the test tubes, wear safety glasses and a dust mask to protect your eyes, nose and lungs from the glass dust.

Appendix Section A13 Sample History:

A13.1 Sampling date: Sample history incudes sampling date of core. If sampling date of a core is very old, then we apply decay correction to a core.
A13.2 Sample Pre-treatment: Dry samples which we receive for Pb-210 analysis with modelling & plotting, we need to know sample history like whether there were bulk density performances for samples . We require dry weight per wet weight cc data for samples received as dry . If there is no bulk density performance for samples but received as dry, we need to know original volume of wet samples.
A13.3 Sample Container: Sample container should not be metallic otherwise there will be reaction between Pb and other metal. Sample container should be made up of glass or plastic with teflon line / plastic cap.
A13.4 Sample Holding Time: Dry samples , frozen samples in glass can be hold for unlimited time before analysis.

Appendix Section A14 Supporting Test method:

A14.1 We performed Pb-210 analysis with and without distillation for sediment to find out most efficient method. We came out with same kind of recovery with distillation and without distillation for sediment. So, in spite of getting same recoveries from Pb-210 analysis with distillation and without distillation, we selected to use Pb-210 analysis with distillation because distillation process remove most of organic interferences. The results of Pb-210 analysis with distillation in EXCEL file GC04.xls worksheet Pb-210 (2). The results of Pb-210 analysis without distillation in EXCEL file GC04test.xls

A14.2 We performed experiment to find out whether 3 hours digestion is complete digestion or not. We perform Pb-210 analysis with 3 hours digestion and Pb-210 analysis with 6 hours digestion. After 3 hours digestion of sediments , digestate appeared to be clear and transparent solution indicate that whole sample is fully digested. The results obtained from Pb-210 analysis with 3 hours of digestion have same recoveries as from Pb-210 analysis with 6 hours of digestion. These results indicates that 3 hours of digestion is complete digestion.

Appendix Section A15 Glassware cleaning procedure:

After use, we put all glassware in acid bath containing 1.5N nitric acid for overnight. If there is shortage of time, glassware should be soaked in 1.5N nitric acid for at least 6 hours before use . In morning, all glassware should be take out of acid bath, washed with tap water 3-4 times and then air dried before use it.

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ENCLOSURE 2

Amendments to Accident Prevention Plan

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Site-Specific Health and Safety Plan
RADIOLOGICAL
DATA GAP INVESTIGATION, Parcel F
Hunters Point Shipyard
San Francisco, California

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November 2012

ITSI Gilbane Project No. 07225.0002

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
mg/Kg	milligrams per kilogram
µg/L	micrograms per liter
ACGIH	American Conference of Industrial Hygienists
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
AOC	Area of Concern
APP	Accident Prevention Plan
BTEX	benzene, toluene, ethylbenzene, and xylene
CAA	Corrective Action Area
Cal-OSHA	California Occupational Safety and Health Administration
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	cardiopulmonary resuscitation
CIH	Certified Industrial Hygienist
CSO	Caretaker Site Office
CSP	Certified Safety Professional
CTO	Contract Task Order
dBA	decibels A-weighted
DOT	Department of Transportation
EZ	Exclusion Zone
GFCI	Ground Fault Circuit Interruptors
G-RAM	General radioactive material
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
HSM	Health and Safety Manager
ITSI Gilbane	ITSI Gilbane Company
MSDS	Material Safety Data Sheet
MTBE	methyl-tert-butyl ether
Navy	United States Department of the Navy
NIOSH	National Institute for Occupational Safety and Health
PAHs	polycyclic aromatic hydrocarbons
PEL	Permissible Exposure Limit
PERMAC	Performance-Based Multiple Award Contract
PID	photo ionization detector
PPE	personal protective equipment
ppmv	parts per million per volume
ROICC	Resident Officer in Charge of Construction

RPM	Remedial Project Manager
SSHO	Site Health and Safety Officer
SPF	sun protection factor
SHSP	Site-Specific Health and Safety Plan

LIST OF ACROYNMS AND ABBREVIATIONS (continued)

SWP	Safe Work Procedure
TLV	threshold limit values
TPH	total petroleum hydrocarbons
UL	Underwriters Laboratories
UV	ultraviolet
USACE	United States Army Corps of Engineers
VOCs	volatile organic compounds

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1.0 INTRODUCTION

This Site-Specific Health and Safety Plan (SHSP) was prepared by ITSI Gilbane Company (ITSI Gilbane), as requested by the Department of the Navy (Navy) Naval Facilities Engineering Command Southwest (NAVFAC SW) (Contract Number N62473-11-D-2227, Delivery Order Contract Task Order (CTO)-0002). The Base Realignment and Closure (BRAC) Program Management Office (PMO) West will manage the Work Elements under this CTO. This Plan covers implementation radiological data gap investigation at multiple locations in Parcel F of Hunters Point Shipyard (HPS), San Francisco, California (Figures 1).

This SHSP was developed in accordance with the United States Army Corps of Engineers (USACE) Safety Manual EM385-1-1 (September 2008); Code of Federal Regulations (CFR) Title 29, Part 1926, Safety and Health Regulations for Construction; California Code of Regulations (CCR), Title 8, Sections 1500-1938, Construction Safety Orders; 29 CFR 1910.120/8 CCR 5192, Hazardous Waste Operations (as general guidance); the Navy Environmental Health Center Health & Safety Plan Checklist; other applicable regulations; and good industrial hygiene and safety practice.

This SHSP is designed to be part of ITSI Gilbane's overall Corporate Health & Safety Program. The Corporate Program is incorporated into this SHSP by reference. This SHSP is project-specific and addresses safety and health-related hazards anticipated to be encountered during project activities. This SHSP incorporates ITSI Gilbane's Hazard Communication Program and Codes of Safe Practice by reference. If, in any instance, there is a conflict between this SHSP and any employer's corporate health and safety program, the more stringent requirement will apply to the work.

This SHSP covers all ITSI Gilbane employees, and serves as the minimum requirement for protective measures for all subcontractors on the site. A copy of this SHSP will be provided to all subcontractors on site. All subcontractors working on the site are responsible for the health and safety of their own employees, and are responsible for compliance with the provisions of the

applicable health and safety regulations. Each subcontractor will provide health and safety equipment for its employees. All on-site personnel, including visitors, are expected to be familiar with, and comply with the provisions of this SHSP.

This SHSP is intended as a practical approach to the activities in light of the potential occupational and public health hazards identified. The procedures and guidelines are based on the best information available at the time of the preparation of this Plan. Specific requirements may be revised during the course of the field work if new information is received or conditions change. Written amendments will document any changes made to this plan and will be included as addenda.

2.0 SITE DESCRIPTION AND SCOPE OF WORK

2.1 SITE BACKGROUND AND DESCRIPTION

The Historical Radiological Assessment (HRA) covers 64 years of radiological activities at HPNS from 1939 through June 2003. Historical radiological operations include:

- Repair, use, and disposal of radioluminescent commodity items (dials, gauges, and deck markers)
- Gamma radiography for testing of materials
- Calibration laboratory operations for ensuring radiation survey equipment accuracy
- Decontamination of and scientific research on ships contaminated during atomic weapons testing and use of various radionuclides for scientific research by the Naval Radiological Defense Laboratory (NRDL) and its predecessors.

The HRA has designated the underwater areas of OPERATION CROSSROADS decontamination activities and areas containing outfall discharge from the storm drain and sanitary system as likely having radiological contamination. Scoping surveys in these areas were recommended by the HRA. Additionally, the dry docks and berthing areas used for OPERATION CROSSROADS ships and those berthing areas used by the NRDL were recommended for Final Status Surveys (FSS) by the HRA.

General radioactive material (G-RAM) was used at HPNS since the mid-1940s and throughout its occupation by the Navy. The use G-RAM can be separated into broad categories of refurbishment and handling of radioluminescent devices, gamma radiography, calibration of radiation detection instruments, and decontamination of ships other than OPERATION CROSSROADS vessels. Some of the G-RAM was released into the environment,

Based on the historical G-RAM use at HPNS, the HRA lists five radionuclides of concerns (ROCS) for all underwater areas: Cs-137, Pu-239, Ra-226, SR-90, and U-235. The HRA lists four of those five as primary ROCS within Ship Berthing Areas: Cs-137, Pu-239, Ra-226 and Sr-90. The Navy has added Co-60 as an ROC in the South Basin Area based on Co-60 use on land at the Experimental Shielding Areas adjacent to the South Basin. Therefore, extensive

delineation studies and remediation have been conducted on land, but very little data have been collected in the Bay Environment of Parcel F.

Because of sufficient uncertainty about the nature and extent of the radionuclide levels within Parcel F, a two-phased approach was developed to both minimize data uncertainties and maximize the efficiency of the study. The first phase (Phase 1), a screening survey conducted in February 2009, was designed to determine the nature and extent of radionuclide concentrations on a broad scale within Parcel F. The main objective of this sampling effort was to collect sufficient analytical data to quantify the range and extent of ROCs — Co- 60, Cs-137, Pu-239, Ra- 226, Sr-90, and U-235 — in Parcel F sediments. For this Phase 1 study, Parcel F was delineated into five areas: 1) the Submarine Base Area; 2) the Northern Berths Area; 3) the Southern Berths Area; 4) South Basin; and 5) Drydock Suction Structures. In addition, one reference area (Oyster Point) was sampled. Data from the February 2009 Phase 1 Screening Survey indicated low levels of radionuclide activity (primarily Cs-137 and Ra-226) throughout the five areas and at all depths. These data have been used to develop the Phase 2 RAD DGI sampling. Phase 1 data did indicate elevated activity in sediments sampled from the six drydocks: within the discharge structures sampled in Drydocks 2, 3, and 4; adjacent to the Gun Mole Pier; along the northwestern shoreline of South Basin; and in India Basin near the Parcel B shoreline with known radiological impacts. Two areas that were among the initial AOCs that did not indicate elevated levels were the shoreline near the termination of the discharge structure from Drydock 3 through Building 140 and the southeastern shoreline of South Basin. Following the Phase 1 screening, the Phase 2 RAD DGI Workplan was finalized in August 2011 (Battelle, 2011).

The Phase 2 RAD DGI investigation has been previously initiated under a separate contract and is separated into two parts (2a and 2b). The Phase 2a investigation that took place in 2011 focused on the Submarine Area in Parcel F and the San Francisco Bay Reference Site locations (six total locations). The fieldwork was completed in October 2011 and the Tech Memo for Phase 2a discussing the findings is currently being prepared under the separate contract. This CTO continues the Phase 2 investigation as Part 2b, which will cover the remaining Parcel F areas that include the Berths North Area, Berths South Area, and the South Basin Area.

Confirmation sampling will also be conducted in areas of Phase 2a that exceeded project action levels.

Following fieldwork, a Phase 2b Tech Memo will be prepared under this CTO. The Parcel F RAD DGI Final Workplan and supporting Plans (Battelle, 2011) and this ITSI Gilbane SHSP will be used to conduct the Phase 2b investigation.

2.2 SITE ACTIVITIES

The project site activities included in this scope of work are expected to include the following:

- Mobilization and demobilization all equipment, materials, and personnel for the field effort.
- Collecting Sediment Cores with a Piston/Push Hammer Corer
- Collection and At-Sea Processing of Benthic Grab Samples
- Deploying and Retrieving Bivalve Mollusks for *In-situ* Bioaccumulation

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3.0 HEALTH AND SAFETY PERSONNEL AND RESPONSIBILITIES

Personnel on site will be responsible for continuous adherence to this SHSP during the performance of their assigned work. In no case may work be performed in a manner that conflicts with the requirements or intent of this SHSP. After due warnings, personnel violating safety procedures will be dismissed from the site and possibly terminated from this project. All personnel are expected to report unsafe acts or conditions or other safety problems immediately to their supervisors and the Site Safety and Health Officer (SSHO). If there is any dispute with regard to health and safety, assistance should be requested from the ITSI Gilbane Health and Safety Manager (HSM). The qualifications, responsibilities, and reporting structure for health and safety personnel are described in the following subsections. Figure 3 presents the lines of responsibility between ITSI Gilbane, the Navy, and ITSI Gilbane's subcontractors for this project.

3.1 ITSI GILBANE PROJECT MANAGER

The ITSI Gilbane Project Manager, Mr. Ken Leonard, will have overall responsibility for successful and safe completion of the project, and for management of ITSI Gilbane crews. The ITSI Gilbane Project Manager will be responsible for assuring that ITSI Gilbane project personnel are trained and qualified for their assigned tasks; setting expectations for the safe performance of their work; and assuring that all necessary safety equipment is provided to them. The Project Manager will also be responsible for assuring that all required recordkeeping is completed, including inspections, training documentation, and accident reporting and investigation.

3.2 ITSI GILBANE HEALTH AND SAFETY MANAGER

The ITSI Gilbane Certified Industrial Hygienist, and Health and Safety Manager (HSM), Mr. Jeremy Sawyer, Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP), has reviewed and approved this SHSP, will approve all changes to the SHSP during the course of project activities, and will provide support to the site SSHO as HSM for questions or problems relating to health and safety concerns at the site. HSM responsibilities also include reviewing and monitoring compliance with this SHSP and other industry standards; implementing corrective measures for health and safety deficiencies; and ensuring required training and

medical monitoring of personnel. If, in the course of this project, changing conditions require revisions/additions to this SHSP, the HSM will review the problems and, if necessary, issue new directions and/or changes to this SHSP. Specific duties of the HSM will include:

- Approving and providing necessary updates to this SHSP
- Providing technical assistance to site personnel on an as-needed basis
- Arranging for employee exposure air monitoring as required
- Arranging for additional hazard-specific training for employees working on the site, as required.

3.3 ITSI GILBANE FIELD TEAM LEADER

The ITSI Gilbane Field Team Leader for this project will be Mr. Tony Olmstead. He will have overall responsibility for implementation of the field activities. He will assure that all activities are conducted in strict accordance with the approved Work Plan and SHSP requirements, while protecting the health and safety of on-site workers. He will oversee the work of ITSI Gilbane's subcontractors, and will communicate with the Project Manager and client representatives

3.4 ITSI GILBANE SITE SAFETY AND HEALTH OFFICER

The ITSI Gilbane Site Safety and Health Officer for this project will be Mr. Mark Blaisdell. As SSHO, Mr. Blaisdell will be directly responsible for implementation of, and compliance of site personnel with, this SHSP, and will be on site or within ready communication at all times. The SSHO will also enforce the minimum requirements of this SHSP for all personnel on site, including subcontractors. The SSHO will function as the Response Coordinator in case of an emergency. The SSHO has the responsibility and authority to modify and stop work, and/or to remove personnel from work areas, if conditions warrant. Other SSHO responsibilities will include:

- Reviewing, understanding, and administering this SHSP in the field
- Conducting health and safety oversight of ITSI Gilbane and subcontractor personnel
- Monitoring daily weather and site conditions
- Performing and documenting daily worksite inspections, tracking corrective actions and maintaining a site chemical inventory
- Coordinating and conducting daily tailgate health and safety meetings

- Halting project activities, when necessary, for significant noncompliance with this SHSP
- Ensuring proper emergency notifications to client personnel
- Investigating exposure incidents and injuries
- Completing incident reports
- Establishing on-site and off-site communications

3.5 SUBCONTRACTOR SITE SUPERVISORS

All subcontractors to ITSI Gilbane will be directly responsible for implementing and complying with this SHSP as the minimum health and safety requirements on site. Each subcontractor performing on-site activities will designate a responsible person to act as the company's Field Team Leader and competent person for health and safety. Each subcontractor Field Team Leader will act as response coordinator for that company's employees in case of an emergency. The on-site project supervisors for each subcontractor are responsible for oversight of the site activities for their own personnel. They are directly responsible for implementation of, and personnel compliance with, this SHSP.

Subcontractor Site Supervisors will have the following responsibilities with respect to their employed personnel:

- Conducting and documenting daily heath and safety inspections of the subcontractor's work areas
- Ensuring that all site personnel receive the necessary training, medical monitoring, and respirator fit-testing, as required, prior to working on site
- Performing site-specific training as needed
- Performing personal exposure air monitoring as required
- Providing regular pre-task health and safety briefings
- Ensuring that employees follow proper hygiene procedures
- Reporting accidents and incidents
- Preparing safety-related documentation and work logs

3.6 SITE WORKERS

All site workers are expected to comply with the requirements of this SHSP, especially requirements for work practice controls and personal protective equipment (PPE). Employees

must report all unsafe conditions, accidents, incidents, near misses, and/or injuries that occur at the jobsite to their supervisors immediately.

4.0 JOB HAZARD ANALYSIS

This section summarizes the potential chemical, radiological, physical, and biological hazards that may be associated with the project activities. Personnel working most directly with the project activities will have the greatest chance of encountering these hazards; however, all personnel on site may encounter them at one time or another.

Additional specific precautions are provided in the Activity Hazard Analysis (AHA) for this project (Appendix A). The AHA will be reviewed with the field crew prior to the start of work at the initiation of each definable feature of work and at other times as needed during the execution of specific tasks. If additional tasks are identified or added at a later date, if work requirements change or if additional hazards are encountered, the AHA will be revised and the new information will be reviewed with the site personnel. Safe Work Procedures (SWP) and Safety Forms that will be used for this project are attached in Appendix B and C, respectively.

4.1 PHYSICAL HAZARDS

The primary physical hazards potentially associated with the site are expected to include:

- Equipment and vehicular traffic
- Overhead and underground utilities
- Electrical hazards
- Fire hazards
- Heat and cold stress/Inclement weather
- Noise
- Head, back, and eye injuries
- Slips, trips and falls
- Pressurized lines
- Drill rigs
- Working over water/Drowning

Personnel working most directly with the site activities will have the greatest chance of encountering these hazards; however, all on-site personnel will have the possibility of encountering them at one time or another.

4.1.1 Equipment and Traffic

Vehicles and equipment will be used at the site. Only qualified operators and drivers with demonstrated training and experience will be permitted to operate equipment. Operators must ensure that equipment movements are deliberate and predictable. Safe vehicle speeds for each area of the site and each operation will be established, taking into account slope, soil conditions and moisture, types and weights of vehicles, and ground obstructions. All drivers and operators will be required to maintain vehicle speeds which allow them to keep their equipment under control at all times, and are always required to obey the maximum site speed limit of 15 miles per hour. If operators demonstrate an inability to maintain this control, they will be removed from operation of that equipment or vehicle. Operators of ride-on equipment will wear seat belts at all times of operation. Parking brakes must be set and attachments and buckets lowered to the ground when units are parked. Equipment must be shut off when left unattended. All personnel operating such equipment will be made aware of the presence of other site personnel. Communication between workers on the ground and operators will be by line of sight, utilizing standard construction hand signals. Spotters will be utilized when equipment is backed in areas with limited visibility, or when it is moved in proximity to overhead hazards or utilities.

Surface obstructions, overhead hazards and utilities, road hazards, and vehicle routes will be clearly demarcated using cones, tapes, and/or signs. Heavy equipment will have the right of way on site. The Field Team Leader will inspect work areas on a daily basis to verify that roads and the work area are in acceptable condition.

On-site personnel will be made aware of the presence of construction equipment and the unique hazards of working around each piece of equipment. Ground personnel must stand clear of the swing radius and routes of equipment travel, and must never stand under suspended loads or under blades or buckets. Workers on the ground must make sure they are visible at all times to operators and drivers, and should maintain line of sight at all times. Ground personnel will be reminded of the need to approach equipment only after acknowledgement from the operator.

All personnel working around heavy equipment must wear high-visibility vests (minimum of American National Standards Institute [ANSI] Class 2) on the outside of all clothing. Hearing

protection must be worn by operators and by ground personnel working in proximity to equipment, as needed based on ambient noise levels.

Equipment must be equipped with rollover protection where appropriate, and with working backup alarms, and must carry at least one 10 pounds ABC-rated fire extinguisher. Heavy equipment must be marked with the maximum lifting or load capacity. All equipment must be inspected by a qualified person prior to use on site. In addition, daily inspections will be performed by operators. Recordkeeping forms for these inspections are included in Appendix C of the APP. All heavy equipment repairs will be performed by a qualified person in a protected area.

Fuel storage containers will be protected from damage, marked with NO SMOKING signs, have appropriately-rated fire extinguishers within 25 feet, and have spill control materials and eyewashes readily available. The ITSI Gilbane SWP for Heavy Equipment will be followed (Appendix B).

4.1.2 Overhead and Underground Utilities

All work locations will be evaluated for overhead utilities. Where energized overhead power lines may exist within the work area, warning signs reminding ground crews of the presence of overhead lines will be placed at ground level. A minimum separation distance of 10 feet will be maintained from all high-voltage lines of 50,000 volts or less during all construction activities. Additional separation distance based on line voltages will be required for lines with voltages in excess of 50,000 volts.

4.1.3 Electrical Hazards

All electrical equipment and sources at all voltages should be considered dangerous. Before work begins at any location involving power supply lines or electrical equipment, existing conditions shall be determined by an inspection or test by qualified personnel. Electrical equipment and power supply lines shall be considered energized until determined to be de-energized by tests or by other means.

All electrical equipment must be handled with care by trained personnel. All electrical power tools and extension cords must be protected by ground fault circuit interrupters (GFCIs). Personnel must be insulated or guarded from any energized source or conductive object. Tools should have non-conducting handles and hoses. All electrical equipment must be double insulated or grounded. Power cords must be Underwriters Laboratories (UL) listed. Extension cords must be grounded, and grounding plugs must not be removed or disabled. Any tools or cords with loose connections, damaged or frayed wiring, or damaged insulation/shielding must be taken out of service immediately and either repaired or discarded. Flexible power cords passing through areas that would leave them susceptible to damage shall be covered or elevated. ITSI Gilbane's SWP for Electrical Safety and Power Tools is included in Appendix B of the APP.

4.1.4 Fire and Hot Work

Appropriate measures will be taken to reduce fire risk through proper monitoring of site activities; proper storage, handling, and transfer of flammable liquids; good housekeeping; prohibition of smoking on site; hot work protection; and the maintenance within ready access on-site of the appropriate fire extinguishers.

Smoking will not be permitted on site or near fuel storage or equipment servicing areas. Smoking will be permitted only within designated locations.

Generators and gas cans SHALL NOT be filled or refueled in the bed of a pickup truck. The generator or gas container must be placed on the ground during filling or refueling. A suitable tray or other containment device will be placed beneath the generator or gas container to capture any fuel spilled during refueling. Persons performing fueling must ensure that the fill spout remains in contact with the fill port at all times during refueling, in order to prevent a fire hazard from static electricity. Refueling of generators shall not occur in areas where combustibles (including tall grass) are present. Each fueling area will have at least one fire extinguisher, with a minimum rating of 20-B:C, located within 25 feet.

No smoking or other ignition sources shall be allowed in the area during handling of fuel. Fuel containers must be Department of Transportation (DOT)-approved. Fuel containers will be

completely closed when not in use, and secured to a vehicle if kept in that vehicle during movement. Gasoline and diesel fuels will not be used as cleaning solvents or for any purpose other than to power vehicles and generators.

Whenever feasible, non-sparking or open flame methods will be utilized. When open-flame or spark-producing hot work is required (including torch cutting, welding, welding slag removal, or grinding), the appropriate hot work precautions will be implemented at all times. Prior to hot work, a Hot Work Permit will be completed. A Fire Watch equipped with a fire extinguisher with a minimum rating of 2-A:10-B:C will be posted prior to commencement of work; the Fire Watch will remain on duty for at least one-half hour after the work has completed. Cutting, welding, and grinding equipment will be inspected immediately prior to the work. If the potential for flammable gases or vapor exists in the area, air monitoring with a calibrated combustible gas indicator will be performed in the area, and hot work will not be permitted if flammable vapors are detected.

Fire extinguishers with a minimum rating of 2-A:10-B:C will be maintained within each active work area, so that the maximum travel distance to an extinguisher does not exceed 75 feet. In addition, ABC-rated fire extinguishers will be located in each site work vehicle and on each piece of heavy equipment. Each service or fueling area will have at least one fire extinguisher with a minimum rating of 20-B:C located within 25 feet.

In the event of **ANY** fire or explosion, all activities shall halt, personnel will evacuate the area, and the Fire Department shall be notified immediately. Trained personnel may utilize the appropriate extinguisher to attempt to extinguish an incipient-stage fire only. If a fire requires more than one fire extinguisher, all personnel will evacuate the area and wait for the Fire Department to respond.

4.1.5 Heat and Cold Stress/Inclement Weather

Weather conditions are expected to vary during the field work. Wind and moisture, as well as areas lacking in shade at the site, may combine with low or high temperatures to create unfavorable working conditions. Sudden changes in the weather, extreme weather conditions, and natural disasters can create a number of subsequent hazards such as poor working conditions

and slip, trip, and fall hazards. Natural disasters can create many secondary hazards, such as the release of hazardous materials to the environment, structural failures, and fires.

The SSHO will monitor the site conditions and make periodic ambient temperature measurements, and will implement the appropriate control measures to provide for the comfort and safety of project personnel. Preventive measures such as rest breaks in sheltered areas, availability of appropriate clothing based on weather conditions, and hydration will be implemented for the protection of the workers. At least one quart of potable water per hour per worker will be available on site at all times when heat stress conditions are present. Workers will be encouraged and be provided the opportunity to drink water at regular intervals outside of the Exclusion Zone. Electrolyte replacement drinks will be provided as necessary. Workers will have access to a shaded location during hot conditions to take refuge from the heat as necessary to prevent heat stress. Suitable acclimatization periods will be provided for workers to gradually establish their resistance to heat stress, especially during the use of protective clothing.

The SSHO will also monitor workers' conditions for heat stress and implement the appropriate controls, described below, as necessary. If any of the following conditions are present in a worker, they will be removed from heat exposure until their recovery is complete:

- Sustained (several minutes) heart rate in excess of 180 beats per minute (bpm) minus the individual's age in years for individuals with assessed normal cardiac performance
- Body core temperature greater than 101.3 degrees Fahrenheit (°F) for acclimatized personnel, or greater than 100.4°F in unacclimatized workers
- Recovery heart rate at one minute after a peak work effort greater than 110 beats per minute
- Symptoms of sudden and severe fatigue, nausea, dizziness, or lightheadedness

Workers will be trained in the symptoms of heat stress in themselves and their co-workers, the conditions during which it may occur, the precautions to take, and the need to report all observed heat stress symptoms immediately. Heat stress symptoms include:

- Heat Cramps - cramping of muscles usually due to excessive sweating and loss of body salts - most often associated with moderate or strenuous physical activity.
- Heat Rash - a rash produced when working and sweating in hot environments- greatly enhanced by excessive rubbing of clothing or items in direct contact with the skin.
- Heat Exhaustion - excessive sweating, cool clammy skin, fatigue, weakness, headache, un-coordination, nausea, and/or fainting may occur.
- Heat Stroke - a response to heat characterized by extreme high body temperature and failure of the sweating mechanism. Heat stroke symptoms include hot dry skin, weak rapid pulse, and mental confusion. Unconsciousness may occur. Heat Stroke is considered an immediate, life-threatening emergency for which medical care is urgently needed. Emergency medical personnel should be called immediately for assistance.

First aid for heat stress conditions consists of proper evaluation of their condition, removal to a cool area, cooling the victim down, and rehydration. Specific actions which should be taken include:

- First-aid trained persons should be summoned to assist in evaluation of the victim's condition
- If heat stroke is suspected, outside medical responders should be immediately contacted, as this condition should be considered immediately life-threatening.
- Impermeable clothing should be removed as soon as possible following the required decontamination steps, unless the delay could compromise the victim's health
- The victim should be moved to a shaded, cooler location, preferably air-conditioned
- The victim's clothing should be loosened to aid air circulation
- The victim should sit, or lie down if they are dizzy or at risk of losing consciousness
- The victim should be encouraged to drink cool water if they are not nauseous or losing consciousness
- The victim may be cooled down further by moistening the head, neck and torso and fanning them gently. To minimize the risk of shock, do not drench them with cold water unless advised to do so by medical personnel.

- Persons suffering from heat stress, especially heat stroke, should not be allowed to return to work until after evaluation by a medical professional.

Solar radiation exposures and sunburn will be minimized by wearing long-sleeved shirts, hats, ultraviolet (UV)-rated sunglasses, and gloves to cover exposed skin; using high sun protection factor (SPF) barrier cream for exposed skin areas; and encouraging employees to take cover out of direct sunlight when work activities permit.

Although cold stress is not expected because of the location of the field activities, the following information is provided in case of unusually cold temperatures occur at the site. Workers will be advised of the appropriate measures to prevent cold stress, including the appropriate layers of insulating and wind and moisture-resistant clothing, and recognition of symptoms of cold stress. If the SSHO observes or suspects conditions of hypothermia, appropriate first aid will be given, including taking them to a warm, dry area to relieve the symptoms.

4.1.6 Noise

Work around heavy equipment and drilling equipment always entails the possibility of exposure to excessive noise, and as such hearing protection will be utilized by personnel when working in the proximity to such equipment. Excessive noise can be readily identified by workers on site by difficulty in hearing verbal communication at approximately an arm's length away. Employees on site will be briefed on noise hazards and protection as part of the site-specific training, and this information will be included in the regular tailgate sessions and documented. Workers on site will be offered a choice of hearing protection such as earplugs and earmuffs. Proper use of hearing protection is expected to reduce exposure levels to well below the ACGIH TLV of 85 decibels, A-weighted (dBA). Workers will be trained in the hazards of working in proximity to vehicles and heavy equipment while wearing hearing protection. The ITSI Gilbane Hearing Conservation Program is included in the Corporate Health and Safety Program.

4.1.7 Head, Back, Hand and Eye Injuries

Prevention of head, neck, back, hand, and eye injuries is expected to be accomplished through the use of protective equipment and proper work and lifting procedures. Site personnel will be

required to wear an ANSI Z89.1-compliant hard hat at all times on site. Hard hats must be worn properly and not altered in any way that would lessen the degree of protection offered.

Eye protection (ANSI Z87.1 compliant), including safety glasses with side shields, will be required during all work on site, and especially when airborne objects that may be projected or blown into the eyes are present, or when exposure to hazardous materials may occur.

Wherever possible, material handling will be done mechanically. Where manual handling is absolutely necessary, personnel will be instructed in safe handling techniques, and will be instructed to use the appropriate protective gear to prevent abrasions, cuts, and struck-by accidents. Personnel will also be encouraged to request assistance from other site personnel when lifting large, heavy, or awkward objects (greater than 60 pounds). The following steps describe the proper method for lifting.

- Get a good footing.
- Place feet about shoulder width apart.
- Bend your knees to pick up the load. Never bend from the waist.
- Keep your back straight.
- Get a firm hold. Grasp opposite corners of the load, if possible.
- Keep your back as upright as possible.
- Lift gradually by straightening your legs, don't jerk the load.
- Keep the weight as close to your body as possible.
- When changing directions, turn your entire body, including your feet. Don't twist your body or make awkward moves which force you to be off balance.

4.1.8 Slips, Trips and Falls

Slips, trips and falls on the work site are typically caused by poor housekeeping, wet surfaces, lack of awareness of one's surroundings, or the use of unstable equipment (ladders, step-stools, etc.). Proper housekeeping techniques and proper training of workers will minimize this kind of accident. Debris, supplies, and other materials that may present a tripping or slipping hazard will be removed or barricaded to prevent potential injury. Drilling barge deck will be equipped with non-slip surfaces.

4.1.9 Pressurized Lines

Pressurized lines present significant physical risks. High-pressure hoses, such as compressed air lines, may whip around violently if the fittings become disconnected. All hose ends and connections must be secured to prevent accidental disconnects and to restrict whipping in the case of disconnect. All hoses and related equipment must be inspected on a daily basis for damage. Personnel working with high-pressure lines must take care not to point the stream at any body part, and must wear the appropriate eye, face, and skin protection. Prior to disconnection, all pressurized lines must be bled to relieve the pressure, and verified to be depressurized.

4.1.10 Drill Rig

Drilling equipment, including a 32' x 12' drilling barge equipped with DGPS positioning, echosounder, 6 horsepower electric vibracore system, and piston corer will be used on-site. All drilling equipment brought on-site will be operated, inspected, and maintained as specified in the manufacturer's operating manual, and according to United States Army Corps of Engineers' EM-385-1-1, 3 November 2008. Inspections will include use of the 150-R form or equivalent prior to use, and daily inspection by the driller. A copy of the manual will be available onsite during drilling operations. Prior to bringing earth-drilling equipment on the job site, a survey will be conducted to identify overhead electrical hazards and potential ground hazards, such as unexploded ordnance, hazardous agents in the soil, or underground utilities. The location of any overhead or ground hazards will be identified on a site layout plan.

All members of drilling crews will be trained in the operation, inspection, and maintenance of the equipment; the safety features and procedures to be used during operation, inspection, and maintenance of the equipment; and overhead electrical line and underground hazards. Earth drilling equipment will be equipped with two easily-accessible emergency shutdown devices, one for the operator and one for the helper. Drilling equipment will be posted with signs warning the operator of electrical hazards. The equipment operator will ascertain proper clearance before moving equipment. Clearance will be monitored by a spotter or by an electrical proximity-warning device.

Before drilling equipment is moved, the travel route will be surveyed for overhead and terrain hazards, particularly overhead electrical hazards. Drilling equipment will not be transported with the mast up.

During operation, weather conditions will be monitored: operations will cease during electrical storms, when electrical storms are imminent or when seas are too rough to safely work..

Means (e.g., guard around the auger; barricade around the perimeter of the auger; electronic brake activated by a presence-sensing device) will be provided to guard against site worker contact with the auger. Drill crew members will not wear loose clothing, jewelry, or equipment which might become caught in moving machinery. Drill rod tool joints will not be made up, tightened, or loosened while the rod column is supported by a rod slipping device. Augers will be cleaned only when the rotating mechanism is in neutral and the auger stopped; long-handled shovels will be used to move cuttings from the auger.

Site workers will not be allowed on a drill mast while the drill bit is in operation or the drilling equipment is being moved. Auger guides will be used on hard surfaces. The operator will verbally alert site workers and visually ensure all site workers are clear from dangerous parts of equipment before starting or engaging equipment. The discharge of drilling fluids will be channeled away from the work area to prevent the ponding of water.

The use of side-feed swivels collars on drill rods are restricted to those collars retained by either a manufacturer-design stabilizer or a stabilizer approved by a professional engineer. Hoists will be used only for their designed intent and will not be loaded beyond their rated capacity. Steps will be taken to prevent two-blocking of hoists. The equipment manufacturer's procedures will be followed and if rope becomes caught in, or objects pulled into, a cathead. Drill rods will be neither run nor be rotated through rod slipping devices: no more than 0.3 meters (1 foot) of drill rod column will be hoisted above the top of the drill mast. Open boreholes will be capped and flagged; open excavations will be barricaded.

4.1.11 Working over water/Drowning

USCG-approved personal flotation devices (PFDs) shall be provided and properly worn (zipped, tied, latched, etc., in closed fashion) by all persons in the following circumstances:

- On floating pontoons, rafts, or stages;
- On structures or equipment extending over or next to water except where guardrails, personal fall protection system, or safety nets are provided for employees;
- Working alone at night where there are drowning hazards, regardless of other safeguards provided;
- In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit; or
- Whenever there is a drowning hazard.

At least one life ring or ring buoy will be provided on all motor boats longer than 26 ft in length.

At least one safety skiff shall be immediately available at locations where employees work over or immediately next to water. Skiffs shall be kept afloat or ready for instant launching. Personnel trained in launching and operating the skiff shall be readily available during working hours.

- Skiffs shall be equipped as follows:
- Four (4) oars (two (2) if the skiff is motor powered);
- Oarlocks attached to gunwales or the oars;
- One (1) ball-pointed boat hook;
- One (1) ring buoy with 70 ft (21.3 m) of 3/8 in (0.9 cm) solid braid polypropylene, or equivalent, line attached;
- PFDs in number equaling the skiff rating for the maximum number of personnel allowed on board, and;
- Fire Extinguisher.

4.2 CHEMICAL HAZARDS

This section outlines the potential chemical hazards associated with the project. During the project activities, employees may be exposed to the chemical products brought on site for the work.

4.2.1 Chemical Products

The chemical products to be used on site include reagents, solvents, fuels and lubricants for equipment, spray paints, and calibration gases. Personnel exposure to these materials may occur through inhalation of vapors or airborne particulates, direct contact with materials and

subsequent absorption, ingestion due to poor work practices, and/or poor personal hygiene practices.

Isobutylene gas is used for calibration of direct-read instruments, and will be brought on site in extremely small quantities (e.g., a 1-pound compressed air cylinder). Exposure may occur through inhalation; however, exposures are expected to occur only at low concentrations and only during calibration activities. Isobutylene is a simple asphyxiate and is non-toxic; as such, there is no Permissible Exposure Limit (PEL). No specific air monitoring is anticipated for this gas, as the exposure to project staff is expected to be insignificant.

Reagents Formalin and Borax® will be brought onsite and used as sample preservatives during collection and at-sea processing of Benthic Grab Samples. Formalin at a concentration of 37-40% formaldehyde (this is the maximum concentration of formaldehyde in water and is commonly referred to as Full Strength Formalin' even though it is not 100%) or formalin diluted to a lower (safer) concentration. All containers holding formalin need to be stout, able to seal very effectively and well labeled. Note that most macro-benthic organisms are preserved in 10% formalin which is the same as, and can be described as, 3.7% formaldehyde. Be very careful not to confuse the units and designations of formalin and formaldehyde. Borax® is used to buffer the formalin.

Solvents will be used for cleaning equipment between sampling locations. Solvents typically consist of one or more of the following:

- Acetone
- DCM (Dichloromethane)
- Alcohol (e.g. methanol, ethanol)
- Hexane
- Alconox

A Material Safety Data Sheet (MSDS) will be obtained for each chemical product brought on site. Each employer shall assure that all site personnel handling such materials or working close

enough to be exposed to the materials are familiar with the contents of the MSDS and any specific precautions needed to work safely with the materials.

Fuels handled on site may consist of diesel and gasoline. In addition, spray paint propellants and mastic removers typically consist of solvents. The fire hazards associated with these materials will be addressed as discussed in the Physical Hazards section. Personnel will utilize the appropriate storage and handling precautions and protective equipment, including handling these materials only in well-ventilated areas, preventing spillage, and storing in ventilated areas away from incompatible materials.

4.3 BIOLOGICAL HAZARDS

Potential biological hazards associated with project activities may include ticks, biting or stinging insects, spiders, snakes, poison oak, and blood borne pathogens.

4.3.1 Ticks

Ticks attach to their host's skin and feed on its blood, creating an opportunity for the transmission of disease. The first symptoms of tick-related disease are flu-like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If treated promptly by a physician, most individuals recover fully in a short period of time. If not treated, more serious symptoms can occur. Recently, Lyme disease has been the most prevalent type of disease transmitted by ticks in the United States. If an employee believes a tick has bitten him/her, or if any of the signs and symptoms appears, the Field Team Leader or SSHO will direct the employee to visit a physician for examination and possible treatment.

When working in areas that might be infested with ticks, personnel should limit the amount of unprotected skin. Light-colored clothing is preferred for higher visibility of ticks. If heavy concentrations of ticks or other insects are anticipated or encountered, Tyvek coveralls will be used for added protection. Personnel should examine their own and their co-workers' clothing frequently for the presence of ticks and should avoid contact with bushes, tall grass, or brush as much as possible when walking in wooded areas.

If a tick is discovered, it should be detached with a fine-tipped tweezers, not with the fingers. The tick should not be twisted as it is detached, and its bloated body should not be squeezed. All parts of the tick should be removed, and the bite area should be washed thoroughly with soap and water and disinfected with alcohol or a similar antiseptic after the removal. The tick should be saved in a small container labeled with the date, the body location of the bite, and the likely source of the tick.

4.3.2 Stinging Insects

Stinging insects present a serious threat to personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. Nests and hives for bees, wasps, hornets, and yellow jackets often occur in the ground, in trees and brush and under the eaves of buildings. Work areas will be checked for obvious nests and hives before work is started.

Insect stings are responsible for more deaths in the United States than the bites and stings of all venomous creatures. This is due to hypersensitivity and/or sensitization to toxins from repeated stings, which can result in anaphylactic reactions. Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and/or respiratory passages. Individuals who are hypersensitive to such stings and have life-threatening allergies should carry a kit containing antihistamine and epinephrine, and will not work in areas where there is a significant potential for insect stings.

Bites and stings can be painful and may elicit an allergic reaction. To reduce the pain, ice should be placed over the sting and an analgesic corticosteroid lotion applied. If the stinger is embedded in the skin, it should be removed by teasing or scraping rather than pulling. If simple first-aid measures do not alleviate the symptoms, the victim should be taken to the nearest medical center. The offending insect should be killed and taken to the emergency room with the victim if this can be done quickly and without endangering other personnel.

4.3.3 Biting Insects

The biting insects of greatest concern are spiders, especially the black widow and the brown recluse. These spiders are of special concern due to the significant adverse health effects that can be caused by their bites.

The black widow is a coal-black, bulbous spider. The female, whose bite is toxic, has a body length of approximately 1/2 inch and an overall length of about 1-1/2 inches, with a bright red hourglass marking on the underside of the abdomen. The black widow is usually found in dark, moist locations, especially under rocks and rotting logs, and may be found in outdoor toilets.

The brown recluse is brownish to tan in color, rather flat, 1/2 to 5/8 inches long, with a dark brown "violin" shape on the underside. It is most often found in trees or in dark locations.

There is no effective first aid treatment for either of these bites. Except for very young, very old, or weak victims, these spider bites are not considered to be life-threatening; however, medical treatment must be sought to reduce the extent of tissue damage caused by the injected toxins.

4.3.4 Snakes and Rodents

Snakes may be present in the work area. Workers will be advised to avoid reaching into areas where they cannot see and under items resting on the ground, and to avoid walking through brushy areas. If a snake suspected of being poisonous is observed, the SSHO should be advised, and a warning given to site personnel to avoid walking in the area. If a person is bitten, an identification of the snake should be made if possible, and the person transported immediately to the medical center.

Workers should also be aware that if there is evidence of the presence of rodents, the hazards associated with exposure to Hantavirus may be present. Site personnel must be warned to avoid direct contact with dead rodents or dried fecal material, and to avoid exposure to airborne dust where dried rodent fecal matter may be present.

4.3.5 Poison Oak or Ivy

Poisonous plants (primarily poison oak) may be present in the work areas. These plants contain a resin that causes a delayed allergic hypersensitivity reaction following contact. The resin is active in live, dead, dry, and burned plant parts, and may be carried through the air. Signs and symptoms are usually evident within 24 to 48 hours after exposure. These include burning, stinging, and blisters. Site personnel should notify the SSHO if these plants are observed. If exposure or contact occurs, the affected area should be washed, and care should be taken so that the resin does not spread to uncontacted areas.

4.3.6 Blood-Borne Pathogens

Blood-borne pathogens are microorganisms present in human blood that can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus and human immunodeficiency virus. All ITSI Gilbane employees will be responsible for identifying potential exposures, and reporting them to their supervisors or health and safety staff. It is anticipated that the only potential exposure to blood-borne pathogens would occur during first aid given to injured persons on site.

If a potential for exposure to blood-borne pathogens is encountered, first aid responders will don the appropriate PPE from the site first aid kit, which may include latex or nitrile gloves, safety glasses, and CPR shields. Minimum safe work procedures to minimize the risk of employee exposure, including the appropriate hygiene practices, are presented in ITSI Gilbane's Corporate Health and Safety Program.

4.4 RADIOLOGICAL HAZARDS

Activities will be performed at radiologically-impacted sites as designated by the HRA Volume II (NAVSEA, 2004). All work activities will therefore be conducted in accordance with the Base Wide Radiological Work Plan, Rev.1.

4.4.1 Radionuclides of Concern

Based on the historical G-RAM use at HPNS, the HRA lists five radionuclides of concern (ROCs) for all underwater areas: Cs-137, Pu-239, Ra-226, Sr-90, and U-235. The HRA lists four of those five as primary ROCs within ship berthing areas: Cs-137, Pu-239, Ra-226, and Sr-90.

The Navy has added Co-60 as an ROC in the South Basin area based on CO-60 use on land at the Experimental Shielding Area adjacent to the South Basin.

These radionuclides are not expected to pose a significant health risk during the project activities, and exposure may easily be controlled through basic hygiene and dust control procedures.

Routes of exposure include inhalation of the radionuclides as particulate as well as ingestion of particulate due to poor personal hygiene. Exposure will be controlled through Radiation Safety Awareness Training, administrative controls, PPE and personal dosimetry, as required.

5.0 AIR MONITORING

Based on the current scope of work no air monitoring is required. The provisions of this Plan may be modified based on changes in field conditions. Such modifications shall be made in writing as addenda to this SHSP.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Specific designations for PPE are identified in the appropriate Activity Hazard Analysis for each task. General guidance for PPE is identified in this section. All PPE must meet ANSI standards, where applicable. The minimum level of protection for personnel working on site is Level D PPE, which includes:

- Work clothes
- Protective-toe boots
- Safety glasses with side shields
- Hard hat
- High-visibility (ANSI Class 2) vest/garment.

A USCG approved PFD is required for work over or near water

During activities where skin contact is a potential exposure mechanism - such as during activities that may involve direct contact with contaminated materials - Tyvek coveralls; nitrile, poly vinyl alcohol, or Viton gloves will be utilized. Tyvek coveralls will prevent contaminated dirt from getting onto employee's work clothing, being transferred in their vehicles, and taken home. These coveralls do not protect against wet materials. If contact with wet materials is a possible, polyethylene-coated Tyvek coveralls and chemical-resistant boots and gloves will be required. Chemical goggles or safety glasses in conjugation with a face shield will be worn during all activities with a splash potential.

Respiratory protection is not anticipated to be used during this project. Exposures to the site ROC's will be minimized or eliminated through personal hygiene, engineering and administrative controls.

All personnel using respiratory protection, including voluntarily, must meet all requirements of the respective employer's Respiratory Protection Program, including medical clearance to wear a respirator, fit testing, and training on the proper selection, use, and limitations of respirators.

Voluntary use of respiratory protection is allowed, but may only involve equipment provided by the employer. Voluntary use of filtering face-pieces (dust masks) will also be allowed for nuisance dust only. Employees voluntarily using filtering face-pieces must receive a copy of Appendix D of 1910.134 (Mandatory) Information for Employees Using Respirators When not Required Under Standard.

Hearing protection, when required, will consist of the worker's choice of earplugs or earmuffs. Workers will be instructed to utilize hearing protection whenever normal conversation at approximately three feet or arm's length becomes difficult due to work area noise levels.

7.0 WORK ZONES AND SITE SECURITY

This section presents work zone designations and site security procedures. The site is located within the boundaries of the Base, and all applicable Base security provisions will be followed by workers. Additional restrictions within the overall site will consist of establishment of Exclusion Zones (EZs) at each area where contaminated materials are handled, Decontamination Zones for equipment and personnel cleanup, and Support Zones.

7.1 EXCLUSION ZONES

The active work areas around each location will be considered EZs. The EZs will be established to accommodate all equipment, personnel, and vehicular movement where the potential for exposure to hazardous materials exists. For operations at-sea, the area where sample handling and preparation, including but not limited to drilling operations, sample preparation tables, etc. should be designated as the EZ.

The EZs will be modified, as necessary, as the work progresses at a specific location. The EZ will be demarcated by barricades, warning tape, temporary construction fence, and/or other appropriate measures, as well as signs posted in English and, if appropriate, in any other language necessary for all workers and visitors to clearly understand. Access to these areas will be limited to authorized personnel with the appropriate protective equipment, who have met the training and medical requirements, as specified in the appropriate sections of this SHSP, appropriate for their work effort. Personnel working in these areas will utilize the buddy system.

Site activities in the EZ will stop if unauthorized personnel enter the area and work will not resume until those individuals have exited the area. Eating, drinking, and smoking will be prohibited in these zones in order to prevent inadvertent ingestion of contaminated materials.

7.2 DECONTAMINATION ZONES

Decontamination zones will be located immediately adjacent to each EZ. All site personnel working in the EZs must pass through the Decontamination Zone before proceeding to the Support Zone. Personal protective equipment cleaning and storage areas will be included in the Decontamination Zone. Equipment and vehicle decontamination areas will be located

immediately adjacent to the work areas, in a manner that prevents tracking of contamination from the source location to other areas. Temporary equipment decontamination wash pads will be constructed as necessary; all wash water will be collected for appropriate testing and subsequent disposal.

7.3 SUPPORT ZONE

A Support Zone will be established outside each Decontamination Zone. An eyewash station, first aid kit, fire extinguisher, potable water, emergency communications equipment, and sanitary facilities will be maintained in each support zone. Portable or fixed toilet facilities will be provided and maintained in sanitary condition. Sufficient toilets will be available to provide one unit for every 20 workers of each gender. Hand washing facilities will be provided adjacent to the toilets. Adequate supplies of paper towels, toilet paper, and hand soap will be maintained at all times.

8.0 EXPOSURE CONTROL METHODS

8.1 GENERAL APPROACH AND SCHEDULE OF IMPLEMENTATION

Employee exposures to the ROC's will be minimized through engineering and administrative controls, and through the use of PPE. Engineering and administrative controls will be used wherever possible, even if PPE will also be utilized. Exposure control methods will be implemented before any work with contaminated materials is performed on site, and protective measures will be utilized at all times during soil disturbance or other activities on the work site with the potential to create exposure. These controls include careful handling of samples and other materials; establishment of work zones; establishment of appropriate housekeeping and decontamination procedures; assignment of the appropriate personal protective equipment; and provision of hygiene facilities for personnel hand and face washing. In addition, all personnel must show proof of the appropriate level of training before working on the site.

8.2 WORK ZONES

Work zones will be established during all work involving hazardous materials handling, in accordance with the provisions of Section 7. Access to the work areas will be limited to authorized personnel with the appropriate protective equipment and training. All personnel working in an Exclusion Zone or Regulated Area must perform the required decontamination procedures upon exiting the work zone.

8.3 ENGINEERING AND WORK PRACTICE CONTROLS

Engineering controls for any sample handling activities shall consist of those methods that require the least amount of sample handling. All work will be performed with the goal of eliminating direct contact with contaminated sediment. All work activities will be evaluated prior to implementation for their potential to produce dust, and the appropriate proactive measures will be implemented.

Waste materials will be handled in such a manner to minimize their spread. Contaminated materials will be stored in approved containers pending disposal.

Dermal exposure will be controlled by limiting contact, the use of protective clothing as appropriate and personal hygiene. Ingestion hazards will be controlled by strict prohibition of eating, drinking, and smoking in the EZs and decontamination zones, and by rigorous application of decontamination and personal hygiene protocols.

8.4 HOUSEKEEPING

Active work areas and equipment must be cleaned daily to prevent the accumulation of contaminated dust and debris, and waste materials must be contained on an ongoing basis. Dry sweeping and blowing with compressed air will not be used to clean up or remove contaminated debris or dirt. Removal of materials from equipment or protective clothing by blowing, shaking, or any other means, which may disperse materials into the air, is prohibited. All eating areas shall be kept clean and sanitary.

8.5 DECONTAMINATION

8.5.1 Personal Decontamination

Disposable PPE will be placed in trash bags and disposed of in on-site trash receptacles for subsequent off-site disposal. As needed, wash tubs with soap and water and rinse tubs will be provided for decontamination of boots and outer gloves that will be re-used. Respirators, if required, will be cleaned with respirator wipes unless gross contamination requires heavier cleaning in separate wash and rinse tubs. Soap and running water will be available for personnel to wash up after work, prior to eating, drinking or smoking or if any skin contact occurs during the workday.

8.5.2 Equipment Decontamination

The primary method to be used to prevent equipment contamination is to prevent or minimize travel through contaminated materials. Any equipment that comes in contact with contaminated materials will be properly cleaned before being removed from the site. Equipment decontamination will be in proportion to the degree of contamination encountered.

Equipment decontamination is expected to require only gross removal of soils from buckets or wheels. Shoveling, wet- or damp-brushing or wiping will be the primary decontamination methods used for equipment. Wastes removed from equipment will be returned to the appropriate waste stockpile or placed with the load of waste for transport.

If necessary, when heavier contamination is present, equipment and vehicles will be washed with a pressure washer. Any pressure washing will be performed over a lined area. Decontamination will proceed until all soil and residues are removed. Waste liquids will be contained and disposed of properly.

Small equipment will be washed in the same manner as contaminated personal protective equipment (i.e., with a brush and soapy water and rinse water).

Employees exiting the work area will wash any boots and/or gloves to be reused in the buckets provided for washing and rinsing, and will remove contaminated clothing items carefully and place them in the appropriate containers.

8.5.3 Decontamination Waste Handling

Decontamination wastes are expected to include disposable PPE and wash/rinse fluids. Bags of contaminated PPE will be included in the loads of contaminated waste for transport to the disposal facility.

Decontamination fluids are expected to be containerized on site in DOT-approved containers prior to disposal. If approval for discharge to the sanitary sewer is not received due to contaminants exceeding regulatory limits, liquid wastes will be disposed of at a licensed waste disposal facility based upon analytical results from representative samples, under the appropriate documentation (e.g., bill of lading or manifest).

8.6 HYGIENE FACILITIES AND SANITATION

Portable toilet and hygiene facilities for the work crews will be located in clean areas near the work area. The number of toilets and the servicing interval will be appropriate for the size of the work crew. These facilities must be serviced frequently enough to ensure cleanliness with no visible accumulation of debris. There will be a minimum of one toilet for every 20 workers of each sex, or fraction thereof, at the site. Separate toilet rooms for each sex need not be provided if toilet rooms can only be occupied by one person at a time, can be locked from the inside, and contain at least one toilet. Toilet facilities will be lockable. The supervisor or foreman will

assure that adequate breaks are given for personnel to use the toilet facilities. Hand washing facilities will be available on all vessels at-sea where contact with contaminated materials is possible. A portable-hand washing facility with adequate supply of soap, running water, and towels will also be provided. The SSHO and Site Supervisors will ensure that employees wash their hands and faces thoroughly before breaks, before lunch, and at the end of the work day. Potable water in closed containers will be available on site.

8.7 INSPECTIONS

The SSHO/Site Supervisor(s) will make daily inspections of the work site and employee work practices to ensure compliance with this SHSP, note changed conditions, and identify new hazards. These inspections will be recorded in the daily log, and all necessary corrective actions will be implemented in a timely manner. A Deficiency Tracking Log per EM385 requirements will be maintained and posted on the job board. Additionally, periodic in-depth inspections will be performed. These inspections should include, but are not limited to: housekeeping, implementation of tailgate meetings, employee training, employee exposure monitoring, project recordkeeping, accident investigation and recordkeeping, equipment maintenance and inspection, compliance with standard work procedures, response to employee safety concerns, and specific hazard communications.

8.8 HAZARD COMMUNICATION PROGRAM AND LABELING

ITSI Gilbane Hazard Communications Program is attached in Appendix B – Safe Work Procedures.

9.0 GENERAL SITE SAFETY PROVISIONS

All on-site personnel are expected to conduct themselves in a professional manner on site. Appropriate conduct includes following established work rules, and supporting the safety of others. Violation of established work rules will result in disciplinary action, which may include verbal warning, written reprimand, and removal from the site and/or termination of employment.

9.1 GENERAL SITE HEALTH AND SAFETY WORK RULES

- All employees must complete the required training programs and submit copies of required certifications prior to starting work at the site.
- No consumption or possession of alcoholic beverages or illegal drugs will be allowed on-site. Anyone reporting to work under the influence of alcohol and/or illegal drugs will be subject to disciplinary action. Any employee under a physician's care and taking prescribed narcotics must notify the Site Supervisor. Any employee taking over the counter (OTC) medications that can impair judgement (ie: pseudoephedrine, etc.) must notify the Site Supervisor.
- Personal Protective Equipment is required in designated areas. Such equipment may include, but is not necessarily limited to: hard hat, safety glasses with side shields, protective-toe boots, high-visibility garments, gloves, earplugs/earmuffs, protective face shield or splash goggles, and respiratory protection.
- Smoking is allowed only in designated areas. Eating, drinking, smoking, and the chewing of gum or tobacco are not allowed in the Exclusion Zones or Regulated Areas.
- Changes in work practices or work rules will be implemented only after approval by the SSHO and/or the HSM.
- Construction equipment always has the right-of-way over regular vehicles.
- Employees must listen for warning signals on construction equipment and must yield to construction equipment at all times. When working around heavy equipment, employees shall routinely establish eye contact with the equipment operator so that they are certain that the operator has seen them and knows where they are.
- All equipment operators shall pay deliberate attention to workers on the ground who may be in their path, and provide these people with warning before moving the equipment.
- The wearing of seat belts in personal vehicles, trucks, and equipment is mandatory.
- All workers must follow emergency procedures and instructions from supervisors and health and safety personnel explicitly.

- For any potentially hazardous compounds brought to the site, an MSDS will be provided and will be kept in an on-site binder.
- All workers will demonstrate proper etiquette as the Site lies on a former military base. Workers will enter and depart the Site using routes designated by the Site Supervisor.

9.2 CONDITIONS OF ACCESS TO EXCLUSION ZONES

- All personnel must meet the medical monitoring requirements described in this SHSP. Failure to submit to, or pass, any examination will be grounds for excluding the employee from the site.
- As required for site-specific work, employees must participate in an air quality exposure-monitoring program by wearing personal monitors or sampling devices designated by the SSHO. Any employee refusing to participate in the program, or tampering with a monitoring device or sample, will be subject to disciplinary action.
- No beards, goatees, or long sideburns will be allowed by personnel who will be using respiratory protection since they interfere with the seal of the respirator to the face. Trimmed sideburns and mustaches are acceptable. All employees who may be using respirators must report to work clean-shaven in any area of the face that comes in contact with the face-piece seal.
- All on-site personnel must wear the prescribed health and safety equipment, and go through specified decontamination procedures upon exiting the Exclusion Zone.
- Protective clothing to be worn inside the work areas will be supplied. None of this clothing will be permitted to leave the site with any employee for personal use. Any equipment to be used elsewhere for another project will be fully decontaminated before it is removed from the site.
- Kneeling or sitting directly on the ground in the EZ is prohibited.
- All employees will utilize a buddy system while working on the site.

10. EMPLOYEE TRAINING REQUIREMENTS

10.1 NEW EMPLOYEE HEALTH AND SAFETY ORIENTATION

All new ITSI Gilbane hires are required to attend the ITSI Gilbane Health and Safety Orientation Training which is conducted by the ITSI Gilbane Health and Safety Training Coordinator. This training includes:

Review of the Corporate H&S Program and the Injury and Illness Prevention Program (IIPP)

- General H&S Safety Rules and Regulations
- Information on the ITSI Gilbane safety training recording keeping Portal
- Hazard Communication
- Motor Vehicle Safety
- Ergonomics
- Emergency Response and Evacuation Routes and Plans
- Workplace Violence Procedures

10.2 CONTINUING SAFETY AND HEALTH EDUCATION

The ITSI Gilbane Corporate Director of Health & Safety is responsible for establishing training requirements for all ITSI Gilbane employees including PMs, SSHOs, and Site Superintendents. The Director creates training profiles based on regulatory requirements, project specific hazards and requirements, and ITSI Gilbane Corporate Health & Safety Program and Policies. ITSI Gilbane employees are required to complete the required training including scheduled refresher courses within an allotted timeframe. Course completion is tracked by the H&S Department and the employee's supervisor.

10.3 EMERGENCY RESPONSE TRAINING

At least two employees on site must be current in first aid and cardiopulmonary resuscitation (CPR). Spill control procedures, fire prevention and extinguisher training, site evacuation procedures, emergency contact information, and hospital routes will be reviewed with all field personnel prior to the start of field activities. The SSHO will conduct this training in the field.

10.4 PERSONAL PROTECTIVE EQUIPMENT TRAINING

The PPE selected for the project will be determined following a complete hazard assessment of the tasks to be performed. The specific PPE to be used on this project can be found in this SSHP and/or the AHA (Appendix B). Training specific to the PPE selected will be completed prior to its use in the workplace. Training will include the following:

- Review of OSHA requirements
- Rationale why the PPE was selected
- Nature of the hazards and the consequences of not using the PPE
- Limitations and human factors influencing PPE performance
- The proper selection, fitting, use, donning/doffing and inspection procedures
- Decontamination, cleaning , storage and care of the PPE
- Reporting procedures in the event of problems with the PPE, i.e. degradation, odors, interference of vision, communication, etc.

All selected PPE will be used in accordance with the manufacturer's recommendations and best management practices. Once on site, visual inspection of the work activities by the SSHO may indicate the need for changes in PPE. Any significant changes in the required PPE will be approved by the ITSI Gilbane SSHO in consultation with the HSM.

All personnel using respiratory protection will comply with ITSI Gilbane Respiratory Protection Program which includes: medical clearance by a physician for use of a respirator; training in respirator use, limitations and care as well as fit-testing to ensure acceptable protection factors. Documentation of physician clearance and results of fit testing will be maintained on site for all employees who are required to use respiratory protection.

10.5 VISITORS AND VENDORS

All visitors and vendors on site must receive a briefing by the Site Supervisor/SSHO regarding the basic safety rules on site, such as speed limit, work zones, and emergency procedures. This briefing will be documented on the Visitor Sign-In Log, included in Appendix C of the APP.

10.6 EXCLUSION ZONES

All on-site personnel who may enter an EZ will be required to have the appropriate prior experience and training, in compliance with 29 CFR 1910.120 and 8 CCR 5192. Such training includes the 40-hour basic training, 3 days of supervised field experience, 8-hour update training, and site-specific training such as radiological hazard awareness.

10.7 SITE-SPECIFIC TRAINING

All personnel performing work on site will receive site-specific training, conducted by the Field Team Leader or SSHO and documented on the HSP Acknowledgement form, prior to the initiation of the on-site activities to which the training applies. This training will include:

- Review of this SHSP
- Key personnel and lines of authority
- Project activities and potential hazards
- Boating safety
- Working on or near water safety
- Physical and biological hazards on site
- Chemical hazards on site
- Baseline Radiation Awareness Training
- Hazard Communication training for handling chemical products, as necessary
- Work zones
- Training and medical monitoring requirements
- Site safety rules and conditions of access
- Required personal protective equipment
- Emergency response procedures and route to the hospital
- Heat and cold stress
- Fire extinguisher training
- Hazard and accident reporting requirements
- Excavation Training for exposed personnel
- Rights to access medical and exposure monitoring records.

A copy of this SHSP, including all attachments, will be maintained on site, and will be available to site employees. Documentation of this availability will be included with documentation of the training.

10.8 HAZARD COMMUNICATION TRAINING

All personnel on site who may be exposed to chemical hazards related to chemical products brought on site will receive Hazard Communication training in accordance with ITSI Gilbane Hazard Communication SWP (Appendix B). This training will include a review of the chemical

products and Material Safety Data Sheets, routes of exposure, potential physical and toxicological hazards, appropriate handling procedures, safe storage, labeling, and personal protective equipment.

10.9 FIELD TEAM LEADER AND SSHO

The SSHO must have completed the 30-hour OSHA Construction Safety training and SSHO and Field Team Leader must have completed 8 Hr Hazwoper Supervisor Training in addition to the 40Hr course with appropriate refresher training.

10.10 FIRST AID AND CARDIOPULMONARY RESUSCITATION

At least two persons with current training and certification in first aid and cardiopulmonary resuscitation (CPR) must be present on site during field work. The various employers on site may pool personnel to meet this requirement. The ITSI Gilbane SSHO will coordinate any pooling efforts.

10.11 TAILGATE SAFETY MEETINGS

On-site tailgate meetings will be held before each workday to reinforce pertinent topics from the site-specific training, coordinate work activities, address task-specific hazards (AHA) and protection levels, and anticipate problems that may arise during the day. Topics will include site-specific hazards, accident investigation results, air-monitoring and employee exposure monitoring results, and any specific employee concerns that may arise during the project.

The Site Supervisor/SSHO, or subcontractor's supervisor, will conduct these meetings for their respective crews. These meetings may be combined into a single meeting in order to aid coordination between the contractors. The SSHO will review and document the items discussed at the tailgate meeting. Attendance and the items discussed at the meeting will be documented (using the appropriate safety form as provided in Appendix C of the APP) as part of the daily documentation for the site. The Supervisors for the various employers will coordinate work activities on a daily basis.

11.0 MEDICAL MONITORING

All personnel working on site will participate in a medical monitoring program appropriate to their work. Any site personnel and visitors who have not received medical clearance will be excluded from the active work areas. Employees not directly involved with materials handling or disposal, and not likely to be exposed to site contaminants, are not subject to the medical monitoring requirements.

All on-site personnel working in an EZ will participate in a medical monitoring program in compliance with 29 CFR 1910.120/8 CCR 5192. The monitoring program will consist of either a corporate annual physical examination or a pre-employment physical (if the employee was hired specifically for this job) provided by a board-certified occupational medicine physician, which includes:

- Medical and occupational history
- Physical exam
- Pulmonary function test
- EKG
- Audiogram
- Blood chemistry
- CBC with differential and platelets
- Urinalysis with dipstick and microscopic morphology
- Chest x-rays.

For those employees who work infrequently in the EZ, i.e., site visitors and those needing only occasional access, the medical exam will be that which the examining physician determines is sufficient given the potential level of exposure.

All personnel wearing respiratory protection must have medical clearance to wear respirators, in accordance with 29 CFR 1910.134. The medical exam will be that which the examining physician determines is sufficient to provide clearance to use respiratory protection.

Post-project physical examinations will be conducted in light of actual site conditions and exposures. Additional monitoring may be required based upon initial results of examination, employee symptoms, or physician request. Employee medical records will be maintained to preserve their confidentiality. As required by 8 CCR 3204, Access to Medical and Exposure Records, employees shall have the right to access their personal records. Medical and exposure records will be managed in accordance with the provisions of Section 13.0, Documentation.

12.0 EMERGENCY PROCEDURES

Potential on-site emergencies are expected to be restricted to drowning, fires, injuries to site personnel, or minor spills. Site conditions are generally expected to be within the limits of response measures which can be taken by on-site personnel. Any emergency that is life-threatening, or which poses a potential threat to the public, will be considered a situation requiring outside assistance from emergency response agencies. The Fire Department, listed in Table 1 of the APP, will provide first response support for fire, medical, and rescue emergencies. During any on-site emergency, work activities in the affected area will cease until the emergency is brought under control. Site workers will report incidents to the Site Supervisor, who will report them in turn to the client and the appropriate agencies. Figure 2 presents the Hospital Route. Table 1 of the APP presents the Emergency Contact information.

12.1 EMERGENCY RESPONSE ASSIGNMENTS

The Field Team Leader and/or SSHO will function as Response Coordinator for emergency operations at the site. He or she will function as the initial site contact for response teams arriving at the site. The Response Coordinator will assign additional roles during the emergency, as needed.

12.2 EMERGENCY REPORTING AND COMMUNICATIONS

Site personnel must report all incidents including near misses to their supervisors immediately. The supervisor will assure the appropriate notifications are made. If the Supervisor or SSHO is not immediately available in emergency situations, site personnel may contact outside responders directly.

Table 1 of the APP contains the project emergency contact information, and Figure 2 contains the route to the hospital. This information will be maintained in the site trailer and in all site vehicles including sea-faring vessels. All personnel working on site will be informed of these emergency numbers and emergency routes, and will also be informed of evacuation routes, meeting places, and evacuation warning signals in case of the need for an evacuation.

Normal onsite communications will consist of verbal communication and cellular telephones. Cell phone reception will be tested upon mobilization to the site. The Field Team Leader will provide telephone notification to local response agencies and designated client and other agency contacts. After local agencies have been notified, an individual will be assigned to wait at the project entrance to provide initial information regarding the nature of the emergency and direct response teams to the Response Coordinator. The Field Team Leader will assure that the appropriate notifications are made to the client representative. Any spill will be reported to the client immediately.

Local (site) evacuations will be signaled by site personnel verbally or through repeated three long blasts of vehicle or equipment horns. Emergency evacuation drills will be conducted by the SSHO on a periodic basis.

12.3 EMERGENCY EQUIPMENT

Emergency equipment available on-site, to be used only by trained personnel, will consist of:

- Safety Skiff equipped as follows:
  - Four (4) oars, two (2) if the skiff is motor powered);
  - Oarlocks attached to gunwales or the oars;
  - One (1) ball-pointed boat hook;
  - One (1) ring buoy with 70 ft (21.3 m) of 3/8 in (0.9 cm) solid braid polypropylene, or equivalent, line attached;
  - PFDs in number equaling the skiff rating for the maximum number of personnel allowed on board, and;
  - Fire Extinguisher.
- First aid kit in the site trailer, and trauma kits in the Site Supervisor's and SSHO's vehicles, at a minimum.
- Fire extinguishers, with A,B,C rating. Fire extinguishers will be available, in each supervisor vehicle (minimum 5 pounds ABC), on each piece of heavy equipment (minimum 10 pounds ABC), and immediately available to all fueling operations (minimum 10 pounds ABC). Fire extinguishers will receive a full inspection annually by a qualified service technician, and a visual inspection monthly and during each job site inspection. Fire extinguishers will be re-charged as necessary by a qualified service technician.
- An eyewash station that meets the criteria of ANSI standard Z-358.1-2004 or later, will be available on site and located within immediate use of areas with injurious substances, such as fueling areas and the EZ.

- Spill control materials will be immediately available to all chemical and waste handling areas. These materials will include the appropriate absorbent pads for the materials, noncombustible granular absorbent material, polyethylene sheeting, DOT-approved drums/containers, shovels and assorted hand tools, and the appropriate PPE.

12.4 EMPLOYEE INJURY OR ILLNESS

If an employee is injured or becomes ill, he or she shall be removed from the work area if it can be done safely and without aggravating medical conditions. An injured individual should be moved only under the following circumstances:

- When there is immediate danger (e.g., risk of fire/explosion, lack of oxygen, collapsing structure).
- When the location of the individual is obstructing co-workers or emergency personnel from caring for another individual who needs immediate attention.
- When the movement is necessary to administer proper care (e.g., transfer of the individual to a firm, flat surface for cardiopulmonary resuscitation).

Minor injuries may be treated by trained personnel at the site. Only individuals currently trained in first aid and CPR shall render this type of assistance. Personnel designated to provide first aid to injured workers will receive training and information for blood borne pathogens. Potentially affected individuals will be advised of the hazards and modes of transmission of blood borne pathogens. The site first-aid kit(s) will be outfitted with universal precaution protective gear for prevention of exposure to blood borne pathogens during treatment of injured workers. Any items which come in contact with blood or other body fluids will be "red bagged" and disposed as medical waste. Each employer having designated first aid responders on site must maintain its own Blood borne Pathogens Exposure Control Plan.

Injuries requiring more than first aid will be transported to the medical facility designated in Table 1 of the APP and Figure 2. Depending on the nature of the injury, site personnel may be transported in site vehicles or by ambulance. All life-threatening injuries will require contacting emergency responders and transport by ambulance.

Directions to the designated medical facility nearest the work location are included in Figure 2. This Figure will be kept in site vehicles that may be used to transport injured personnel. The list

of the emergency contact information included in Table 1 of the APP will also be kept in site vehicles including sea-faring vessels.

Whenever possible, personnel injured on site who have been exposed to ROC's will be decontaminated prior to transport to the medical facility, so long as such procedures do not further compromise the health and safety of the injured individual. Emergency employee decontamination should consist of removing protective clothing and washing affected areas with soap and water as necessary. If necessary, protective clothing should be cut away to minimize additional trauma to the injured person.

12.5 CHEMICAL EXPOSURES

The following procedures will be initiated as soon as possible in response to chemical exposures:

- For eye exposure, wash the victim's eyes immediately at the emergency eyewash station using large amounts of water for 15 minutes and lifting the lower and upper eyelids occasionally. If irritation persists see a physician.
- For skin exposure, remove any contaminated clothing and wash the contaminated skin areas promptly using soap or mild detergent and water. Obtain medical attention immediately if there are symptoms of chemical exposure (e.g., redness, blistering, or ulceration of the skin).
- For inhalation exposure, move the person to an area with clean air immediately (unless the scene is determined to be unsafe, or other injuries make moving the victim unadvisable). Keep the affected individual warm and at rest. Do not give anything to drink to an unconscious person. If person was or is unconscious, obtain medical attention immediately.
- For ingestion, contact the National Poison Control Center regarding the emergency response procedures specific to the ingested chemical.

12.6 FIRES

Fire risks will be minimized through proper monitoring of the work areas, proper work procedures, good housekeeping, and through the maintenance on-site of adequate fire extinguishers.

Site personnel will not engage in fire-fighting activities beyond the incipient stage. The local fire department will be called for any fire event. If a fire requires more than one fire extinguisher, site personnel will evacuate the area and wait for the fire department to respond.

Fire Extinguisher General Guidelines:

	Type and Size	Notes:
Vehicles and Equipment	10-ABC	Must be secured in holder
Compressed Gas Cylinder Staging	20-ABC	Must be near but not immediately adjacent to or within staging area
Structures undergoing work	20-ABC	At least one adjacent to stairwells (per floor)
Office and Trailers	20-ABC	Immediately inside common entrance
Fuel Container Storage Areas	20-BC	Must be near but not immediately adjacent to or within staging area
Fuel Dispensing or service truck (truck mounted saddle tank)	20-BC	Must be protected from weather if mounted on exterior
Propane Storage	20-BC	Must be near but not immediately adjacent to or within staging area

NOTE: All exterior fire extinguishers shall be protected from the elements and their location marked with obvious signage. This chart is not intended for formal fueling locations or fuel carrying vehicles

12.7 SPILLS

Care will be taken to prevent spills during handling of liquids. Any spill of contaminated soil, fuel, chemicals, or groundwater will be contained and cleaned up immediately. Hand tools (shovels) and/or heavy equipment can be used to berm and contain site spills utilizing soil if necessary. Liquids will be containerized for appropriate disposal. Personnel handling contaminated materials shall be current in the training specified in this SHSP. For personnel entering the Exclusion Zone, this includes 40-hour Hazardous Waste Operations training, which according to the OSHA standard must include the elements of spill response. Drums and other liquid storage will be staged such that a spill in the vicinity of a storm water drain is avoided, if at all possible. ITSI Gilbane's Spill Response SWP (included in Appendix B) will be followed in the event a spill occurs. Any spill will be reported to immediately to the Navy CSO, ROICC and RPM.

12.8 SITE EVACUATION

Potential reasons for site evacuation include earthquakes, fires, or explosions. In the unlikely event of site evacuation, verbal notification or three long repeated blasts on a vehicle or equipment horn will be used to sound the alarm. Employees will report to the supervisor's vehicle without delay, where the supervisor will conduct a head count and establish the proper

means and route of evacuation to the gathering point shown on Figure 3. The Field Team Leader will notify emergency personnel as soon as possible once all field team personnel are accounted for. If appropriate and safe, the Field Team Leader and a "buddy" should remain near the site after the site has been evacuated to assist local responders and advise them of the nature of the incident.

12.9 ACCIDENT FOLLOW-UP

Accident follow-up will be performed in accordance with ITSI Gilbane's Corporate Health & Safety Program. Immediately following serious accidents, the appropriate notifications will be made to the Navy and the appropriate agency (e.g., Cal OSHA for serious injuries, National Response Center for releases, etc.). In all cases, the appropriate client notifications will be made. Following all accidents and near-misses, an investigation will be initiated by the ITSI Gilbane SSHO/ Site Supervisor, utilizing the Accident/Loss Report form presented in Appendix C of the APP, in coordination with the ITSI Gilbane HSM. The focus of all investigations will be to collect accurate information, to discern the underlying causes of the accident, to implement appropriate control measures to prevent future accidents, and to improve future emergency response procedures. Corrective actions will be implemented based on the findings; corrective actions will be tracked, and publicized to all affected employees.

13.0 DOCUMENTATION

13.1 TYPES OF DOCUMENTATION

Health and safety-related documents will be maintained by the SSHO throughout the duration of project activities. These documents include, but are not limited to:

- Site-Specific Health and Safety Plan (SHSP)
- *Safety and Health Requirements Manual, EM 385-1-1* (USACE, September 2008)
- 8 CCR 5192 (Hazardous Waste Operations)
- Site safety inspections
- Vehicle and heavy equipment inspections
- Safety equipment inspections
- Visitor sign-in logs and SHSP acknowledgements
- Tailgate Safety Meeting records
- Employee training and medical clearance (non-confidential) records
- Instrument calibration records
- Air monitoring records and documentation of employee exposures
- Accident or incident reports
- Material Safety Data Sheets for chemical products used on site and Chemical Inventory.

13.2 POSTINGS AND SIGNS

The following information will be posted on a job board at the site and maintained by the Site Supervisor/SSHO, as a minimum:

OSHA Safety and Health Poster	Date of last lost workday injury
OSHA 300A logs	Safety and Health promotional posters
Map to Medical Facility and # to contact	Activity Hazard Analysis location
Accident Prevention Plan location	Emergency Phone #'s
Contact information for any safety concerns and Emergency # for after hours contact	Site plan show gathering locations with note on alert method (3-blasts of horn)
Deficiency Tracking Log location	MSDS location for the project

Warning signs will be utilized to warn personnel of work zones, special hazards, and PPE requirements. These notices will be posted in English and, if appropriate, in any other language necessary for all workers and visitors to clearly understand.

13.3 RECORDS MANAGEMENT

All safety-related records generated for project will be reviewed for completeness and accuracy by the SSHO, and may be audited by the ITSI Gilbane Health & Safety Manager. All equipment inspections will be tracked for completeness by the Field Team Leader on a daily basis.

All on-site personnel will be required to provide documentation of their training and medical monitoring to the SSHO before they begin to work at the site. Documentation must include (as appropriate):

- 40-hour hazardous waste training
- Most recent 8-hour refresher for hazardous waste
- Most recent medical examination clearance, including clearance to wear respiratory protection (as appropriate)
- Most recent respirator fit test (as appropriate)

The ITSI Gilbane Field Team Leader and SSHO must also provide documentation of the following, as appropriate:

- 8-hour supervisory course for hazardous waste
- 30-hour OSHA Construction Safety training

The subcontractor Site Supervisors must also provide documentation of the following as appropriate:

- 8-hour supervisory course for hazardous waste
- Relevent Competent Person training

These records will be tracked by the SSHO via the Site Employee Records Log, included in Appendix C of the APP.

Permanent medical records are maintained in confidential files by the respective contract physicians and/or medical clinics. The examining physician must supply the employing

company with a medical status document certifying that the individual examined is physically capable of performing his/her individual work tasks and of wearing respiratory protective devices (as appropriate). These certifications are maintained in confidence at the company's offices. Medical records for each employee shall be preserved and maintained for at least the duration of employment plus thirty (30) years.

Each employee exposure record shall be preserved and maintained for at least thirty (30) years and must contain the collection methodology (sampling plan), a description of the analytical and mathematical methods used, and a summary of other background data relevant to interpretation of the results, including a correlation of the employee name, social security number, and job classification with the calculated or monitored exposure levels (this may be accomplished by a daily sign-in log).

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14.0 REFERENCES

Innovative Technical Solutions, Inc. (ITSI Gilbane), 2005. *Corporate Health and Safety Program.* October.

Battelle, 2009. *ACCIDENT PREVENTION PLAN FOR RADIOLOGICAL DATA GAP INVESTIGATION*, February 13, 2009.

Battelle, 2008. *Field Sampling Standard Operating Procedures.*

United States Army Corps of Engineers, 2003. *Safety and Health Requirements Manual,* EM-385-1-1. November.

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FIGURES

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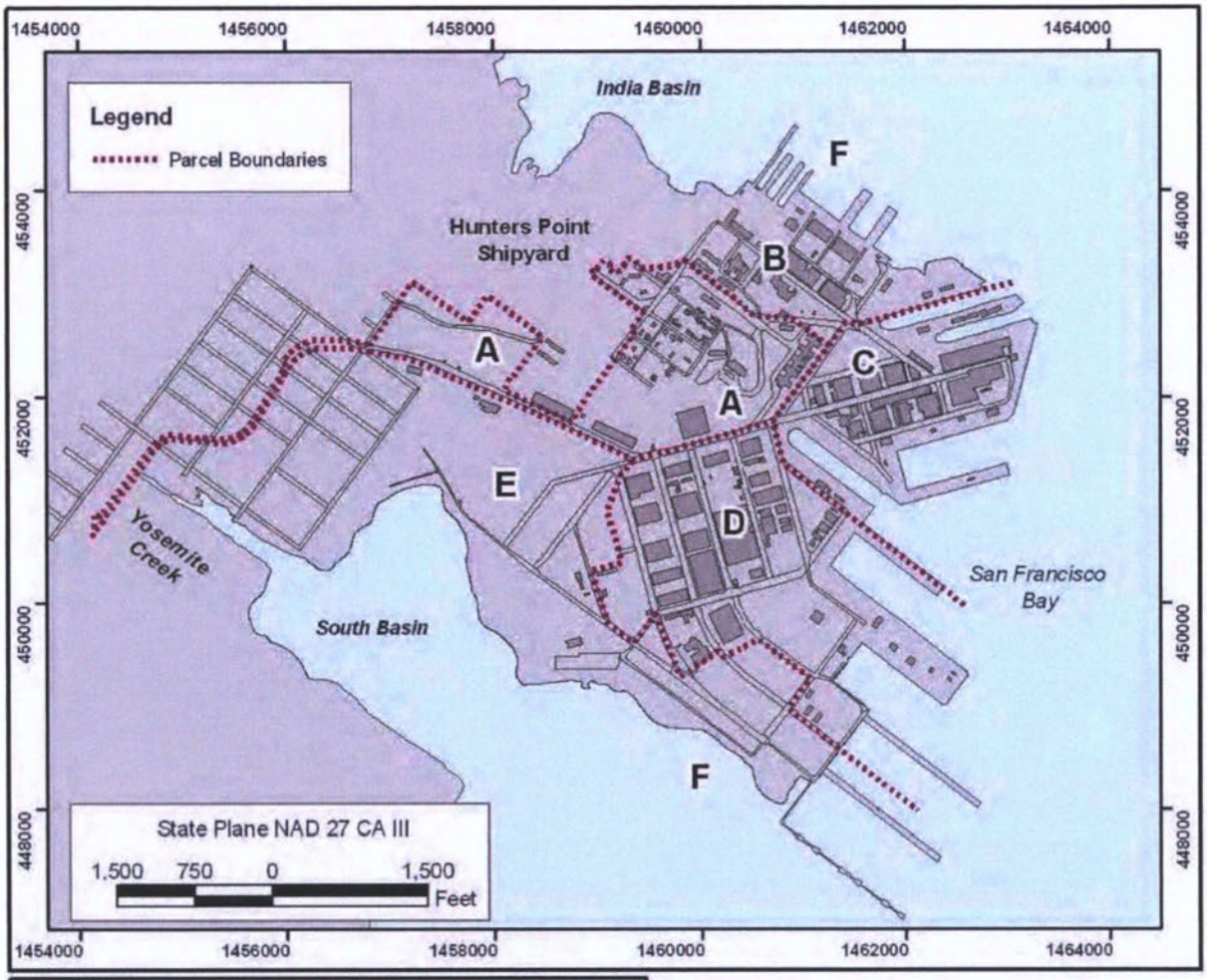
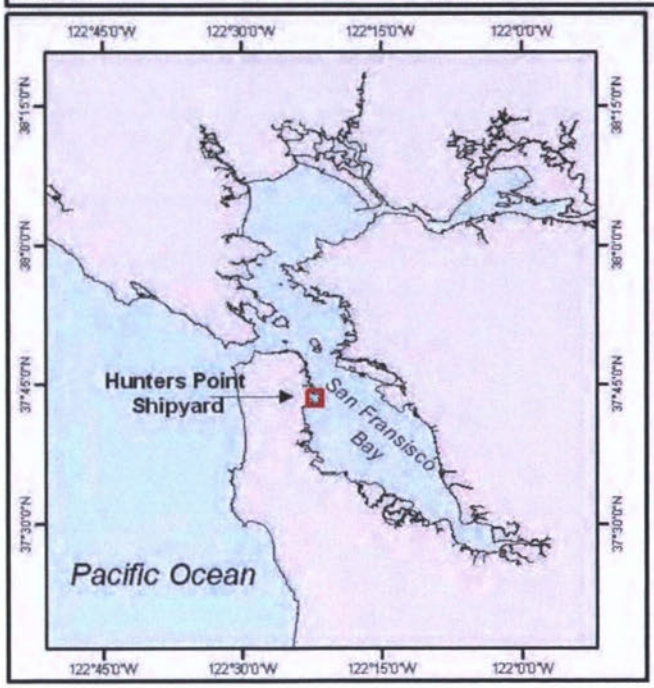




Hunters Point Shipyard Site Location Map

N

ITSI Gilbane	**Data Gap Investigation**	**Figure 1** Site Map

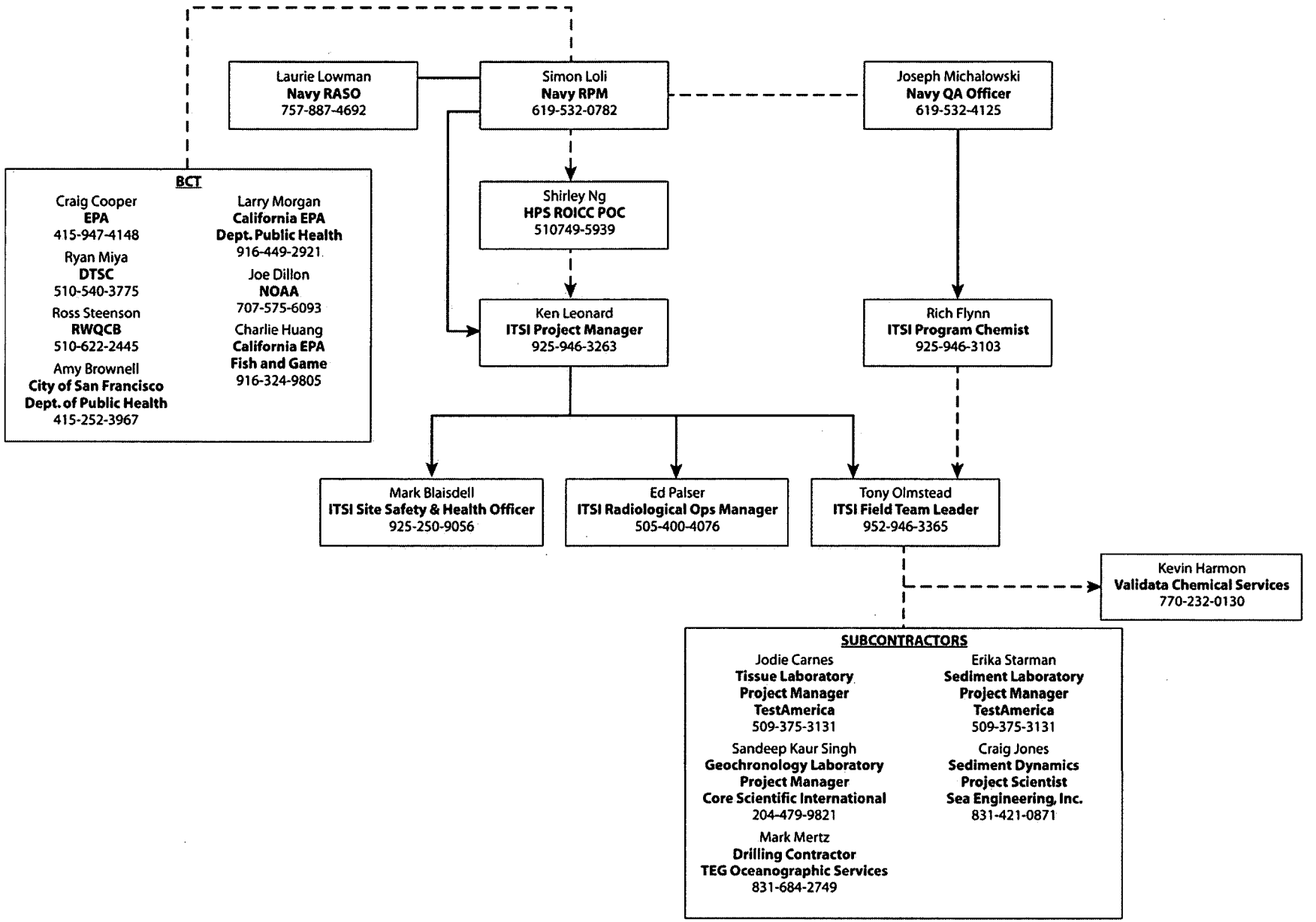
Directons

1. Leave Hunters Point Naval Shipyard through the main gate.
2. Go northwest on Evans Avenue past Third Street to Cesar Chavez (formerly Army) Street.
3. Go past Third Street to Cesar Chavez (formerly Army) Street.
4. Go west on Cesar Chavez approximately 3/4 mile to St. Luke's Hospital.
   St. Luke's Hospital, 3555 Cesar Chavez Street.
5. An alternative hospital is San Francisco General Hospital.
6. From Cesar Chavez Street, go north on Potrero Avenue approximately 1/2 mile to San Francisco General Hospital, 1001 Potrero Avenue.

1,200 0 1,200
Feet

ITSI Gilbane	Data Gap Investigation	Figure 2 Route to Hospital

Figure 3. Project Organization Chart



TABLE

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Table 1
Emergency Telephone Numbers and Emergency Route

Contact	Phone Number
BRAC Field Team Leader Caretaker: Mike Mentink	Phone: (415)743-4729 Fax: (415)743-4700
BRAC Field Team Caretaker: Mel Asuncion	Phone: (415)743-4721 Fax: (415)743-4700
U.S. Navy ROICC Contacts: Ms. Shirley Ng	(510)749-5939 (office) (510)755-5878 (mobile)
U.S. Navy Lead Remedial Project Manager (LRPM): Melanie Kito	Phone: (619)532-0787 Fax: (619)532-0995
U.S. Navy Project Manager (PM): Simon Loli	Phone: (619) 532-0782 Fax: (619) 532-0983
Police Department	911
Fire Department	911
San Francisco General Hospital (Trauma Center) 1001 Potrero Ave San Francisco, CA 94110	415-206-8111
St. Luke's Hospital (Emergency) 3555 Cesar Chavez Street San Francisco, CA 94110	415-641-6626
Poison Control	800-222-1222
ITSI Gilbane: Mr. Ken Leonard (Project Manager) Mr. Tony Olmstead (Field Team Leader) Mr. Jeremy Sawyer (HSM) Mr. Mark Blaisdell (Safety & Health Officer) Mr. Ed Palser (Radiological Operations Manager)	 925-946-3263 925-250-7875 303-204-3896 925-250-9056 505-400-4076
Office of Emergency Services, Coastal Region – Help Desk	510-286-0895
Regional Water Quality Control Board (RWQCB) – Reception	510-622-2300

Directions to Hospital from Hunters Point Shipyard (HPS) Main Gate:

1. Leave HPS through the Main Gate.
2. Go northwest on Evans Avenue, past Third Street, to Cesar Chavez (formerly Army) St.
3. Go west of Cesar Chavez St approximately ¾ mile to **St. Luke's Hospital**, 3555 Cesar Chavez St.
4. An alternative hospital is **San Francisco General Hospital**. To reach this hospital from Cesar Chavez St, go north on Potrero Avenue approximately ½ mile to 1001 Potrero Ave.

APPENDICES

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Appendix A

Activity Hazard Anaylsis

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Activity Hazard Analyses

Analyzed By: Jeremy Sawyer *Date:* 09-26-2012

Checked By: Gail Jones *Date:* 09-26-2012

Location:	**Contract No:**	**Project Title:**
Parcel F, Hunter's Point Naval Shipyard	**N62473-11-D-2227, Task Order 0002**	Radiological Data Gap Investigation at Parcel F, Hunters Point Naval Shipyard San Francisco, CA
Activity: Radiological Data Gap Investigation	**Prime Contractor:** ITSI Gilbane Company	**Subcontractors:** Science Applications International Corporation (SAIC) TEG Oceanographic Services (TEG

General Description for Scope of Work of This Activity:

The primary objectives of this SOW are sample collection, implement the DGI work plan, survey, collect, and analyze samples, and prepare a Radiological DGI Technical Memorandum.

RAC = Risk Assessment Code Matrix

RISK ASSESSMENT CODE (RAC) MATRIX				
HAZARD PROBABILITY	HAZARD SEVERITY			
FREQUENCY OF OCCURRENCE	CATASTROPHIC	CRITICAL	MARGINAL	NEGLIGIBLE
FREQUENT	E	E	H	M
LIKELY	E	H	M	L
OCCASIONAL	H	H	M	L
SELDOM	H	M	L	L
UNLIKELY	M	L	L	L

Hazard Risk Assessment Code (RAC)	Risk Level	
Probability is the likelihood to cause an incident, near miss or accident & identified as: *Frequent, Occasional, Seldom* or *Unlikely*	E= Extremely High Risk	M= Moderate Risk
Severity is the outcome/degree if an accident did occur & is identified as: *Catastrophic, Critical, Marginal or Negligible*	H= High Risk	L= Low Risk

Date of Preparatory Inspection: TBD

Estimated Start Date of Site Activity:

Activities

- Mobilization and demobilization all equipment, materials, and personnel for the field effort.
- Collecting Sediment Cores with a Piston/Push Hammer Corer
- Collection and At-Sea Processing of Benthic Grab Samples
- Deploying and Retrieving Bivalve Mollusks for In-situ Bioaccumulation

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Set up site including the development of laydown areas for materials and equipment • Set up support facilities such as toilets, hand washing station, first aid area, eyewash and fire extinguishers • Install fencing or other barricades • Demobilize all equipment and materials from site once the work has been completed.	• Slips, trips, falls	• Wear well-fitted safety boots with good tread. • Be careful around piles of wood and other debris. • Watch where you walk • Follow good housekeeping practices: create walkways, establish proper materials storage, etc. • Remove, cover, or barricade identified hazards. • Step carefully on slopes or wet/muddy areas.	L

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• Vehicle and equipment accidents • Struck-by or crushing accidents with ground personnel	*General:* • Establish and demarcate vehicle and equipment routes. • Assure all equipment has operational backup alarms. *Ground personnel:* • Wear reflective vests. • Maintain line of sight with operators when approaching equipment. • Observe vehicle/equipment routes before entering site. • Stay out of swing radius of equipment. • Stay out of equipment areas if possible. • NEVER stand under suspended loads. *Operators:* • Operate vehicles/equipment within the speed limit and at a safe speed for current conditions. • Wear seat belts at all times. • Check mirrors and blind spots on an ongoing basis. • Use spotters during dumping, backing, when near overhead power lines, or with limited visibility. • Establish and use appropriate hand signals • Do not let equipment run unattended. • Secure loads on trucks. • Perform repairs in a safe location. • Maintain at least a 10-foot distance from overhead power lines.	M

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	RAC
	• Fire and fueling hazards	• Smoke only in designated areas, and never during fueling. • Keep charged fire extinguishers accessible on vehicles, in equipment, near fuel storage, and near hot work. • Do not conduct flame- or spark-producing activities in areas of wood debris, dry grass, or brush. • Post NO SMOKING signs at fuel storage areas. • Use only approved metal fuel storage cans. • Do not fill gasoline cans in the back of pickup trucks or other vehicles. • Fuel vehicles and equipment away from brushy areas, and shut down during fueling. • Clean up spills promptly. • Keep supplies of PPE and absorbent readily available. • Always work within your training and equipment limitations during spills.	L
	• Poisonous snakes, spiders, plants, mold- Biological hazards	• Stay on established paths; avoid walking through brush. • Don't reach under objects on the ground. • Use insecticide (bug spray) in areas heavily infested by mosquitoes and other biting insects • Wash your hands regularly, and shower at the end of your shift or immediately at home.	L
	• Strains and sprains due to handling heavy and/or hazardous objects	• Use proper lifting methods, including team lifting. • Use mechanical equipment w Lift with legs, keep loads close to body, don't twist while picking up loads. • Wear cut-resistant work gloves when working with sharp objects whenever possible.	L

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• Storms, inclement weather, high winds, lightning	• ITSI Gilbane to be familiar with site evacuation routes for emergency weather events and the individual area severe weather shelters. • Assign person to monitor weather each day. • Review each of sites Emergency Weather Warning Systems with all site workers. • A NOAA "weather-cube" radio alert will be in use at the site to deliver back-up severe weather warnings in addition to any site alerting system. • Discontinue work and seek shelter in severe weather conditions such as high winds or heavy rain, or if lightning is observed. • Best shelters for lightning include a large permanent building or a fully enclosed vehicle. Unsafe places are near metal or water; under trees; on hills; near electrical/electronic equipment. • If lighting is observed or thunder heard, work will cease immediately • It's usually safe after no thunder and no lightning have been observed for thirty minutes but be conservative.	L
	• Earthquake	• Remain calm, assess the situation • If outside, avoid buildings, walls, power poles, and other objects which could fall during the earthquake. If possible, move to an open area away from all hazards • If in a vehicle, pull your car to the side of the road and stop in the safest place available. Avoid power lines. Remain inside your vehicle until the shaking is over. Proceed with extreme caution because of the danger of debris in the road or damage to the road itself • Do not touch downed power lines or objects touched by the downed wires	L

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• Electrical tools	• Only qualified electricians may perform electrical work • Electric tools with missing ground prongs or cut or frayed cords shall be removed from service. • Electric tools used in highly conductive locations, such as where the employee may contact water, shall be approved for use in those locations. • Power for portable electric tools shall be supplied from a ground fault circuit interrupter (GFCI)-protected receptacle. • Electric tools must be grounded, except tools that are equipped with double insulation. • Electric tools shall not be used in hazardous locations such as flammable or explosive atmospheres unless they are approved for such locations. • Perform Lockout/Tagout as necessary per the ITSI Gilbane LOTO SWP	L

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• Electrical hazards - marine NOTE: A specific plan for control of energized systems will be coordinated by ITSI and each exposing contractor and reviewed prior to any work. This planning session must follow the protocols established by the USACE EM 385-1-1 Safety and Health Requirements Manual section 12 Control of Hazardous Energy and all codes and standards referenced. **The hazards and controls identified by exposing contractors are not included here.**	• Only qualified electricians may install temporary power or generator for power. Grounding will follow NEC and USACE requirements. • Electric tools with missing ground prongs or cut or frayed cords shall be removed from service • Field repairs to power tools, cords or any line that supplies energy is not allowed. • All grounds shall be present in flexible cords and no separation from cord and plug shall be visible. • Flexible cords shall not be routed where they can be run over or cut/abraded. Cords shall be kept from water. • Temporary panels for shall approved for marine use. • Electric tools used in highly conductive locations, such as where the employee may contact water, shall be approved for use in those locations. • **Only 12 AWG shall be used on this job site and marked to identify their use in wet conditions** • **The use of battery-operated tools is recommended to eliminate cords and those hazards.** • Power for portable electric tools shall be supplied from a ground fault circuit interrupter (GFCI)-protected. • Portable GFCI's shall be inspected by the user daily – GFCI breakers shall be inspected/tested before each use and at a minimum weekly by an electrician. • Electric devices including gensets must be grounded, except tools that are equipped with double insulation. • Electric tools/equip. shall not be used in hazardous locations such as flammable or explosive atmospheres unless they are approved for such locations. • **A daily cord inspection program is required**	L

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• General hazards from miscellaneous tools and equipment	• Use tools only for their intended purpose. • Inspect all tools prior to use. Tag and remove from service all defective tools and equipment. • Only use power tools equipped with a safety guard with the guard in place and functioning properly. • Unplug electric tools when changing attachments or performing maintenance. • Assure that all pressurized hoses have safety restraints at connections. • Disconnect and release air pressure from pneumatic tools prior to repairs or adjustments.	L

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• Traffic safety	• Site vehicles will observe posted speed limit, which will be reduced to no more than 5 mph in hilly areas or areas with limited visibility or high congestion • Personnel working within 10 feet of an active road shall employ warning signs, cones, and a traffic flag person • Use a flag person equipped with a stop/slow sign or flag when: 1) two-way traffic is reduced to using one common lane; 2) driver visibility is impaired or limited; 3) project vehicles enter or exit traffic in an unexpected manner; or 4) the use of a flagger will enhance or enforce established vehicular traffic warning systems • Wear an ANSI-rated Class 2 reflective safety vest when working on or near roadways • Implement additional controls as necessary for factors such as glare, rain, wind, limited sight-distance, hills, curves, etc • Always remain aware of an escape route–behind an established barrier, parked vehicle, guardrail, etc • Always pay attention to moving traffic; never assume drivers are looking out for you • Work as far from any traveled road way as possible to avoid creating confusion for drivers • Use a "buddy system" so that one worker is always looking towards traffic and alert for potential hazards Minimize the amount of time that you will have your back to on-coming traffic	L

Activity (Task Identification):	Mobilization and Demobilization		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• Invasive Species – contact between water bodies	• All equipment and materials that will contact or move water will be disinfected or steam-cleaned prior to delivery and documentation confirming that cleaning will be provided for each piece of equipment. This includes ANY items that previously contact other waters including ropes, pumps, boats, waders and boots etc. • ITSI will consult with the BRAC Field Team Leader Caretaker on their protocols and state requirements for invasive species protection and protocols.	M
	• Spills over or near water	• Review MSDS for appropriate control measures, PPE, absorbent material selection, disposal methods, etc. • Clean up spills promptly and report • Keep supplies of PPE and absorbent readily available • Always work within your training and equipment limitations • Keep supplies of PPE and absorbent readily available at the point of fuel transfer or storage as the work proceeds along lines. • When water is present on or adjacent to a work area, equipment will be filled at least 20' from the water edge. ▪ **Floating sorbent booms will be immediately available when equipment is working within 20' of the water's edge.**	L

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Hand tools and power tools • Site vehicles • Fire extinguishers, 1st aid kit, eye wash • Radiological screening equipment per Hunters Point Radiological Program	• Daily site inspections • Daily equipment inspections (hand tools, PPE) • Initial inspections of heavy equipment when staged on site and prior to use.	• Site orientation • Emergency procedures • Review of this AHA. • Training in specific equipment used • SSHO must have OSHA-approved 30-hour Construction Safety training • Two 1st Aid/CPR/Bloodborne Pathogen trained workers • Radiation Safety Training is required for all employees working at radiologically impacted areas • Daily tailgate meetings

Activity (Task Identification):	Collecting Sediment Cores with a Piston/Push Hammer Corer		
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	RAC
	• General site hazards	• All Site Activity Hazards and Controls Apply	

Activity (Task Identification):	Collecting Sediment Cores with a Piston/Push Hammer Corer		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Drilling Barge use	• Slips, trips, falls, drowning **NOTE: Falls through openings present specific hazards and physical barriers will be available to those exposures or other controls planned <u>before the task</u> is started.**	• Wear well-fitted safety boots with good tread and well defined heel. • No portable ladders are allowed on the barge deck • Watch where you walk on the barge deck • Observe possible dock and area traffic patterns to avoid contact with any other vessels • Follow good housekeeping practices – no accumulation of tools, materials or debris allowed on a walking/working surface • Establish walkways and materials storage areas and maintain • Establish proper materials storage, etc. • Remove, cover, or barricade identified hazards. • Step carefully when leaving any elevated work platform including work on the skiff • Provide safe access through rated stairs or work platforms to the dock, work areas or landings • Ensure all equipment on the barge is tied down per manufacturer requirements/specifications. • Walking and working surfaces including the skiff and those surfaces shall be made of non-slip surfaces. • Weight of materials on the barge should never exceed the posted maximum capacity • The user capacity of the barge must be posted • Wear a Coast Guard approved PFD at all times on the barge • Ensure life rings are present the barge • Ensure skiff is available and on the ready whenever operations on the barge are taking place • Ensure all equipment on the barge is tied down per manufacturer requirements/specifications.	M

Activity (Task Identification):	Collecting Sediment Cores with a Piston/Push Hammer Corer		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Sampling with Piston/Push Hammer Corer	Drill-rig hazards • Struck by - lifting or moving of stems and tools	• Establish barge movement route • Operate equipment within the speed limit and at a safe speed • Use spotters during movement • Establish exclusion zone around drilling and sampling area, and limit access during site activities. • Only trained and authorized personnel may operate and/or assist in drilling operations. • Two operational emergency shutoff switches must be readily accessible to the driller and helper. • Do not let equipment run unattended. • Drill rigs must have protective guarding separating workers from shafts, belts, and pulleys. • Do not wear loose fitting clothing or jewelry that may become entangled in machinery. Long hair must be tied back. • Hard hats must be worn at all times. • Transport drill rods and bits either by a rack, rig, or utility trailer. • The mast and cables must be able to support all equipment and drill rods. • Refer to ITSI Gilbane SWP for Drilling and Heavy Equipment	M
	• Strains and sprains from material handling	• Use proper lifting methods, including team lifting. • Use mechanical equipment w Lift with legs, keep loads close to body, don't twist while picking up loads. • Wear cut-resistant work gloves when working with sharp objects whenever possible	L

Activity (Task Identification):	Collecting Sediment Cores with a Piston/Push Hammer Corer		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Sampling with Piston/Push Hammer Corer (Continued)	• Pressurized lines	• Perform daily inspections of hoses and connections • Assure that all pressurized hoses have safety restraints at connections. • Disconnect and release air pressure from hoses and equipment prior to repairs or adjustments.	M
	• Exposure to radionuclides	• Limit access to exclusion zones to only trained and qualified personnel • Do not eat, drink, or smoke in the exclusion zone • Wear the appropriate PPE, including gloves (nitrile), safety glasses, boots, coveralls • Follow decon procedures and wash hands upon exiting exclusion zone and after all handling of samples • Dispose of PPE appropriately, and store all waste materials and used PPE in approved containers to await appropriate disposal. • Maintain good housekeeping, keep equipment clean. • Work areas must be inspected at least once per shift by the SHO. • Maintain ANSI-rated eyewash in support zone	L

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Piston Corer • Drilling Barge • Hand and power tools • Safety equipment such as first aid kits, fire extinguishers, eyewashes, heat stress monitoring equipment • Radiological screening equipment per Hunters Point Radiological Program	• Daily site inspections • Pre-use and daily equipment/vehicle inspections • Drill Rig Inspection • Instrument calibration • Radiological screening per Hunters Point Radiological Program	• Site orientation • Review of this AHA • Site Superintendent and SHO must have OSHA-approved 30-hour Construction Safety training • Radiation Safety Training is required for all employees working at radiologically impacted areas. • Daily tailgate meetings

Activity (Task Identification):	COLLECTION AND AT-SEA PROCESSING OF BENTIIIC GRAB SAMPLES		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• General site hazards	• All Site Activity Hazards and Controls Apply	
• Boat/Barge/Floating work platform Use	• Slips, trips, falls, drowning **NOTE: Falls through openings present specific hazards and physical barriers will be available to those exposures or other controls planned <u>before the task</u> is started.**	•Wear well-fitted safety boots with good tread and well defined heel. •No ladders are allowed on the barge deck •Watch where you walk on the barge deck •Observe possible dock and area traffic patterns to avoid contact with any other vessels •Follow good housekeeping practices – no accumulation of tools, materials or debris allowed on a walking/working surface •Establish walkways and materials storage areas and maintain •Establish proper materials storage, etc. •Remove, cover, or barricade identified hazards. •Step carefully when leaving any elevated work platform including work on the skiff •Provide safe access through rated stairs or work platforms to the dock, work areas or landings • Ensure all equipment on the barge is tied down per manufacturer requirements/specifications. •Walking and working surfaces including the skiff and those surfaces shall be made of non-slip surfaces. •Weight of materials on the barge should never exceed the posted maximum capacity •The user capacity of the barge must be posted •Wear a Coast Guard approved PFD at all times on the barge •Ensure life rings are present the barge •Ensure skiff is available and on the ready whenever operations on the barge are taking place	M

Activity (Task Identification):	COLLECTION AND AT-SEA PROCESSING OF BENTIIIC GRAB SAMPLES		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Collecting Grab Samples **NOTE: Refer to SOP No. *5-169-03*: COLLECTION AND AT-SEA PROCESSING OF BENTIIIC GRAB SAMPLES for safety precautions of the different types of grab samplers.**	• Exposure to radionuclides	• Limit access to exclusion zones to only trained and qualified personnel • Do not eat, drink, or smoke in the exclusion zone • Wear the appropriate PPE, including gloves (nitrile), safety glasses, boots, coveralls • Follow decon procedures and wash hands upon exiting exclusion zone and after all handling of samples • Dispose of PPE appropriately, and store all waste materials and used PPE in approved containers to await appropriate disposal. • Maintain good housekeeping, keep equipment clean. • Work areas must be inspected at least once per shift by the SHO. • Maintain ANSI-rated eyewash in support zone	L
	• Strains and sprains from material handling	• Use proper lifting methods, including team lifting. • Use mechanical equipment w Lift with legs, keep loads close to body, don't twist while picking up loads. • Wear cut-resistant work gloves when working with sharp objects whenever possible	L

Activity (Task Identification):	COLLECTION AND AT-SEA PROCESSING OF BENTHIC GRAB SAMPLES		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Collecting Grab Samples (Continued)	• Struck-By	• Be very careful at all times where you place your hands. In general, your body is exposed to a high amount of risk from the grab falling unexpectedly, rising unexpectedly, closing unexpectedly, and swinging while suspended in the air. Any of these situations can cause serious harm to any part of your body, especially hands and feet. • Avoid placing your hands under the grab or the grab frame. • Always leave a path for your hands, arms, and feet to move and quickly if you need to let go of the cable and trigger mechanisms. • Never place your hands in between the cutting edges of the jaws, • Keep your hands on top of equipment while it is being lowered into the water or lowered on the deck since gravity will cause the grab to drop rapidly if a cable or hydraulic system fails. Your hands are safest while positioned on top of an equipment surface and with an open exit path. ▪ Also be very aware that the hydraulic system could also fail during lifting of the grab or the winch operator could make a mistake and lift when they should not be lifting so you need to be aware of lower, upper, and lateral pinch points for your body at all times. • Keep your hands at a mid point when lifting the grab. Avoid placing your hand or body in between the top of the grab and overhead points such as the sheave the cable travels through or the lifting frame (e.g. davit or A-frame).	M

Activity (Task Identification):	COLLECTION AND AT-SEA PROCESSING OF BENTHIC GRAB SAMPLES		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Collecting Grab Samples (Continued)	• Struck-By (continued)	• Avoid placing your feet under the grab when it is hanging on the cable and in the air. • Do not stand or place any body part (e.g. resting a hand on the vessel rail) in the vicinity of the operations, and specifically avoid standing between the grab and the side of the vessel or the lifting equipment. The grab swings during deployment and recovery, sometimes erratically, as the vessel rocks. The swinging grab can cause serious injury. • Assume the winch, cable, and/or sheaves can fail at any time and the operator can make a mistake at any time. Thus: ♦ Avoid standing under the cable system when there is tension (weight) on it. ♦ Do not stand under a grab suspended in the air. ♦ Agree on clear hand signals, avoid excess talking during deployment and recovery operations, and do not stand in the lines of sight between the winch operator, captain, and equipment being deployed.	M

Activity (Task Identification):	COLLECTION AND AT-SEA PROCESSING OF BENTIIIC GRAB SAMPLES		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Processing Samples	Personal exposure chemical products including inhalation, ingestion and skin contact • Struck-by – eye injuries • Fire hazards of volatiles • Burns • Chemicals(Reagents, Solvents) • Personal exposure to materials when mixing, preparing or application	• Review MSDSs for chemicals used. • Where appropriate face and hand protection for the material (chemical resistant etc.) and consider if gauntlet type glove would provide additional protection based on the task. • Ensure adequate ventilation during preparation and application • Follow safe work procedures for fire hazards of fuels and other flammable products. • Perform air monitoring and follow action levels per confined space plan. • Do not eat, drink, or smoke in areas where chemicals are used or stored or when handling or applying. • Maintain good housekeeping, keep equipment clean. • Wash hands after handling chemicals. • Maintain ANSI-rated eyewash within ready access (10-seconds) of work areas.	M

Activity (Task Identification):	COLLECTION AND AT-SEA PROCESSING OF BENTIIIC GRAB SAMPLES		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
• Processing Samples (Continued)	Personal exposure chemical products including inhalation, ingestion and skin contact • Struck-by – eye injuries • Burns • Chemicals(Reagents, Solvents) • Personal exposure to materials when mixing, preparing or application (Continued)	• Gloves, safety glasses (with side shields) and protective clothing such as rain gear that protects from chemical exposure must be worn when handling any of the chemicals. Open containers must remain in a fume hood or used on deck at sea. If the analyst is exposed to any of the above chemicals the following procedures should be followed: ♦ **Skin contact.** Remove contaminated clothing immediately, directing a stream of water under clothing while it is being removed, if possible. Wash affected area 15-20 mm and ensure no evidence of chemical remains. ♦ **Eye contact.** Wash eyes immediately with large amounts of water while lifting upper and lower lids for at least 15-20 mm. Get medical attention immediately. ♦ **Ingestion.** If victim is conscious, give large quantities of water immediately. **DO NOT INDUCE** VOMITING. Milk or activated charcoal may also be administered by trained medical personnel. Get medical attention immediately. Contact Poison Control Center and adhere to their advice. ♦ **Inhalation.** Remove from exposure area to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, oxygen is required. If near shore, an ambulance should meet the boat at the nearest dock. Otherwise, the coast guard should be called.	M

Activity (Task Identification):	COLLECTION AND AT-SEA PROCESSING OF BENTIIIC GRAB SAMPLES		
PRINCIPLE STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• General hazards from miscellaneous tools and equipment	• Use tools only for their intended purpose. • Inspect all tools prior to use. Tag and remove from service all defective tools and equipment. • Only use power tools equipped with a safety guard with the guard in place and functioning properly. • Unplug electric tools when changing attachments or performing maintenance. • Assure that all pressurized hoses have safety restraints at connections. • Disconnect and release air pressure from pneumatic tools prior to repairs or adjustments	L

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS

• Boat/Barge/Floating work platform
• Rescue Skiff
• PFD's
• Grab Sampling Equipment
  • Young-Modified Van Veen
  • Van Veen
  • Smith-McIntyre
  • Ponar
• Sample Processing Table
• Sample Equipment (i.e. bucket, squirt bottles, Water filter unit, sieves, etc)
• Boat/Barge/Floating work platform Hand and power tools
• Safety equipment such as first aid kits, fire extinguishers, eyewashes, heat stress monitoring equipment
• Radiological screening equipment per Hunters Point Radiological Program
	• Daily site inspections
	• Pre-use and daily equipment/vehicle inspections
	• Instrument calibration
	• Radiological screening per Hunters Point Radiological Program
		• Site orientation
		• Review of emergency procedures, including operation of drill rig shutoff switches
		• Review of this AHA
		• Hazwoper 40-hour training, 8-hour annual refresher
		• 8-hour supervisor's training, as appropriate
		• Current medical exam
		• Clearance to wear respirator, and fit test, as required
		• Drill rigs may be operated only by designated and qualified personnel
		• Site Superintendent and HSO must have OSHA-approved 30-hour Construction Safety training
		• Radiation Safety Training is required for all employees working at radiologically impacted areas.
		• Competent person to calibrate PID and perform monitoring
		• Daily tailgate meetings

Activity (Task Identification):	Cataloging and Processing Sediment Core Samples		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• General site hazards	• All Site Activity Hazards and Controls Apply	
Core Cutting	• Struck-By/Cut-By	• As core cutting involves the use of a power tool, electric scissors or a router, all standard safety procedures should be followed and knowledge of the tool should be acquired before starting. • Before opening the core insure that the blades are installed correctly and are tightly secured. • During the cutting operation, always wear safety glasses and make sure to keep fingers away from the blade. • Also if heavy resistance is experienced during core cutting, do not apply extreme force to move the electric scissors beyond the point of resistance, this could damage the tool or the user.	M
	• General hazards from miscellaneous tools and equipment	• Use tools only for their intended purpose. • Inspect all tools prior to use. Tag and remove from service all defective tools and equipment. • Only use power tools equipped with a safety guard with the guard in place and functioning properly. • Unplug electric tools when changing attachments or performing maintenance. • Assure that all pressurized hoses have safety restraints at connections. • Disconnect and release air pressure from pneumatic tools prior to repairs or adjustments.	L

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Boat/Barge/Floating work platform • Rescue Skiff • PFD's • Core Logs, Cutting Table, C-Clamps, Metal Bracket, Electric Scissors / Router, Utility Knife, Wire, Titanium Knife, Nitrile Disposable Gloves, Engineering Tape Measure (feet divided into 10"s), Geotechnical Gauge, Sample Jars, Tap Water, Liquinox/Alconox, Scrub Brush, Solvent Liquid Waste Container, Aluminum Foil, Plastic Sheeting • Safety equipment such as first aid kits, fire extinguishers, eyewashes, heat stress monitoring equipment	• Daily site inspections • Pre-use and daily equipment inspections • Radiological screening per Hunters Point Radiological Program.	• Site orientation • Review of emergency procedures • Review of this AHA • Hazwoper 40-hour training,8-hour annual refresher • 8-hour supervisor's training, as appropriate • Current medical exam • Clearance to wear respirator, and fit test, as required • Site Superintendent and HSO must have OSHA-approved 30-hour Construction Safety training • Radiation Safety Training is required for all employees working at radiologically impacted areas. • Daily tailgate meetings

Activity (Task Identification):	Deploying and Retrieving Bivalve Mollusks for In-situ Bioaccumulation		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	• General site hazards	• All Site Activity Hazards and Controls Apply	
• Working over or near water	• Slips, trips, falls, drowning **NOTE: Falls through openings present specific hazards and physical barriers will be available to those exposures or other controls planned <u>before the task</u> is started.**	• Wear well-fitted safety boots with good tread and well defined heel. • Watch where you walk • Follow good housekeeping practices – no accumulation of tools, materials or debris allowed on a walking/working surface • Establish walkways and materials storage areas and maintain • Establish proper materials storage, etc. • Remove, cover, or barricade identified hazards. • Step carefully when leaving any elevated work platform including work on the skiff • Provide safe access through rated stairs or work platforms to the dock, work areas or landings • Job-built ladders are not allowed • Walking and working surfaces including the skiff and those surfaces shall be made of non-slip surfaces. • Wear a Coast Guard approved PFD • Ensure skiff is available and on the ready whenever operations on or near water are taking place	M

Activity (Task Identification):	Deploying and Retrieving Bivalve Mollusks for In-situ Bioaccumulation		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
Deploying Bivalve Mollusk cages	Handling heavy materials and/or hazardous objects • Struck by and strains, soft-tissue injuries • Struck by - handling heavy materials (rigging) and/or hazardous objects and pinch-points • Struck-by – lacerations from tool use • Struck-by – failure of lifting devices • Struck-by – failure of lifting devices	• Use mechanical equipment whenever possible. • Use proper lifting methods, including team lifting for loads that are more than 50 lbs. • Lift with legs, keep loads close to body, don't twist while picking up loads and avoid awkward positions. • Wear cut-resistant work gloves when working with sharp objects or knives/razor knives. • Use proper body positioning to avoid pinch point when handling materials or moving and installing equipment to reduce or eliminate hand injuries. • Materials will be stored and transported on wheeled carts or similar devices to eliminate trip, fall and handling exposures. • Work areas for preparation will be in a neutral position. • Only qualified riggers will be used for any such operation • Refer to ITSI Gilbane SWP for Material Handling	M

Activity (Task Identification):	Deploying and Retrieving Bivalve Mollusks for In-situ Bioaccumulation		
PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**	**RAC**
	Personal exposure – domestic animals, snakes, poisonous plants and insects like ticks and chiggers, wildlife etc.	• Stay on established paths; avoid walking through brush. • Don't reach under objects on the ground. • Recognize and avoid poisonous plant like ivy, oleander etc. Never burn • Wear gloves, wash your hands regularly, and shower at the end of your shift or immediately at home. • Recognize insects of concern like mosquito and ticks and symptoms of exposure. • Avoid insect and vermin nests • Use DEET or similar insect repellents. • Avoid contact with wild animals. Never approach or entice an animal no matter how tame it seems. • Do not feed or provoke animals. • If an animal approaches you, back away facing the animal. • Never turn your back to the animal. • Report any animal bites or unhealthy looking animals immediately to SHO or Supervisor	L

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Boat/Barge/Floating work platform • Rescue Skiff • Waders • PFD's • Plastic cages with openings large enough for water and sediment to move freely but small enough to contain organisms. • Stainless steel to weight cage (-I 5lbs per cage) • Polypropylene tag line (-3/8" diameter). -30ft per cage • Weight for tag line (-10 lbs steel) • Polypropylene float line (-3/8" diameter); length dependent on water depth • Floats (small lobster pot size) • Grapnel hook • Marking system (e.g. cable ties, notch system, plastic sheet/permanent marker) • dGPS • Digital Camera • Safety equipment such as first aid kits, fire extinguishers, eyewashes, heat stress monitoring equipment	• Daily site inspections • Pre-use and daily equipment inspections • Radiological screening per Hunters Point Radiological Program.	• Site orientation • Review of emergency procedures • Review of this AHA • Hazwoper 40-hour training,8-hour annual refresher • 8-hour supervisor's training, as appropriate • Current medical exam • Clearance to wear respirator, and fit test, as required • Site Superintendent and HSO must have OSHA-approved 30-hour Construction Safety training • Radiation Safety Training is required for all employees working at radiologically impacted areas. • Daily tailgate meetings

REVIEWED BY:	**REVIEWED BY:**
Safety Officer (signature)	
Subcontractor (signature)	Authorized Representative (signature)

Appendix B

Safe Work Procedures

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Innovative Technical Solutions, Inc.
A Gilbane Company

Bloodborne Pathogens Exposure Control
Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910.1030, Bloodborne Pathogens
- 8 CCR 5193, Bloodborne Pathogens
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 2008

2. INTRODUCTION

The purpose of this Program is to protect employees from the health hazards associated with bloodborne pathogens, including Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV), and to provide appropriate reporting, treatment and counseling should an employee be exposed.

The goals of this Program will be accomplished by providing worksite training, personal protective equipment, engineering and work practice controls, post-exposure Hepatitis B inoculations, appropriate housekeeping practices, medical surveillance and signs and labels. These procedures are designed to reduce and/or eliminate potential transmission of bloodborne pathogens and to protect the health and safety of our employees.

3. DEFINITIONS

- *Bloodborne Pathogens:* Pathogenic microorganisms present in human blood that can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).
- *Decontamination:* Use of physical or chemical means to remove, inactivate, or destroy blood borne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.
- *Exposure Incident:* Specific contact with blood or other potentially infections materials that results from the performance of an employee's duties. This includes ingestion or contact with the eyes, mouth, other mucous membranes, cut or scraped skin, or punctures.
- *Occupational Exposure:* Reasonably anticipated contact with blood or other potentially infectious materials during the performance of work-related activities and assignments.
- *Universal Precautions:* An approach to infection control, which requires treating all human blood and certain human body fluids as if they are infectious for HIV, HBV, and other blood borne pathogens.

4. EXPOSURE DETERMINATION/SCOPE

This Program applies to contact and potential contact with human body fluids in all ITSI operations.

4.1 Exposure Determination by Job Classification

ITSI does not have any job classifications in which employees may have routine occupational exposure to bloodborne pathogens. However, all ITSI employees may potentially experience occupational exposure to bloodborne pathogens as the results of office or work site accidents, to which they may respond or at which they may be present. In addition, during some project activities, some ITSI employees may have the potential for *incidental* contact with site materials contaminated with bloodborne pathogens.

4.2 Exposure Determination by Job Task

Employees may be exposed to bloodborne pathogens while providing first aid or CPR to injured persons. Performing first aid and CPR is voluntary and on a "Good Samaritan" basis only. Performing first aid and CPR is not a condition of employment.

Exposure to bloodborne pathogens may also occur during project activities involving waste materials from former landfills (stepping on waste needles), demolition or renovation of medical related facilities or hazardous waste sites. Examples of waste materials that may be contaminated with bloodborne pathogens include syringes, razor blades, needles, used bandages and surgical instruments. Exposure may also occur during project activities through incidental contact with debris contaminated with bloodborne pathogens while working in locations of high public access such as beaches and parking lots.

5. RESPONSIBILITIES

5.1 Exposure Control Officer

The Corporate Director, Health and Safety will function as the Exposure Control Officer. The Exposure Control Officer is responsible for administration of, and overall compliance with, the OSHA Bloodborne Pathogens Standards. Specific responsibilities include:

- Ensuring appropriate training is conducted for employees on the subject of bloodborne pathogens
- Reviewing the requirements for engineering controls, work practice controls, housekeeping, labeling and personal protective equipment where occupational exposure may occur
- Assuring follow-up of all potential exposures
- Knowing current requirements of the OSHA Bloodborne Pathogens Standard and other regulations relating to handling and disposal of potentially contaminated materials
- Reviewing the Exposure Control Plan at least annually, making revisions where necessary

5.2 Medical Consultant

The Medical Consultant, also termed the Independent Medical Provider, is a physician or other health care provider designated by ITSI to review and determine occupational exposure incidents and follow-up care.

5.3 All Employees

All ITSI employees are responsible for identifying potential and actual exposures and reporting them to their supervisors or safety and health staff.

6. METHODS OF COMPLIANCE

In order to provide the highest level of protection to employees, employees will use Universal Precautions in combination with engineering controls, work practice controls, and personal protective equipment, in addition to specific housekeeping practices.

6.1 Universal Precautions

All personnel will use Universal Precautions in the performance of any task that may cause an occupational exposure to bloodborne pathogens. Use of Universal Precautions means that all blood and body fluids are treated as if they were contaminated with bloodborne pathogens. In circumstances where it is difficult or impossible to differentiate between body fluid types, employees are to assume all body fluids to be potentially infectious. Universal Precautions involves applying a barrier between the employee and potential infectious material. The barrier may involve utilizing engineering controls, work practice controls, Personal Protective Equipment, or a combination of any of these.

6.2 Engineering Controls

Engineering Controls positively isolate or remove possible bloodborne hazards from contacting employees. During fieldwork, employees will observe for, and avoid contact with, medical, sanitary and biological waste. They will notify their supervisor or SHO of the presence of such waste, so that contractors may use mechanical handling devices such as heavy equipment, shovels, or litter pickers to handle and remove such waste.

6.3 Work Practice Controls

Work practice controls are adjustments in the manner in which tasks are performed; these alterations reduce the likelihood of exposure to blood or other potentially infectious materials. The following work practice controls will be used:

- Hand washing with soap and running water will be performed after any potential contact with blood or other potentially infectious materials, after emergency medical care, and after removing gloves or other PPE. Hand washing facilities are provided in all offices, and will be provided on all construction sites. Where hand washing facilities may not be immediately present, alternate forms of skin cleansing, such as towelettes will be made available. If these are used, hand washing with soap and running water will be carried out as soon as possible.
- If a splash occurs to mucous membranes, those areas will be flushed with water as soon as possible.
- Employees providing mouth-to-mouth breathing will use a barrier shield whenever possible and rinse their mouths as soon as possible after the incident.
- Eating, drinking, handling of contact lenses, handling food or applying cosmetics or lip balm will not be allowed in areas where reasonable or potential exposure to infectious materials exists.
- Potentially-contaminated needles and other sharps will be collected in properly labeled containers and disposed of at an appropriate disposal facility.
- A periodic review of work practice controls will be conducted by the Exposure Control Officer or the site safety and health officer.

6.4 Personal Protective Equipment

Personal Protective Equipment (PPE) is clothing or other specialized equipment used by workers to protect themselves from direct contact with blood or other potentially infectious materials. Employees will wear PPE whenever contact with blood or potentially-infectious materials is reasonably expected. The Exposure Control Officer and/or Site Health & Safety Officer will be responsible for selection, distribution and use of personal protective equipment.

Gloves will be provided in first aid kits, and are required to be used any time contact with an injured or ill employee is anticipated. Splash protection will be worn whenever splash of these materials is reasonably expected. CPR shields will also be provided in first aid kits.
During First Aid/CPR training, employees will be instructed NOT to respond to a medical emergency if they do not have the appropriate personal protective equipment at hand.

Used personal protective equipment suspected of contamination with body fluids will be placed in plastic garbage bags, labeled with biohazard warning labels, and placed in a segregated storage area pending disposal as biological waste.

Clothing that becomes contaminated will be removed as soon as possible, and placed in disposal bags with the contaminated PPE. Employees whose clothing becomes contaminated with body fluids will shower with soap and water after removing the contaminated clothing.
The company will provide suitable temporary change of clothing following an exposure incident.

Should physical hazards exist (Sharps such as needles on the ground at medical waste landfill) barriers like steel-sole inserts may be required.

All incidents where PPE is used for contact avoidance will be reported to the Exposure Control Officer.

7. POST EXPOSURE EVALUATION AND FOLLOW-UP

Following an exposure incident, there will be a confidential medical evaluation and follow-up. Specific procedures will be followed, and information will be provided as required in the Bloodborne Pathogens Standard.

7.1 Exposure Incident Definition

According to OSHA, an Exposure Incident is defined as a specific eye, mouth, other mucous membrane, non-intact skin, or potential contact with blood or other potentially infectious materials that results from the performance of an employee's duties.

An exposure of a few drops of blood on intact skin is NOT an exposure incident according to the definition. However, a few drops of blood coming into contact with a hand that has cuts or cracked skin **IS** an exposure incident. If an employee has any doubt whether or not a contact constitutes an exposure incident, the employee should ask the Exposure Control Officer.

7.2 Procedures if an Exposure Incident Occurs

If an exposure incident occurs, the employee must notify his/her supervisor immediately. An Exposure Incident Report will be completed by the employee and supervisor, which will include the names of all first aid providers and a description of the incident, regardless of whether Personal Protective Equipment was used. The report is then forwarded to the Exposure Control Officer or designee. This is a confidential document the information provided and shared by the the Exposure Control Officer, case physician and individual only.

The Exposure Control Officer or designee or physician managing the case performing the post-exposure follow-up will work in determining whether or not an exposure incident actually occurred, and to address source testing; follow-up testing and treatment; and post-exposure reporting and counseling. Communication will be between the Exposure Control office, medical consultant and reporting individual only.

From this report, a determination of whether or not an exposure incident actually occurred will be made by the ITSI Medical Consultant. If it is determined that an exposure incident occurred, the Hepatitis B vaccination will be made available to all eligible employees within twenty-four hours. In all cases the report will suffice as a record of the event.

7.3 HIV and HBV Testing of the Source

Following the report of exposure, the Exposure Control Officer will contact the exposure source individual and request that the person be tested for HIV/HBV at company expense. The request is not mandatory and if refused will not affect that employee's future employment. If consent from the source individual cannot be obtained, the ITSI will document that consent could not be obtained. The results of any HIV/HBV tests conducted will be provided to the exposed and source individuals within 5 business days of receipt. The exposed employee will be advised of the laws regarding disclosure of the source individual's identity and infection status.

7.4 Follow-up for the Exposed

The exposed employee's blood will be collected and tested after consent is obtained. If the employee consents to baseline blood collection, but does not give consent at that time for HIV serologic testing, the sample will be preserved for at least 90 days. If, within 90 days of the exposure incident, the employee elects to have the baseline sample tested, such testing shall be done as soon as feasible.

Following the initial blood test at time of exposure retesting will the recommendations provided by the ITSI physician managing the case.

Evaluation of future potentially related illnesses of the exposed employee will be performed. The above will be done without cost to the exposed employee. Complete documentation of the event and a copy of the OSHA Bloodborne Pathogens Standard will be provided to the evaluating healthcare professionals.

7.5 Hepatitis B Vaccinations

A safe and effective vaccine has been developed to prevent the transmission of Hepatitis B. The vaccine is effective if administered either before or shortly after exposure. Employees who render first aid are not required to receive pre-exposure Hepatitis B vaccinations, as providing first aid is not their primary job assignment. Employees who render first aid are eligible for a post-exposure vaccination and follow-up examination, as described below.

ITSI employees with potential exposures will be informed of the safety and efficacy of the vaccine, and will be given the opportunity to receive the vaccine at no cost.

Any employee who refuses the vaccine must sign the HBV Declination form, or equivalent, which will be kept in the employee's file. However, after refusing the vaccine, an employee may later decide to receive the vaccine, at no cost. The vaccine is not mandatory for employees who have already received it or those with antibodies which protect them. Routine titers (antibody tests) are not required. If boosters are necessary, either because post-exposure titers show insufficient antibodies, or because the US Public Health Service recommends routine boosters, the boosters will be provided at no cost to the employee.

7.6 Post Exposure Reports and Counseling

The consulting medical practitioners or healthcare providers managing a case of potential exposure will furnish a written opinion within fifteen days to the Corporate Director, Health & Safety, who will provide a copy to the exposed employee. This written opinion will contain the following:

- Recommendation regarding Hepatitis B vaccination;
- Opinion for further post exposure evaluation and follow-up;
- Notice that the exposed employee has been informed of the results of the evaluation;
- Notice that the employee has been informed about any potential medical conditions as a result of exposure; and
- Notice that the employee has been informed about recommended further treatment.

All other findings of the medical evaluation are confidential and shall not be included in the written report. These findings will be reported only to the exposed employee, not the company. During all phases of Post Exposure, the confidentiality of the affected Employee and exposure source will be maintained on a "need to know basis."

8. TRAINING

8.1 Introduction

Employee knowledge and training is vital to compliance and to reduce the likelihood of employee exposure. For this reason, all employees with a potential occupational exposure to blood or other potentially infectious material will receive Bloodborne Pathogens training with the First Aid training. It will also be provided to each new employee who has potential routine exposure within ten working days from the start of employment or at the time of mobilization to a project site, and to any employee transferred to a new job role, which creates a different type or level of exposure from the previous job.

8.2 Training Content

Contents of this training will include:

- Federal and state Bloodborne Pathogens Standards, and location of an accessible copy;
- The epidemiology and symptoms of bloodborne diseases;
- The modes of transmission of bloodborne pathogens;
- The Exposure Control Plan content and location;
- Recognizing tasks that may involve exposure;
- Review of work practice controls, including housekeeping and personal hygiene;
- Proper selection, use, removal, and disposal of personal protective equipment;
- Information about the HBV Vaccination and how to obtain it;
- Information on what to do if an exposure occurs, including reporting procedures;
- Proper packaging, labeling and disposal of contaminated waste; and

- An opportunity for interactive questions and answers with training instructor.

8.3 Access to this Program

A copy of this Exposure Control Plan is available, upon request, to all employees. Any employee who wishes to review this information may do so by contacting the Exposure Control Officer.

9. WASTE HANDLING AND DISPOSAL

All bags or containers of potentially infectious materials will be clearly labeled with red or red/orange labels with lettering or symbols in a contrasting color. Red bags or containers may be substituted for labels except for sharps containers or regulated waste red bags. Red bags must be labeled but do not need to be color-coded. Potentially-contaminated sharps, including used syringes, broken glass or sharp objects which have cut a person, etc. will be placed in rigid-walled containers with the appropriate labels. Potentially-infectious wastes that have been disinfected need not be treated as a potential biohazard. However, sharps must always be handled and disposed of in a manner so as not to pose a hazard to disposal personnel.

10. RECORDKEEPING

Specific record keeping requirements are included in the OSHA Bloodborne Pathogens Standard. These requirements address the confidentiality of records and the length of time that records must be maintained. Several types of records must be maintained, including confidential medical records, training, and OSHA Injury & Illness records.

10.1 Medical Records

All employee medical records are confidential and must be securely stored and locked. Medical records are the responsibility of the Independent Medical Provider retained by the Company. Medical records will include the following information, as appropriate:

- Name and Social Security Number;
- A copy of the employee's Hepatitis B vaccination status or a copy of the signed refusal form;
- A copy of any post exposure medical testing;
- A copy of the consulting medical practitioner or healthcare professional's written opinion of the exposure evaluation; and
- A copy of the information provided to the medical practitioner or healthcare professional.

These records will be maintained for the duration of employment, plus 30 years.

10.2 Training Records

Training records will be maintained by the Corporate Director, Health and Safety or designee in the same manner as other health and safety training. Training documentation will contain the dates of training, content or a summary of the training sessions, the name and qualifications of

the instructor, and the names and job titles of all employees at the training sessions. Training records will be maintained for a minimum of three years.

10.3 OSHA Injury & Illness Records

Occupationally-contracted HBV or HIV will be recorded on the OSHA 300 Log of Occupational Injuries and Illnesses as an illness. Exposures to bloodborne pathogens from contact with sharps will be recorded on the OSHA 300 Log, if treatment such as gamma globulin, hepatitis B immune globulin or hepatitis B vaccine is prescribed by a physician.

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Innovative Technical Solutions, Inc.
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ITSI
Hazardous Energy Control Program (HECP)
Safe Work Procedures

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Example of Panel Lock, Tag and Breaker Barrier Cable

1. REGULATIONS

- 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 15, 2008 Section 12 Control of Hazardous Energy

2. INTRODUCTION AND SCOPE

This program describes minimum safe work practices to protect ITSI employees from the potentially harmful effects of uncontrolled hazardous energy. It details procedures for achieving a zero energy condition before employees perform any activities where the unexpected energizing, start-up, or release of stored energy could cause injury or damage.

Fundamental to this program is consistent communication and coordination between ITSI, the Government Designated Authority (GDA) or Owner, the creating, and exposing contractor(s) as well as notification of non-affected contractors or persons working in the area.

This safe work procedure applies to operations at work sites where hazardous energy must be controlled to prevent worker injury, including:

- During construction, renovation, servicing and maintenance of systems, utilities or facilities; and
- When testing systems as they are installed or later during commissioning.

This program does not apply to plug-connected electrical equipment when:

- All sources of hazardous energy are controlled by unplugging the cord, and
- The plug is under the exclusive control of the employee performing the work.

Subcontractors are required to provide their own HECP program that must meet or exceed this ITSI program, the regulations stated above, and any code or standard referenced. The HECP must be submitted to ITSI SHO at least 2 weeks prior to beginning work for our review prior to formal submittal to the client.

The HECP for any work must be submitted as part of the site Accident Prevention Plan to the GDA prior to any implementation for acceptance.

This program will be reviewed and updated whenever operations or regulatory standards change or best practices or lessons learned are incorporated. This program applies only to ITSI employees and USACE employees when ITSI, the contractor, and USACE employees are affected.

NOTE: ITSI will not work on energized systems and strives for a zero-energy state in all circumstances. During some portions of the work, like energization of a transformer or switching system, other standards may apply to the work, such as the National Fire Protection Association 70E for electrical safety. Each affected and exposing contractor must design their task specific HECP Plan and Activity Hazard Analysis to reflect the requirements of regulations, standards, codes and the manufactures installation policy.

3.0 DEFINITIONS

- *Affected Employees* are those employees who operate machinery or equipment upon which lockout or tagging out is required under this program.
- *Authorized Person* means a qualified person or employee delegated to perform specific duties under the conditions existing.
- *Barricade. A* physical obstruction such as tapes, screens or cones intended to warn and limit access to a hazardous area.
- *Barrier.* A physical obstruction which is intended to prevent contact with energized lines or equipment or controls.
- *Block:* Placing some physical barrier to prevent parts from moving, objects from falling or pressure from being released; in order to prevent the flow of hazardous energy from a hazard source to a person. A blocking device must be physically locked into place to positively prevent removal without the affected person knowing it.
- *Construction*: The erection of new wiring and equipment, and the alteration, conversion, and improvement of existing wiring and equipment.
- *Creating Contractor*. The employer that caused a hazardous condition that violates an OSHA standard
- *Controlling Contractor*. Controlling contractor means a prime contractor, general contractor, construction manager or any other legal entity that has the overall responsibility for the construction of the project, including its planning, quality and completion.
- *De-energized Parts.* Parts that have been previously energized and are now free from any electrical connection to a source of potential difference and from electrical charges.
- *Dissipate:* To release the hazardous energy by grounding electrical sources, allowing very cold or hot objects to come to room temperature, relieving pressure or vacuum until it reaches standard outdoor air pressure, stopping the mechanical motion of moving parts, or neutralizing hazardous chemicals.
- *Energized Parts (Live Parts)*: means parts that are of a potential different from that of the earth, or some conducting body which serves in place of the earth.
- *Energy, including:*
  - Mechanical motion;
  - Potential or stored energy due to pressure, vacuum, gravity or springs;
  - Electricity;
  - Hot and cold surfaces (thermal energy);
  - Chemical energy (flammables, corrosives, reactives).

- *Energy Control Point:* The location where hazardous energy can be positively blocked so it cannot cause injury or damage. The control point can be a circuit breaker, a valve, or a physical setup such as a misaligned pipe, a line blanking device or missing link. Energy control points must be physically locked into a safe position. There may be multiple energy control points that affect work in a hazard zone and they must all be identified and locked out.
- *Exposing Contractor:* An employer whose own employees are exposed to the hazard.
- *Guarded.* Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers or casings, barriers, rails, or screens, mats, or platforms intended to prevent or impede the approach of persons or objects to a point of danger.
- *Hazardous Energy:* Energy that is not controlled and can cause injury, death or property loss
- *Hazardous Energy Control:* Hazardous energy is considered adequately controlled if it cannot be reactivated, mistakenly or intentionally, without the affected persons knowing it.
- *Interlock.* An electrical, mechanical, or key-locked device intended to prevent an undesired sequence of operations.
- *Isolate:* For electrical energy, blocking or breaking the energy path so that electricity cannot flow to cause electric shock. This is typically accomplished by turning off a circuit breaker or physically disconnecting electrical wires to break the current path.
- *Lockout/Lockout Device:* A device that uses a key or combination lock to positively prevent reactivation of hazardous energy. This may include a lockout plate or pliers for electrical sources, or a chain or bar for valves, pipes and mechanical parts. Lockout also applies to the use of a lock to hold a physical barrier in place. Related devices can be clamped over or around valve handles, electrical cord plugs, circuit breakers, fuses and other operating equipment. These devices are padlocked closed to prevent their operation during maintenance or servicing activities.
- *Tagout/Tagout Device:* The placement of an obvious warning tag or label at an energy control point to warn personnel not to reactivate the energy. This method does not provide positive hazard control and it should only be used when it is physically impossible to lock the energy control point.
- *Qualified Person.* A person who, by reason of experience or instruction, is familiar with the operation to be performed and the hazards involved.
- *Zero Energy:* The safe condition in which all hazardous energy sources are locked out of service.

4. RESPONSIBILITIES

4.1 Site Supervisors/Safety & Health Officers

On-site supervisors and site safety staff are responsible to coordinate with the GDA (or contract representative) and affected contractors in order to verify that all hazardous energy sources are locked out before work begins. The task specific Authorized Person is responsible for verifying that all lockouts are in place at the beginning, during the work as needed and end of each work shift. The ITSI on-site supervisor and SHO are also responsible for providing staff awareness level training on this SWP and ensuring documentation of that training.

A preplanning session is required with the GDA and all affected employees to understand and communicate the procedures specific to the energy source being controlled. Tis will be a specific agenda item and minutes and signatures of attendance are to be retained.

4.2 All Employees

Employees are responsible for knowing this HECP and strictly following it, and for notifying their supervisors of any questions, unsafe conditions, or non-compliance situations regarding plan procedures.

5. CLASSES OF EMPLOYEES

5.1 Authorized (Qualified) Employees

Authorized (Qualified) Employees are the only ones certified to lock and tagout equipment or machinery. Whether an employee is considered to be qualified will depend upon various circumstances in the workplace. It is likely for an individual to be considered "qualified" with regard to certain equipment in the workplace, but "unqualified" as to other equipment. An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person, is considered to be "qualified" for the performance of those duties.

5.2 Affected Employees

Affected Employees are those employees who will work directly with the equipment, etc., for upon which lockout or tagging out is required under this program. Training of these individuals is less stringent in that it includes the purpose and use of the lockout procedures.

6. ENERGY CONTROL PROCEDURES

6.1 Identification of Hazardous Energy Sources

All hazardous energy sources must be identified. Personnel will look for combinations of energy sources. Plans, prints, drawings, manuals, or schematics will be reviewed as necessary to help identify all energy sources and paths. Such evaluations will include a representative of the GDA or Owner who has an understanding of the facility and energy source to be controlled.

6.2 Identifying Energy Control Points

All control points must be identified for each energy source. This includes looking for circuit breakers, control valves, backup generators, uninterruptable power supplies (UPS), batteries, etc. Those energy control points that must be locked in a safe position to prevent re-accumulation of energy will be particularly marked or otherwise identified. These include vent valves, relief valves, and electrical shorting bars.

Specific care is needed when working in facilities with overhead gantry-type equipment due to the exposed energy in related buss-bars.

6.3 Verify Lockout Capability

The qualified person will evaluate each control point to verify that a lockout device can be physically put in place.

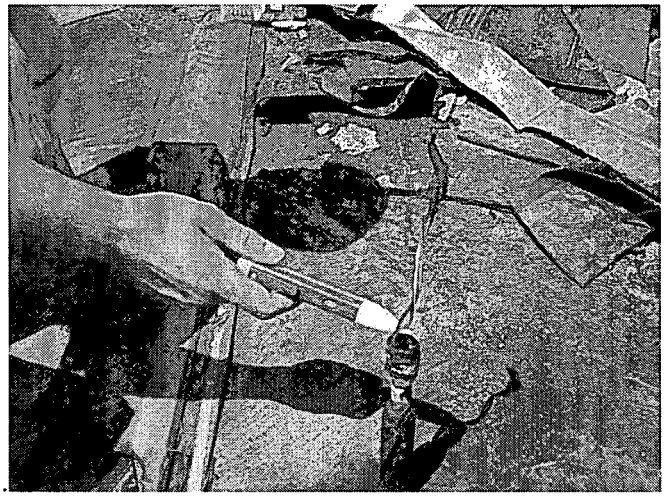
6.4 Preferred Method: Lockout

Prior to the application of physical controls to an energy source, a step-by-step procedure will be developed by the qualified person to define specific activities and the order of those steps for initial control and the later re-energization of the energy source if needed. This plan will be submitted in writing to the ITSI superintendent and SHO for their review prior to submitting it to the GDA.

If the control point can be locked out, the following steps may include, but will not be limited to, the following:

1. All affected employees must be notified of the shutdown and the reason. This must be communicated in a preplanning session coordinated with the GDA as a defined agenda item.
2. If the machinery is in operation, the equipment should be shut down by the normal operational controls, moving controls to OFF.
3. The energy source will be turned off at the control point(s). (Open circuit breakers, close valves, etc.)
4. A lockout plate and locks will be applied to each control point. Each person working on the equipment must apply his own lock. This is in addition to any locks already put in place by the GDA. Personnel will not rely on limit switches or interlock devices to shut down hazardous energy sources.
5. The control point(s) will be tagged with warning tags. The name of each person applying a lockout must be written on the warning tag, along with the date.
6. Stored energy will be dissipated. This includes any electrical energy that must be shorted or grounded, relieving pressure in fluid lines and springs, and blocking off mechanical devices. To prevent re-accumulation/recharging of energy, grounding and bonding cables may be applied per the protocols agreed upon during the preplanning session.
7. Any parts that may cause injury or damage, if accidentally applied, must be physically blocked in place for example an overhead door under repair. Blocking devices must be locked in place with padlocks when ever possible.

8. Mechanical links in systems will be broken or removed to block the flow of energy. This may include removing drive chains, links, rods or shafts. To break the energy flow path in piping systems the line must be split open at a joint or valve and the ends of the pipe must be physically misaligned. Blanking lines or closing valves alone is not adequate since blanks and valves may leak.The specific protocols shall establish each connection disabled to ensure system integrity prior to restoration.
9. The Qualified Person will then verify that all persons are clear of the area and attempt to restart the equipment that was locked out. This verification will include the GDA and all affected employees.
10. After the test, controls should be placed in the neutral or the off position.
11. Qualified personnel must verify that all circuits have zero energy with appropriate measurement tools.



Verification of De-energized Circuit

NOTE: In all public or public accessible areas, locks must always be used.

6.5 Least Desirable Method: Tagout

If it is physically impossible to lockout the control point, the control point must be tagged out. The control point must be secured in some obvious manner to prevent re-energizing. This may include removing fuses, disconnecting wires, taping circuit breakers open, etc. Such details will be included in the step-by-step plan created specific for the task.

A warning tag must be placed on the energy control point(s). The tag must specifically warn against restarting the system (i.e., "DO NOT START," "DO NOT OPEN," "DO NOT OPERATE"). This tag shall be located to the same location where a lock would have been applied.

All affected employees must be notified of the shutdown and the reason. This must be presented in a preplanning session coordinated with the GDA.

6.6 Lockout/Tagout Removal

Once the work is finished, the work area must be checked by the qualified person to verify that it is clean and clear of workers and tools before coordinating restoration of energy to the system. Prior to the removal sequence, a planning session will be held, including the GDA, to ensure all affected parties are aware of the re-energization and sequence of restoration. The removal of a lockout or tagout will be in reverse order of installing it. With the area still clear of workers, the restoration sequence will be conducted and the system will be reactivated and operationally tested under the control of the qualified person and per their written plan.

6.7 Temporary Work Interruptions

If an individual must leave the area before their work is finished, their lock must remain in place. The individual's lock may only be removed at this point if the project supervisor or site safety representative applies his own lock and tag to the energy control point and specific, verbal coordination and approval by the qualifed person is completed. Then the individual may remove his lock and tag. If a substitute worker completes the job, the substitute must put his own lock and tag on the energy control point before the supervisor's, qualified person or safety representative's lock is removed.

6.8 Lockout/Tagout Involving More Than One Employee

If more than one person is required to lockout or tagout equipment, each shall place his/her own lockout device on the energy isolating device(s). When an energy isolation device cannot accept multiple locks or tags, a multiple lockout hasp may be used. A single lock may be used to lockout the machine or equipment with the key being placed in a lockout box or cabinet which allows the use of multiple locks to secure it. Each employee will then use his/her own lock to secure the box or cabinet. As each employee completes their task and no longer needs to work on the locked out system, they may remove their lock from the multi-lock hasp.

Typical Lock and Tag at Control Point

6.9 Concurrent Work Activities

If additional work must be done on the locked out equipment the HECP must be updated, any new personnel assigned to work on the equipment must put their own locks and tags on the energy control point. Newly affected personnel must be notified as well. The new personnel will NOT try to restart the equipment. They will coordinate.all work with the Qualifed Person.

6.10 Shift Changes

Work operations frequently take more than one shift to finish. In this case, the incoming worker will put his lock and tag on the energy control point BEFORE the outgoing worker removes his lock and tag. The outgoing worker must go over the entire job with the incoming worker and show him any blocking devices that were used to block off parts of the equipment and advise him of any changes to the planned protocols and those reasons.

6.11 Failure to Clear a Lockout

If an individual leaves work without exchanging locks and tags with his replacement, and the job is finished, the project supervisor or site SHO will try to contact that individual to resolve the issue. If the individual cannot be contacted, the project supervisor or site SHO are responsible for checking the equipment to be sure that all other blocking devices and lockouts have been removed and it is safe to re-activate the equipment. If a group lock is involved, reasonable effort to contact each member shall be conducted. The project supervisor or site SHO under the direction of the ITSI project manager and qualified person may then cut off the last lock and re-activate the equipment.

6.12 Emergency Procedures

Prior to implemention of the energy-specific control plan, procedures will be agreed upon between ITSI, the affected contractor and the GDA should access to the energy or equipment be required in an emergency. For example the use of a stand-by generator that would be required due to heavy snowstorms where work cannot be completed but the generator is required. A specific step-by-step protocol (if reasonable and safe) may be designed for review by all affected parties.

7. SPECIFIC APPLICATIONS

This Program must be followed whenever there is hazardous energy in the workplace that must be controlled to prevent injuries and property damage. A list of examples follows.

7.1 Equipment or Systems that May Retain Charges

Transformers, capacitors, computer systems and circuit breakers are examples of potential static charge sources.

7.2 Pressurized Systems

Work around pressurized systems includes hydraulic, steam or air-pressure (pneumatic), and compressed gases. Pressure-activated machinery, compressed gas lines, pressure vessels, backhoes, forklifts, lift gates on trucks, drum crushers and front end loaders are examples.

7.3 Inspection, Maintenance, Servicing, Repair, Troubleshooting, Setup or Clearing Jams on Machinery or Equipment

Note, these activities may require bracing or blocking moving parts to prevent workers from being caught or crushed in machinery.

7.4 Piping Systems Containing Hazardous Chemicals or Pressurized Fluids

Piping or containers that currently or previously held hazardous or pressurized chemicals, and that may have been out of service for long periods, may rupture explosively or release toxic gases and vapors. These lines must be properly drained, flushed, and de-energized before repairs or maintenance begins.

7.5 Piping or Containers Pressurized by Internal Evaporation of Contents

Piping and containers exposed to elevated temperatures may develop significant internal pressure that must be safely vented before work begins.

7.6 Systems that May Automatically Start Up

Coordination with the GDA is critical when working with such systems since they may start from a power failure (standby generator or battery storge), load requirements or automatically. This also includes conveyors, ventilation systems like smoke ejectors, sumps pumps and related liquid handling components.

7.7 Confined Space Operations

Workers in confined spaces must be protected from the hazards of engulfment or drowning if materials are allowed to reenter the confined space. Electrical equipment must also be de-energized and prevent from accidental restarting while workers are working in confined spaces.

7.8 Portable Tools and Equipment

Portable power tools, pressure-washers, and other equipment must be unplugged from power sources before repairs or maintenance are performed. The plug must remain in the exclusive control of the person doing the repair. If this cannot be done, a plug lockout device must be utilized.

7.9 Routine Maintenance and Machine Adjustments

During such operations, employees will not place hands, other parts of their body, or tools in areas where they may be exposed to hazardous energy, such as breaking the plane of a normally guarded area of the equipment.

8. REQUIRED EQUIPMENT

- Each individual working on a hazardous energy system will have their own unique lock and key or combination lock.
- Warning tags should be placed on all lockout devices. The tags should be plastic coated and reusable. These tags must contain at least the information shown below:

DANGER **DO NOT START** **EQUIPMENT LOCKED OUT** Name: Date:

- Danger tags must be used for tagout situations where a lockout device is physically impossible. These tags must contain at least the information shown above, as a minimum.
- Grease pens or other suitable waterproof markers are required for making legible entries on tags.
- Nylon cable ties are required for tying the tags onto control points.

- Lockout plates/pliers may be required where more than one worker must place his or her lock on the control point. These devices fit onto the control point and have several holes through them to accommodate multiple locks.
- Chains or bars may be required to block valves or turnstiles when locking out piping.
- Grounding and bonding cables and clamps will be required for dissipating electrical charges when dealing with electrical systems or flammable liquids.
- Line blanking devices may be required for blocking off pipes.

9. SUBCONTRACTORS

The on-site supervisor must be familiar with the scope of work for any sub-contractors on a job site. The on-site supervisor must be sure that contractors use proper lockout and tagout procedures. ITSI on-site supervisors should also put a lock and tag on any system that is locked out by a sub-contractor so that the contractor must check with the on-site supervisor before restarting the equipment.

10. TRAINING

The authorized (qualified) person shall be trained in the recognition of hazardous energy, possible sources in the workplace and how to safety control that energy.

Every affected employee required to perform repairs or maintenance on machines or equipment shall be trained on procedures for isolating hazardous energy and the step-by-step plan developed for each HEC activity.

Training will be provided by a competent or qualified person or vendor and documented. Training must consist of verbal instruction and hands-on demonstration of lockout and tagout procedures..

Written publications should be used only to supplement verbal instruction. Written documentation of all lockout/tagout training shall be maintained by the SHO and each subcontractor supervisor. The training will include:

- Need for energy isolation.
- Intended use and limitations of lockout/tagout equipment.
- Procedures for performing lockout/tagout.

The training shall be repeated as necessary, at least annually, to ensure that employees remain familiar with proper lockout/tagout procedures or when there is evidence based on performance that his or her training is inadequate.

11. INSPECTIONS AND PROGRAM REVIEW

A daily, documented inspection of the physical controls and verification of the agreed procedures and control will be conducted by the qualified person.

The SHO shall conduct periodic audits to the energy control procedures, as needed during the work, to ensure that the procedures, agreements and requirements of the plan are being followed. All affected contractors will be invited to participate in this audit. A summary defining who conducted the audit as well as the findings will be produced.

This HECP program will be reviewed at least annually by ITSI Corporate H&S staff to ensure it reflects existing regulations, standards and best practices.

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Decontamination, Site Control, and Sanitation Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response
- 29 CFR 1910.141, Sanitation
- 29 CFR 1926.51, Sanitation
- 8 CCR 5192, Hazardous Waste Operations and Emergency Response
- 8 CCR 3360-3368, Sanitation
- 8 CCR 1524, Potable Water
- 8 CCR 1526, Toilets at Construction Jobsites
- 8 CCR 1527, Washing Facilities, Food Handling, and Temporary Sleeping Quarters
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 2008

2. PURPOSE AND SCOPE

This procedure describes minimum requirements for preventing the transfer of chemical contamination to uncontaminated materials and personnel, and for providing adequate sanitary facilities on site. **Specific decontamination methods and site work zones will be specified in site Health and Safety Plans for each project.** This procedure applies to all construction work sites, especially where employees may come in contact with chemical contaminants.

This procedure does not specifically address asbestos abatement, lead abatement or radiological materials, although many of the procedures and principles in this procedure may be applied to these operations. Decontamination requirements for these materials are covered in the Safe Work Procedures (SWP) for Asbestos and Lead Activities.

Site control, decontamination and sanitation procedures for project sites consist of establishment of work zones and site security, decontamination procedures for equipment and personnel, and provision of sanitation facilities for workers. These site specific procedures will be discussed during project orientation with all affected.

3. DEFINITIONS

- *Decontamination:* The process of removing or neutralizing contaminants that have accumulated on personnel and equipment. Decontamination methods physically remove contaminants and/or inactivate them by chemical breakdown, neutralization or disinfection/sterilization.
- *Exclusion Zone:* Areas of a field work site that are potentially contaminated with hazardous substances. Access to these zones is restricted to properly trained personnel with appropriate protective clothing, respirators and safety equipment.
- *Decontamination Zone:* Areas of a field work site bordering exclusion zones, where personnel, tools and equipment are cleaned to prevent the spread of contamination into clean work locations. These areas can also be used to store respirators, protective clothing and other safety supplies, as well as first aid kits, fire extinguishers and other emergency equipment. Shower and locker room facilities are located in decontamination zones.
- *Support Zone:* Clean areas of a field work site where no contamination exists. Clean break areas are located in the support zone, as well as necessary office trailers, toilets and drinking water supplies. Access to the support zone is generally unrestricted.

4. WORK ZONES

The goals of establishing work zones are to minimize the number of persons in the contaminated areas, assuring that persons present possess the necessary qualifications, and limiting the spread of contaminated materials outside of the active work areas. Work zones usually consist of an Exclusion Zone, a Decontamination Area, and a Support Area. Work zones should be demarcated clearly; they should be established with drainage, prevailing wind direction, neighbors, and traffic patterns kept in mind; and existing barriers, such as fences and buildings, should be used whenever possible. Site personnel must be informed of the zone locations and marking system at their initial site safety orientation.

4.1 Exclusion Zone

The active work area during activities involving hazardous materials or wastes should be designated as the Exclusion Zone (EZ). This area should be demarcated by barricades with warning signs and warning tape. In addition, temporary construction fencing, or other such measures may be used. Access to this zone should be limited to authorized personnel, with the appropriate protective equipment, who have met the training and medical requirements. Eating and drinking is not allowed in these areas. Smoking is only allowed in designated areas due to contamination issues, and because of the potential fire risk on sites. Visitors on site are required to meet the same medical, training, and protective equipment requirements as regular workers on site.

4.2 Decontamination Zone

A location adjacent to the EZ should be designated as the Decontamination Zone (DZ). This Area will be established to provide for both personal and equipment decontamination. All personnel working on site must pass through the DZ before proceeding to the Support Zone (SZ). Personal decontamination facilities may include boot wash, bins (and trash bags) for disposal of contaminated personal protective equipment, personnel wash-up area, and personal protective equipment cleaning and storage areas. Small equipment and hand tools may also be cleaned in this area. The decontamination area may be lined with a plastic liner, and demarcated with cones or barricades in such a way as to designate its location and the entry and exit locations.

Decontamination of larger equipment and vehicles may be performed in a variety of ways; however, if wet methods are used, then a temporary wash pad or liner should be used in order to collect the wash water.

4.3 Support Zone

The SZ is located adjacent to the Exclusion and Decontamination Zones, in a location generally up or cross-wind of the EZ. The SZ contains staged equipment and supplies, and functions as a meeting or liaison point with outside personnel.

4.4 Site Security

Access to excavated areas or other potential hazards should be restricted through the use of temporary fencing or other means which provide a reasonable barrier from trespass during non-work hours. This barrier should remain in place for the duration of the project, or as long as the potential hazard exists.

All stockpiled of contaminated or potentially contaminated soils should be covered with plastic sheeting and secured before the end of each work day, immediately should rain occur during the day or as directed by the Storm Water Pollution Prevention Plan (SWPPP).

5. DECONTAMINATION

Personnel, clothing, equipment, and samples leaving the contaminated areas (EZ) of a site must be effectively decontaminated. Specific decontamination procedures are established in the Site Health & Safety Plan and AHA.

5.1 Decontamination Methods

Gross contamination can be removed by physically brushing, scraping, water rinsing, or wiping off surfaces.

Detergent washing is a more aggressive cleaning method for removal of liquids and solids that stick to contaminated surfaces. Cleaning detergents used for PPE, respirators, hard hats and tools could include, but are not limited to, household laundry or dish soap, trisodium phosphate (TSP), or AlconoxTM. TSP is caustic and can cause skin irritation. Rubber or nitrile gloves and liquid-resistant aprons or coveralls are required to prevent skin contact while cleaning.

5.2 Pressure Washing and Steam Cleaning

Pressure washers and steam cleaners can be used to remove stuck-on materials from vehicles and heavy equipment. These methods are also used in tank cleaning. Please refer to the ITSI SWP for Power Washing for details.

5.3 Personal Decontamination

Personnel must perform a decontamination sequence each time they leave the Exclusion Zone. The sequence for employee/site worker decontamination follows:

1. Wash gross contamination and rinse boots and outer gloves.
2. Removal of protective equipment.
3. Wash with soap and water. The use of hand sanitizers does not replace the need to wash with soap and water.

5.4 Personal Decontamination During Medical Emergencies

Whenever possible, contaminated clothing and safety equipment should be removed from injured or ill personnel prior to transporting them to off-site medical facilities. Protective clothing and exposed skin may be decontaminated prior to transport, if time permits and decontamination can be performed without aggravating the victim's injuries. Medical responders should be informed of the potential for contamination upon their arrival on site. The intended treatment facility must be notified as soon as possible so they can prepare their facility for a contaminated person.

In the event of eye contact with contaminated materials, eyes will be flushed using an ANSI-approved eyewash for at least 15 minutes per requirements. The eyewash shall comply with ANSI Z358.1 2009 and be capable of delivering tepid water for 15minutes at a rate of 0.4 gpm (1.5 lpm). Clean water will also be used to flush skin exposed to contaminated materials.

Employees are prohibited from applying solvents or chemical neutralizing agents to contaminated skin or eyes unless specifically instructed to do so by a National Poison Control Center, paramedic, emergency medical technician, physician or other licensed medical personnel.

5.5 Equipment Decontamination

All equipment that comes in contact with contaminated materials must be decontaminated prior to leaving the site. Contaminated equipment must not be removed from the contaminated area until it has been cleaned. Rental equipment companies should be notified of the use of their equipment on a site with contamination when the equipment is ordered.

Small contaminated equipment should be decontaminated by cleaning off visible residues and materials, then washing in the same manner as personal equipment.
Boots and gloves may be reused provided they have been decontaminated. Otherwise, they should be replaced as necessary. Footwear should be washed in the boot wash tubs upon leaving the contaminated areas.

If reusable respirators are used, they should be washed per the manufacturer's recommendations, with thorough rinsing and drying in a protected area, prior to storage of the respirators.

5.6 Decontamination Materials

Decontamination materials should be collected in a secure container and tested for subsequent disposal. All wash water generated during the decontamination process should be collected in a secure and DOT approved container and tested for subsequent disposal. These wastes will be considered contaminated unless laboratory or field analyses classify them in other waste categories or non-hazardous.

6. CONTAMINATION CONTROL WORK PRACTICES

Employees will use the following work practices to prevent or minimize chemical contamination.

- Avoid direct contact with potentially contaminated surfaces whenever possible;
- Limit access to exclusion zone to essential personnel only;
- Lay out traffic patterns and work areas on site to separate personnel from equipment while walking;
- Enter and exit exclusion zones through the decontamination zone;
- Use tools and heavy equipment to avoid hand and body contact with contaminated materials;
- Use disposable PPE to minimize the need to clean reusable items;
- Cover potentially-exposed instruments and tools with polyethylene or other protective materials whenever possible prior to entry into the exclusion zone. If possible, stage that equipment in the exclusion zone to eliminate the need to decontaminate daily.

7. PERSONAL SANITARY FACILITIES

The proper sanitary facilities must be provided for use by all personnel on site, especially where the potential for chemical contamination exists. Sanitation facilities must include toilets and hand washing facilities that include soap, running potable water, and single-use towels. These facilities must be serviced frequently enough to ensure cleanliness with no visible accumulation of debris.

Shower trailers and clean and dirty locker rooms may be required for hazardous waste sites. Potentially contaminated tools and clothing are prohibited in clean locker rooms. Only potable water will be used for showers and hand or face washing.

Employees are required to wash hands and face prior to eating, chewing, drinking or smoking. Smoking, drinking, eating, chewing tobacco and gum are permitted in designated areas and not in the "clean" areas.

8. TRAINING

General decontamination requirements and site zoning are covered in initial 40-hour training for new employees assigned to field work at Hazwoper sites. Site supervisors and Safety and Health Officers (SHOs) are responsible for informing employees, visitors and contractors of project-specific decontamination requirements and verifying compliance with those requirements. SHOs will also inspect decontamination activities periodically to verify the effectiveness of specific cleaning methods. Alternative cleaning methods will be implemented, if necessary in consultation with the Project CIH. Affected personnel will be informed of changes in specific decontamination procedures prior to their implementation. These changes will be reflected in the Health and Safety Plan, Activity Hazard Analysis, or the Deficiency Log for the project.

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Drilling
Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1926, Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), Section 18 H, September 15, 2008

2. PURPOSE AND SCOPE

This program establishes minimum safety requirements for drill rig operations on ITSI projects. This Program is based on the Drill Operator's Safety Manual published by the Portable Drilling Rig Manufacturer's Association (1980), OSHA regulations, and the USACE 385.1.1 manual, Section 18.H, Drilling Equipment. This program applies to drill rigs used for soil borings and groundwater well installation. ITSI subcontractors must have their own drill rig safety program and health and safety program that complies with OSHA standards, the above regulations and any consensus or local standards that may apply. Should these programs, etc., conflict, the most stringent will apply.

3. RESPONSIBILITIES

3.1 Project Managers and Site Safety and Health Officers

Project Managers are responsible for selecting and approving drilling subcontractors and equipment suppliers. Subcontractors and suppliers must be given the opportunity to walk the job site and must be informed of all safety and health hazards, as well as training, medical monitoring, and drilling, site restrictions and protective equipment requirements before presenting bids.

ITSI will coordinate a site survey for hazards, identify the obvious, known and suspected hazards and identify them on a site layout plan prior to mobilization. These findings shall be included in the Activity Hazard Analysis (AHA) and updated as new findings are determined.

Project Managers, site Safety and Health Officers (SHO) and/or other site managers are responsible for inspecting drill rig operations and verifying they are conducted in compliance with this program, AHA and other safety regulations and safe work practices. They are also responsible for identifying new hazards and developing control measures to prevent injuries and property damage. When the likely hazards are determined, the AHA is completed, and lay-out plan arranged, a pre-planning session must be held prior to any work. Orientation of the drilling crew will require their familiarization with the AHA specific to their work.

3.1 Drillers and Drillers' Helpers

Drillers and drillers' helpers are responsible for complying with this program and for inspecting drilling equipment for damage and defects prior to each use. Workers will immediately report damaged and defective equipment to their supervisors.

All members of drilling crews shall be trained in:

- The operation, maintenance, and inspection of the equipment;
- The safety features and procedures to be used during operation and maintenance of the equipment and the locations of any emergency shut-off; and
- The hazards of operating the equipment, including overhead electrical lines and underground hazards.

4. PRE-STARTUP REQUIREMENTS

4.1 Drilling Equipment Requirements

All drilling equipment shall be equipped with two easily-accessible emergency shutdown devices: one for the operator and one for the helper.

Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts and equipment must be guarded to prevent worker contact and injuries.

Means (e.g., guard around the auger, barricade around the perimeter of the auger, or electronic brake activated by a presence-sensing device) shall be provided to guard against site worker contact with the auger. Guarding must meet the following basic requirements:

- Guarding must be installed and used in such a way as to prevent employee contact with moving augers.
- Guarding must be designed and installed in such a way as to not pose additional hazards, such as protrusions, possibility of becoming entangled with moving augers, etc.
- Guarding should either be securely attached to the drill rig, or be able to be placed on the ground in a stable configuration so as not to fall over during operations.
- If possible, guarding should be interlocked with auger drive mechanism, such that the guard cannot be removed during auger movement.

The use of side-feed swivel collars on drill rods are restricted to those collars which are retained by either a manufacturer-design stabilizer or a stabilizer approved by a professional engineer.

Drilling equipment shall be posted with signs warning the operator of electrical hazards. No modification of the equipment or any tool can be made without the approval of the manufacturer.

If drilling fluids or materials (like Bentonite) are to be used, their MSDS must be made available for ITSI review prior to mobilization.

4.2 Equipment Inspections and Maintenance

All drilling equipment brought on site must be operated, inspected, and maintained as specified in the manufacturer's operating manual, in new or like new condition and according to OSHA regulations. A copy of the manual will be available on site during drilling operations. Inspections will include an initial inspection of the equipment by a qualified mechanic, by ITSI, and subsequent daily inspections by the driller. All inspections are to be documented. Drillers are responsible for inspecting all equipment for damage and defects at the start of each work shift, and must perform the following checks:

- Verify that oil, coolant, hydraulic, and fuel reservoirs are filled.
- Inspect hydraulic fittings and hoses for leaks, cracks, and other damage. Verify that caps and filler plugs are secure.
- Lubricate moving parts according to the manufacturer's specifications.
- Inspect air or mud system lines, valves and pressure reliefs, drain cocks, and other components. Verify correct air pressure with no leakage. All gauges must work.
- Visually inspect equipment for physical corrosion, cracks, missing parts, and bent or deformed plates or welds.
- Tighten or replace loose or missing hardware, nuts, bolts, and pins. Verify that replacement parts meet manufacturer's specifications.
- Verify adequate clearance between the drill rig and surrounding equipment, structures, and electrical lines.
- Inspect pulleys for wear and proper lubrication.

For inspections of rigging including wire-rope the requirements of the USACE EM385-1-1 or manufacturer's recommendations will apply. Lines, cables, and wire ropes must be inspected for evidence of excessive wear, fraying, broken strands, "bird-caging," or unraveling. Lines must be replaced if any of the following conditions exist:

- Evidence of heat damage;
- Kinking, crushing, bird-caging, or other distortion in lines;
- Six randomly distributed broken wires in any one lay of running rope;
- Three broken wires in any one strand of running rope;

- More than two broken wires in any one lay of standing rope in sections beyond the end connections;
- More than one broken wire in any one lay of standing rope at an end connection; and
- Individual outside wires worn down to 2/3 or less of their original diameter.

Wire ropes must be replaced if they are worn down more than the amounts specified below:

Original Nominal Diameter	Amount of Wear Requiring Replacement
5/16-inch	1/64-inch
3/8- to 1/2-inch	1/32-inch
9/16- to 3/4-inch	3/64-inch
7/8- to 1-1/8-inch	1/16-inch
1-1/4- to 1-1/2-inch	3/32-inch

Damaged or defective equipment must be immediately taken out of service, a tag applied stating it is out of service and must repaired or replaced immediately with documented notification to ITSI before re-use.

4.3 Drilling Locations

Prior to bringing earth drilling equipment on the job site, a survey shall be conducted to identify overhead electrical hazards and potential ground hazards such as underground utilities, structures, obstructions, or unexploded ordnance on former military bases. The location of any overhead or ground hazards shall be identified on a site layout plan. A clear travel path must be defined before moving drill rigs on site, or the potential hazards must be removed from the rig's intended travel route and signs posting warning of the overhead hazard from approaching directions.

4.4 Overhead Power Lines

All overhead power lines and other overhead hazards must be identified in advance. If possible, overhead power lines should be de-energized, grounded, and locked out to prevent re-energizing while drill rigs are working nearby. Contact the local utility or property owner responsible for

each power line to request shutdown before drill rig setup begins. The covering of powered lines with blankets or line insulation is not an adequate barrier.

Where de-energizing power lines is impractical, the drill rig and mast must maintain the following minimum clearances from overhead power lines to prevent arcing and electrical shock:

Power Line Voltage	Minimum Clearance for Operating Drill Rigs
50,000 volts or less	10 feet
Greater than 50,000 volts	10 feet plus 4 inches for each additional 10,000 volts in the power line

In transit with the mast lowered, drill rigs must maintain the following minimum safety clearances from overhead power lines.

Power Line Voltage	Minimum Clearance for Drill Rigs in Transit
50,000 volts or less	4 feet
50,000 volts to 345,000 volts	10 feet
345,000 volts to 750,000 volts	16 feet
750,000 volts to 1,000,000 volts	20 feet

A signalman or spotter is required when moving or positioning drill rigs near overhead power lines.

4.5 Underground Utilities

Utility locating **must** be performed prior to drilling. 811 Underground Facilities Protective Organization (UFPO) and Facility Owner/POC must be contacted by the contractor penetrating the earth. The 811 E-ticket or fax must be available at the site of penetrations. For OCONUS locations, that country's utility locating service must be contacted in accordance with local regulations. All underground utilities and structures like tunnels, vaults must be located before the drill rig setup on site. This includes fiber-optic cables, water, natural gas, septic and fuel tanks, electrical, sewer, process lines, etc. Local utilities must be contacted to request location and marking of their lines. The facility owner/POC must be consulted and utility locators used to locate buried utilities/structures on the client's property. Locations of buried utilities must be clearly marked with signal flags or paint before drilling begins and those marks maintained while working in that area. The intended drill locations shall be marked out with white paint. If a utility owner does not respond to the 811 or other locator requests (Base CE, private locators, etc.) are not completed, work will not be started until those responsible parties have marked out the site or documented they do not have utilities/structures in that area.

4.6 Rig Movement

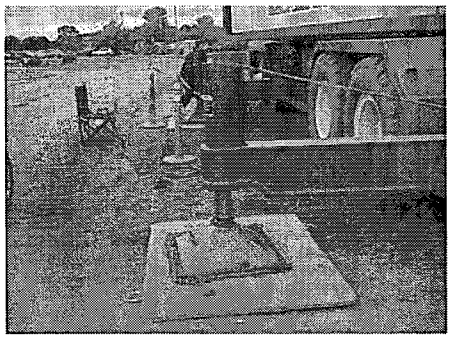
The equipment operator shall ascertain proper clearance before moving equipment. Clearance shall be monitored by a spotter or by an electrical proximity warning device.

Earth drilling equipment shall not be transported with the mast up. The exception is movement of the equipment required in drilling a series of closely-spaced holes, ONLY if all of the following conditions are met:

- Movement is over level, smooth terrain;
- The manufacturer allows mast-up movement;
- The path of travel has been inspected for stability and the absence of holes, other ground hazards, and electrical hazards; and
- The travel distance is limited to short, safe distances and within slopes tolerances required by the manufacturer.

4.7 Rig Setup

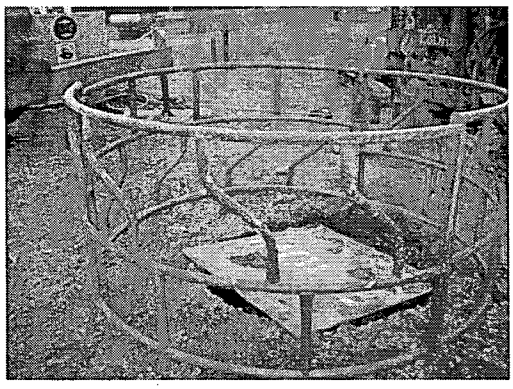
Drilling equipment must be set up on stable ground, the frame must be in a level position (plumbed with a level or built-in bubble levels), and the outriggers extended per the manufacturer's specifications, prior to raising the mast. Ground pads must be solid and prefabricated and not of timber or other loose materials and sized per the manufactures requirements.



5. OPERATIONAL PROCEDURES

- Drillers, helpers, and other personnel working near drill rigs must wear protective-toe safety shoes, safety glasses, and hard hats as a minimum. Hearing protection, respirators, and personnel protective clothing will be specified in the site-specific Health and Safety Plan.
- Loose fitting clothing, long hair, jewelry and equipment which might become entangled in moving equipment are prohibited while working near drill rigs. The use of ANSI-rated t-shirt style retro-reflective protection is acceptable due to the potential entanglement hazard of conventional safety vests.
- Eating, drinking, smoking, and chewing are prohibited while working near drill rigs. These activities may be performed in designated break areas.
- Workers must mount and dismount drill rigs using grab irons and handholds provided. Jumping off equipment is prohibited. All steps and walking surfaces are to be non-slip and gripping surfaces (like dimpled steel steps) maintained.
- Mounting and working surfaces must be kept free of mud, snow, ice, grease, oil, and other debris.
- Tools must be stored in tool boxes when not in use.
- Where drill rigs are operated indoors, direct-reading instruments must be used to monitor for carbon monoxide and other exhaust gases. Ventilation must be provided as necessary to maintain chemical exposures below OSHA Permissible Exposure Limits. When this condition is planned, a specific coordination meeting shall be held by ITSI to evaluate and plan for the unique hazards of that work.
- Drill rigs must be shut down and properly locked-out and tagged before repairs or maintenance is performed. Only properly trained and qualified individuals are permitted to perform repairs and maintenance.
- Site workers shall not be allowed on a drill mast while the drill bit is in operation or the drilling equipment is being moved.
- Drill rigs must be shut down before being left unattended and all energy released.
- Controls must be engaged slowly until hydraulic fluids and the unit is up to operating temperature. This is critical during cold weather. Impact or shock loading of the drill stem is prohibited.
- Hoists shall be used only for their designed intent and shall not be loaded beyond their rated capacity.
- Steps shall be taken to prevent two-blocking of hoists. The equipment manufacturer's procedures shall be followed and if rope becomes caught in, or objects pulled into, a cathead.
- Drill rods shall be neither run nor be rotated through rod slipping devices: no more than 1 foot (0.3 m) of drill rod column shall be hoisted above the top of the drill mast. Drill rod tool joints shall not be made up, tightened, or loosened while the rod column is supported by a rod slipping device.
- Sharp braking or hoisting is prohibited.
- Riding up the mast on hoist lines or drills is prohibited.

- Drill rigs will be operated from the operator's station only.
- Only authorized, properly trained workers will be permitted to operate drilling rigs. All unnecessary personnel will stand clear of rigs while they are in operation.
- The operator shall verbally alert site workers and visually ensure all site workers are clear from dangerous parts of equipment before starting or engaging equipment.
- Drill stem rotation must be stopped before adding or removing sections, or making adjustments to the drill stem or sampling equipment.
- Augers shall be cleaned only when the rotating mechanism is in neutral and the auger stopped; long-handled shovels shall be used to move cuttings from the auger.
- Throwing or tossing drill stems, well casings, split-spoon samplers, augers, and bags of Bentonite or cement is prohibited when moving these materials around the site. Materials heavier than 50 pounds must be moved mechanically or by using at least two people.
- Drill stems, split-spoon samplers, and augers must be controlled by means of taglines or the free ends must be held by another worker to prevent uncontrolled swinging when these materials are lifted into place above the borehole.
- Auger guides shall be used on hard surfaces.
- Drilling operations must be stopped in the event of local thunderstorm, tornado or lightning activity. During operation, weather conditions shall be monitored and operations shall cease during electrical storms or when electrical storms are imminent.
- Drilling fluids shall be channeled away from the work area to prevent ponding of water.
- Contaminated drill cuttings and purge water must be properly containerized.
- Open boreholes shall be capped and flagged and never left exposed regardless of the diameter. Should boreholes remain open due to the installation of materials, capping etc. a suitable barrier must immediately be provided to eliminate falls into the hole. This protection must comply with the OSHA 29 CFR 1926.500(b), Subpart M — Fall Protection, specifically "holes." Any hole exceeding 2 inches in its least dimension is to be protected. For borings, a physical barrier is needed and shall be secure and marked "hole" and/or or a guard installed to prevent access during work but must be physically and securely covered.



"Cattle guard Barrier"

Innovative Technical Solutions, Inc.

Driving
Safe Work Procedures

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1. REGULATIONS

- California Vehicle Code
- Other State Vehicle Codes
- 29 CFR 1926, Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), November, 2003

2. PURPOSE AND SCOPE

The purpose of this Driving Safety Program is to provide a set of safety procedures for operators of vehicles for company business, including rental vehicles. The primary focus of this Program is the safety of vehicle operators and other personnel. In addition, this Program is designed to provide for the protection of company vehicles. The Driver Safety Program is applicable to all company employees who operate motor vehicles on public roadways or on jobsites. Non-employees operating vehicles on company business, such as temporary workers, shall be also be bound by this Program.

3. DEFINITIONS

- *Assigned Vehicle* is a vehicle assigned directly to a designated position and used primarily by the assigned operator.
- *Darkness* is any time from one-half hour after sunset to one-half hour before sunrise and any other time when visibility is not sufficient to render clearly discernible any person or vehicle on the highway at a distance of 1000 feet.
- *Driver* is a person who drives or is in actual physical control of a vehicle.

- *Drivers License* is a valid license to drive the type of motor vehicle or combination of vehicles for which a person is licensed under the California Vehicle Code.
- *Highway* is a way or place of whatever nature, publicly maintained and open to the use of the public, for purposes of vehicular travel, including streets and roads.
- *Roadway* is that portion of a highway improved, designed, or ordinarily used for vehicular travel.
- *Stop* means a full cessation of movement of a vehicle.
- Traffic includes pedestrians, ridden animals, vehicles, street cars, and other conveyances, either singly or together, while using any highway for purposes of travel.
- *Use* means official company business use of vehicles by company employees.
- *Vehicle* is any device by which a person or property may be propelled, moved, or drawn upon a highway.

4. RESPONSIBILITIES

4.1. Health & Safety Manager

The Health & Safety Manager is responsible for administering the Driving Safety Program and for:

- Maintaining and updating this Program annually and whenever necessary to reflect new or modified tasks and procedures.
- Reviewing vehicle accidents which occurred since the previous update to this Program.
- Assisting supervisors in evaluating vehicular accidents.
- Assisting supervisors in providing training to employees concerning driver safety.
- Performs a periodic review of employee driver records to ensure current license and satisfactory operating record.

4.2. Supervisors

Supervisory personnel are responsible for:

- Ensuring that the provisions of this Program are implemented and that all employees follow the requirements
- Training employees under their supervision concerning driver safety.
- Submitting required accident reports to the Health & Safety Manager within the specified time period.
- Requesting the Health & Safety Manager's assistance in reviewing accident reports to evaluate them for causal elements.

4.3. Employees

Employees are responsible for:

- Operating motor vehicles in a safe manner, and conforming with all applicable laws.

- Maintaining correct operator's license and endorsement(s) required for their position.
- Following the procedures of this Program designed to eliminate or minimize hazards from motor vehicle operations.
- Immediately reporting vehicular accidents to their supervisor.

5. VEHICLE INSPECTIONS

Drivers must be certain that the vehicles under their control operate in a satisfactory manner. Prior to the use of a vehicle, the driver should perform an inspection of vehicle components and systems. Inspections should be completed daily, prior to use of company vehicles. Heavy trucks and equipment shall be inspected under separate procedures specified by under the Heavy Equipment Program. Items to be checked during vehicle inspections include:

- Check overall appearance - windows in place, tires inflated, lights and wipers in place.
- Presence of accident reporting forms, first aid kit, warning devices, window squeegee, etc.
- Operation of controls - ignition switch, steering wheel, gear selector, accelerator pedal, brake pedal, parking brake, mirrors.
- Quantity of fuel, oil and radiator water (check gauges).
- Operation of wipers, lights, turn signals.

If any condition prevents use of the vehicle, or if items are missing from the vehicle, personnel should notify their supervisor immediately

If vehicles are found containing trash or other debris, personnel should inform their supervisor, who should request the last user of the vehicle to clean it. Trash and other debris in a vehicle constitute a safety and health hazard, and should not be permitted to accumulate in vehicles used on company business.

6. OPERATING PROCEDURES FOR VEHICLES

6.1. Observing Laws

All employees who drive vehicles as a part of their employment shall observe the provisions of the Vehicle Code appropriate for the state of operation whenever operating vehicles upon roadways.

6.2. Alcohol and Drugs

Vehicles shall not be operated by anyone under the influence of any drug or alcohol.

6.3. Operator Distractions

Distractions to the operator of motor vehicles present a significant hazard to drivers, occupants, other motorists, and pedestrians. These distractions may include use of cellular phones, eating, reaching for items in the back seat, writing, or reading. Operators must eliminate distractions during driving by pre-planning (reading maps ahead of time), pulling to the roadside to accomplish tasks or make phone calls, and simply by focusing on the task of driving and not letting other tasks or issues interfere with that task.

6.4. Speed Limits

The driver shall drive at a safe speed no greater than that permitted by law.

6.5. Operators License

Drivers of vehicles shall have in their possession a valid Driver's License or Commercial Driver's License with required endorsements.

6.6. Courtesy

Drivers of company vehicles shall be courteous toward other operators and pedestrians at all times.

6.7. Authorized Operators and Riders

Drivers shall not permit anyone other than an authorized employee to operate the vehicle for which they are responsible.

- Hitchhikers shall not be permitted to ride on or in vehicles.
- The driver shall be responsible for the safe loading of the vehicle.

6.8. Use of Seat Belts

Seat belts shall be used by all occupants of vehicles used on company business.

6.9. Following Vehicles

The driver shall allow a sufficient distance ahead when following another vehicle so that a safe stop can be made.

6.10. Parking

Park vehicles in parking spaces provided; otherwise, they shall be parked on the right-hand side of the street or highway (unless on one-way streets). Park so other vehicles can pass with ease and safety. When moving from a parking space, either angle or parallel, the driver shall see that traffic is clear before moving into lane of traffic. Vehicles 20 feet or more in length shall be parked parallel to curb or street. When parking at a curb, the vehicle should not be farther than

18 inches from the curb. When it is necessary to park on a grade, the driver shall make sure that the vehicle is left in a safe position. Front wheels shall be cut into the curb and the wheels chocked for additional protection.

6.11. Stopping on a Roadway

Stopping on a roadway presents additional hazards to vehicle drivers and the motoring public who are sharing that roadway. Most roadways are designed for the smooth flow of traffic. Parking is not normally part of this process except in urban areas, and thus represents an abnormal event for the driver who is used to a routine set of occurrences when traveling a roadway. A parked vehicle near the traffic lanes is an exception to the normal flow. Drivers of other vehicles need additional warning to alert them to the hazards they are approaching. The following list provides several methods to decrease the hazards to Company personnel and the motoring public. When parking on a traveled roadway:

- Pull as far off of the traveled way as possible.
- Look for approaching traffic before opening vehicle doors on the traffic lane side.
- Turn on the vehicle's warning lights (emergency flashers or warning flasher).
- Install warning signs or other devices (barricades, sign, flags, cones, etc.).
- Additionally at night or in reduced visibility, leave the headlights on (low beam).
- If the vehicle is disabled, reflectorized warning triangles shall be placed at an interval of 10, 100 and 200 feet to the rear of the disabled vehicle.

6.12. Backing

No person shall start a vehicle stopped, standing or parked on a highway, nor shall any person back a vehicle on a highway until such movement can be made with reasonable safety.

Whenever possible, personnel should position their vehicle to avoid the necessity of backing later. Extreme caution shall be exercised when backing a vehicle, to avoid injury to persons and to prevent property damage. If an assistant is available, that person shall be stationed at the rear of vehicle to assist the driver in backing the vehicle safely. When backing:

- Check your blind zone.
- Watch both sides.
- Back slowly.
- Do not depend entirely on mirrors.
- In any difficult backing situation, enlist the help of another person on the ground as a guide, when such help is available.
- Most importantly, remember the driver is totally responsible for the backing maneuver.

6.13. Warning for Oversized Loads

When material extends more than four feet from the bed or body of a vehicle, as measured from the tail lights, a warning device - a red flag, 12 inches square or larger (during daylight) or a

warning light (at night) shall be displayed on the end of material or equipment that projects beyond the rear or side of the vehicle. These warning devices must also be displayed whenever the truck or trailer is parked on the highway.

6.14. Passengers

No person shall ride on any vehicle or upon any portion thereof not designed or intended for the use of passengers. Drivers of vehicles shall not allow anyone to ride on the fenders, running boards, engine hoods, tops of cabs, trailers, or in any position not considered safe (except in case of emergency, and then only upon proper authority). Seat belts shall be worn by all passengers.

6.15. Right-of-Way

Drivers shall drive safely and courteously at all times. Drivers shall yield the right-of-way to other vehicles and to pedestrians in all cases where failure to do so endangers any person or vehicle.

- When approaching an intersection, yield to vehicles which have already entered the intersection from the other highway.
- When two vehicles enter an intersection from different highways at the same time, the driver of the vehicle on the left shall yield to the vehicle on the immediate right.
- When approaching an intersection from different highways and the traffic control signals are not working properly, all vehicles shall stop, and proceed with caution when safe to do so.
- When making a U-turn, yield to oncoming traffic and do not proceed unless the complete maneuver can be completed safely.
- At intersections yield to vehicles which constitute an immediate hazard, and proceed unless the complete maneuver can be completed safely.
- At intersections controlled by a yield Right-Of-Way sign, yield to traffic in the intersection or approaching which pose an immediate hazard. Proceed only when reasonably safe.
- When entering or crossing a highway yield to all traffic approaching which constitutes an immediate hazard, and proceed only when reasonably safe.
- Yield to emergency vehicles sounding sirens and displaying red and/or blue lights. Drive to the right hand edge of the roadway and stop and remain stopped until the emergency vehicle has passed.
- Yield to pedestrians crossing the roadway at marked or unmarked crosswalks, and sidewalks.

7. MOTOR VEHICLE ACCIDENTS

Drivers of vehicles on company business shall operate them in a safe manner. If a vehicle is involved in an accident, the driver must take the following steps to alleviate injuries, reduce hazards, and document the incident. The following actions should be taken:

1. Stop at once.
2. Move as far off to side of roadway as possible to prevent further accidents.
3. Place warning devices and/or warn other approaching drivers of the hazard.
4. Call for medical emergency assistance if necessary. If calling from cellular telephone, be sure to state your exact location, and the type of assistance necessary.
5. Check on passenger and other vehicle occupants for medical conditions which require immediate treatment. Render first aid to the extent of your training.
6. Call the police department or the Sheriff to the scene of any vehicle accident if the accident involves personal injury or damage to vehicles, equipment, or property not belonging to the company. If police respond, insist on a report being made.
7. Keep calm. Be courteous. Do not discuss or argue the causes or results of an accident with other parties. Discuss the specifics of the accident only with the police and your employer. Simply give the facts of what happened. Make no statement admitting fault!
8. Get information from the other driver, including name, driver's license number, and insurance carrier.
9. Record the make, model, color, and license plate number of the other vehicle involved.
10. Obtain the names and addresses of all witnesses, and whatever facts you can.
11. Provide only name, license number, insurance information, and work contact information. DO NOT PROVIDE HOME ADDRESS OR PHONE NUMBER.
12. Complete initial parts of the enclosed Accident Report form report at the scene if possible.
13. If damage is slight and your vehicle can be safely operated, proceed with caution to your nearest destination. If the vehicle cannot be safely operated call a tow truck, and get towed to the nearest location which can put the vehicle to a serviceable condition.
14. Report the incident immediately to your supervisor, and fill out rest of Accident Report. The provisions of the Accident Reporting and Investigation Program should be followed. In addition, a Report of Traffic Accident form must be submitted to the appropriate Department of Motor Vehicles generally within 10 days of any incident which results in property damage over $500 or in bodily injury or death.

8. TRAINING

The company will provide Driver Safety Training for employees, as indicated by observance of unsafe driving behavior or vehicle accidents. This training may include periodic refresher training for experienced drivers, commercial truck driver certification classes, and any other type of training which would benefit the company.

9. RECORDKEEPING

The following records will be maintained by the company, in accordance with the provisions of the Recordkeeping Program:

- Certification of employee's current driver's license and endorsements.
- Reports of accidents.

- Reports of license suspension.
- Training attendance reports.

Innovative Technical Solutions, Inc.

Drum and Container Handling
Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response
- 8 CCR 5192, Hazardous Waste Operations and Emergency Response
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), November, 2003

2. PURPOSE AND SCOPE

This procedure describes the minimum requirements for the safe handling, sampling, overpacking and crushing of drums and other similar containers. Drums and containers may be handled for purposes of staging, characterization, removal, and disposal. Potential hazards of drum and container handling may include:

- Detonation
- Fire
- Explosion
- Vapor generation
- Physical injury

3. PRE-INSPECTION

All drums and containers should be approached cautiously until their contents and condition have been characterized. Prior to handling, drums must be inspected for potential hazards. Personnel should look for:

- Symbols, words, or other marks on the drum indicating that its contents are hazardous; e.g., radioactive, explosive, corrosive, toxic, flammable.
- Symbols, words, or other marks on a drum indicating that it contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume individual containers.
- Signs of deterioration such as corrosion, rust, and leaks.
- Signs that the drum is under pressure, such as swelling and bulging.
- Drum type (stainless steel, polyethylene, fiberboard, etc.).
- Configuration of the drum head, which may indicate whether the contents are liquid or solid.

4. REQUIRED EQUIPMENT

The following equipment should be available in the immediate work area during drum handling.

- Fire extinguishers.
- Non-sparking tools.
- Spill adsorbent material (loose or in pads or booms).
- Direct-reading instruments for air monitoring.
- Overpack containers.

5. AIR MONITORING

As a precaution, workers should assume that unlabeled drums contain hazardous contents until their contents have been characterized. Direct-reading instruments such as radiation meters, combustible gas indicators, flame ionization detectors, or photoionization detectors must be used to monitor for toxics, flammables and/or radiation around drums prior to and during handling, if the contents are unknown.

6. PERSONAL PROTECTIVE EQUIPMENT AND RESPIRATORS

Level B protection (supplied-air respirators with a high level of skin protection) must be worn when working with unknown materials. For known materials or those expected to present low hazard potential, Level C with full-face respirators with organic vapor/acid gas cartridges should be worn in addition to the appropriate skin protection.

7. SAFE WORK PRACTICES

The following safe work procedures must be followed for all drum handling:

- Personnel involved in drum handling and characterization must have prior training on potential hazards and safe work practices for these activities.
- Drums should only be handled/moved only to the extent that is absolutely necessary as the potential for leaks, rupture and exposure increases with the amount of handling.
- Personnel must immediately notify their supervisor or the site safety and health officer of any changing conditions and new information that appear during drum handling.
- Drums should be handled one at a time.
- Where explosive or shock-sensitive contents are suspected, drums must be handled and sampled remotely via mechanical means.
- Critically swollen drums must not be moved until pressure is relieved.
- All ignition sources must be removed from a 75 foot radius around drum handling activities.
- Personnel are prohibited from standing, walking or sitting on drums.
- When using slings, yokes or other lifting devices to move drums; personnel assisting the lift should move away a safe distance from the area before the drum is lifted.
- Walking or standing under suspended loads is prohibited.
- Mechanical devices should be used to move drums due to their weight, as drums may weigh 200 - 600 pounds.
- Drums that appear in imminent danger of failing should be overpacked as soon as possible.
- When lifting drums, operators must have a clear view of the path of the drum. Spotters should be used if the operator's view is blocked.

8. STAGING, OPENING AND SAMPLING

Drums should be staged in a logical and orderly manner. The arrangement of drums will allow adequate aisles for entrance and exit when working around the drums. Movement of drums should be kept to a minimum. Drums of like contents must be staged together and away from drums of incompatible contents. Gas cylinders must be staged in a cool shaded area. Potentially explosive and shock-sensitive drums must be stored at a location distant from other site activities and in a bermed, fenced area. Drums may be stacked no more than two high, with pallets between.

The following procedures should be followed for drum opening and sampling.

- Air monitoring must be performed at the drum opening before and during opening.
- Access to the drum opening area must be limited to essential personnel only.
- Where explosive or shock-sensitive contents are suspected, drums must be opened remotely by mechanical means.
- If the drum shows signs of bulging or swelling, excess pressure can be relieved by gently cracking the bung prior to opening.
- Non-sparking tools such as plastic, bronze or beryllium should be used for drum opening.

- Only one drum at a time should be opened. Drums must be left open only as long as is necessary to take samples. Drums should be closed and resealed as quickly as possible.
- Samplers should stand to the side of an open drum and avoid leaning over the opening.
- If the drum lid is unable to re replaced securely, the drum should be overpacked or its contents off-loaded to another container.
- Sampling equipment should be decontaminated between drums to avoid cross-contamination and mixtures of incompatible compounds.

9. OVERPACKING

Drums exposed to the outdoor elements for a long period of time may be in poor physical condition. Many are rusted and have holes, thus creating a high risk for spills and splashes during handling. Drums of questionable integrity must not be moved. Leaky or potentially leaking drums should either be emptied of contents and crushed or overpacked.

Overpacking should be performed by mechanical means when possible. Drums will be lifted, using vise grips or a grappler, and lowered into an overpack drum. The should be lifted no higher than is necessary and swinging of the drums will be kept to a minimum. If overpacking must be performed manually, the overpack should be placed over the leaking drum, the drums tilted on their sides, and then uprighted. Personnel performing manual overpacking must utilize a high level of personal protective equipment.

Lids should be placed and sealed on overpack drums as quickly as possible. Emergency spill materials should be staged in the area of drum overpacking.

10. DRUM DEMOLITION

Empty drums may be crushed in preparation for disposal. Workers must stand well clear of the crushing operation. Crushing, moving and loading the drums for storage or transport must be performed mechanically. The operator should maintain a clear evacuation route from this equipment at all times. Only empty drums may be crushed. Due to the high noise of drum crushing, workers in the area must wear hearing protection.

Innovative Technical Solutions, Inc.
A Gilbane Company

Electrical Sources and Powered Tools
Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910, Subpart S, Electrical
- 29 CFR 1926, Subpart I, Tools – Hand and Power
- 29 CFR 1926, Subpart K, Electrical
- 8 CCR 2300 – 2599, Low-Voltage Electrical Safety Orders
- 8 CCR 1684-1692, Powder-Actuated Tools

- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 2008
- NFPA 70E, Electrical Safety Requirements for Employee Workplaces
- National Electrical Code (NEC)

2. PURPOSE AND SCOPE

Electricity has long been recognized as a serious workplace hazard, exposing ITSI employees and our subcontractors to such hazards as shocks, electrocution, arcing, fire and explosion. This safe work procedure is designed to prevent electrical injuries and property damage when working on our projects or using electrically powered tools or equipment. This procedure is also a resource for awareness training of employees to ensure they have the requisite knowledge understanding of electrical work hazards, common controls to those hazards and safe work practices. This Safe Work Procedure (SWP) does not address the Control of Hazardous Energy or satisfy the need for Hazardous Energy Control Program. The focus is on temporary power and powered tools on ITSI work sites. Should there be a conflict between any local or state regulation and code, the most stringent will apply.

3. RESPONSIBILITIES

The following describes the responsibilities of the Project Managers, superintendents and Site Safety and Health Officers.

3.1 Project Managers, Superintendents and Site Safety and Health Officers

Management and supervisors must:

- Plan for electrical use, its maintenance and controls prior to any mobilization of any trades.
- Ensure awareness training for those arriving at our job site regarding the electrical sources available, electrical hazards, and the expected use of temporary power supplies.
- Ensure anyone on the project understands they have the right to stop work and report any safety concern to their supervisor and any ITSI employee.
- Oversee and maintain a weekly cord inspection program for extension cords and devices that plug in.
- Conduct inspections to identify electrical safety deficiencies and correct all deficiencies promptly.
- Work with those designing the systems to ensure all new electrical installations meet the requirements of quality, codes and regulations.

3.2 Subcontractors, Supervisors and All Site Workers

Subcontractors are required to provide a qualified person with verifiable credentials such as state, national, host nation and/or local certifications or licenses, which a master or journeyman (or equivalent – OCONUS) electrician may hold, depending on the type of work to be performed. These qualifications should be specified in the site specific AHA.

Provide awareness training for those arriving on our project on the electrical sources available and their expected use including:

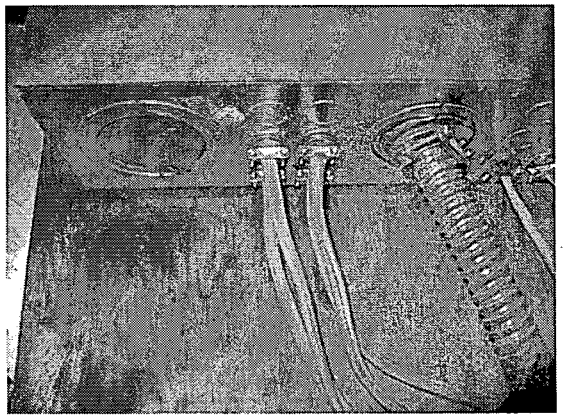
- Properly inspect all electrical equipment prior to use
- Never use electrical related devices that are not in new or like-new condition
- Report electrical deficiencies immediately to a supervisor
- Not work on electrical equipment unless authorized and trained
- Do not operate equipment if you suspect an electrical problem
- Hazards of water and electricity
- Even low voltages can kill or injure
- The dangers of using cords or plugs if the ground prong is missing
- Overloading electrical receptacles or use residential outlet strips for connecting

- If any worker or supervisor is found working with an electrical device that is not in obvious new or like-new condition, the appropriate level of retraining and discipline will be provided up to and including the potential for that person's removal from the site.
- There will be a zero-tolerance for egregious violations, like an unauthorized entry into a locked panel to obtain power or leaving an exposed and energized electrified panel unprotected.

4. HAZARD CONTROL

4.1 Engineering Controls

- A sketch of the proposed temporary power system and those components will be submitted to the client for review prior to that work, when required.
- Water tight enclosure shall be used where there is possibility of moisture entry either from operations or weather exposure. This includes rain in a building under construction.
- Sump-type pumps placement requires a specific plan for their construction, safe installation, protection and maintenance during use.
- No temporary covers for panel protection will be allowed
- Permanent and temporary electrical distribution areas will be guarded against accidental damage by locating in specifically designed rooms, use of substantial cabinets or physical barriers like a bollard or railings.
- A clear approach and minimum of 3 foot side clearance shall be maintained for all distribution panels.
- All conduit shall be fully supported throughout its length. Non-electrical attachments to conduit are prohibited.
- All cords from a fixed device (like a pipe-threading machine or panel) shall be provided strain relief when the cord is great than 2' from a support.
- All combustibles shall be kept at least 30' from distribution boxes and never allowed to accumulate in electrical rooms or vaults.
- All electrical distribution panels, breakers, disconnect, switches, junction boxes shall be completely enclosed.



Missing knock-out New Installation

Lesson learned – temporary power panels shall be inspected prior to energization to ensure all knock-out penetrations are covered with a blank.

4.2 Administrative Controls

- An overall Hazardous Energy Control Program will be developed for each project. This SWP and that HECP will be coordinated by ITSI and the client in regard to energization of systems or devices <u>and include methods of notification developed so each worker is aware of controls, barriers or energization.</u>
- Only trained and authorized employees may conduct repairs to electrical equipment.
- Contractors performing electrical work must hold a state contractor's license for the rated work
- Access to electrical distribution rooms is limited to those employees who have a need to enter. Self-closing doors will be installed prior to energization of a room or vault and those doors secured with working locks.
- All electrical control devices shall be properly labeled
- Work on energized circuits is prohibited

4.3 Safe Work Procedures

- All qualified employees will follow established electrical safety procedures and precautions as dictated by code, generally accepted electrical procedures, or manufacturer's instructions.
- Only authorized and qualified persons shall make repairs or work on electrical equipment.
- Working surfaces shall be kept dry when working with or near electrical equipment.
- All circuits or apparatus shall be considered live and proven de-energized with a test instrument.
- Electrical source equipment or powered devices with damaged insulation, missing grounds, exposed wiring, or conductors shall not be used and immediately tagged out of service when discovered.
- Never use water to put out a fire around energized electrical equipment.

- The use of flexible cords in lieu of permanent wiring is prohibited. All cords are to be 12 gauge or larger and must be marked for medium or heavy duty.
- All cord tools shall have their grounds and polarity verified and GFCI's tested prior to the first use on the job.

Lesson learned – All flexible cords, leads and other conductors of power or grounds shall be kept off walking or working surfaces.

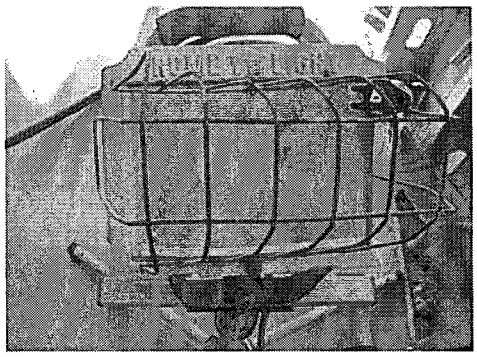
5. ELECTRICAL EQUIPMENT

5.1 Inspection

Electrical equipment shall be free from recognized hazards that are likely to cause death or serious physical harm to employees, grounded as required by the manufacturer, and in new or like-new condition. Safety of equipment shall be determined using the following considerations:

- Suitability for installation and based on durability, ease of use and expected weather conditions.
- Mechanical strength and durability, including, rugged parts designed to enclose and protect the device or equipment
- Electrical insulation.
- Heating effects under conditions of use.
- Arcing effects.
- Classification by type, size, voltage, current capacity, and specific use.
- Other factors which contribute to the practical safeguarding of employees using or likely to come in contact with the equipment.

Lesson Learned: The suitability of equipment for an identified purpose may be stated on the label, for example: "Not suited for commercial use." The light below may be suitable only for the hobbyist:



"Home Light"

5.2 Identification of Disconnecting Means and Circuits

All disconnects or switches shall be marked and of sufficient durability to withstand the environment.

Each disconnect switch or overcurrent device required for a service, feeder, or branch circuit must be clearly labeled to indicate the circuit's function, and the label or marking should be located at the point where the circuit originates. For example, on a panel that controls several temporary power outlets, each breaker must be clearly marked to indicate the specific set of outlets to which each circuit is connected and the main breaker the portion of the work area supplied.

6. ELECTRICAL LOCKOUT & TAGOUT REQUIREMENTS

All maintenance, adjustment, or repair work that could expose employees to hazardous energy sources, including electricity, must be conducted in accordance with the job specific Control of Hazardous Energy Safe Work Plan and the controls coordinated with the client and affected contractors covered by that specific plan. Energized work is prohibited.

7. WORKING AT ELEVATED LOCATIONS

Any activity that requires work at any height will require development of a Fall Prevention Plan specific to each task. This plan will be reviewed by ITSI prior to any work at height and must meet or exceed the Safety Work Plan for Fall Prevention.

8. WARNINGS AND BARRICADES

Warnings and barricades shall be employed to alert those working in areas where electrical systems are being energized. Distances shall be in accordance with NFPA 70E.

When work is being planned for energization of panels, for example, a step-by-step plan for that work would have been created by the Control of Hazardous Energy Plan and may include the installation of self-closing doors to the room containing the panels, and steps for covering of those panels prior to energization.

With the exception of overhead gantry rails or energization of overhead power lines, no energized systems or their components should result in exposure to individuals.

Lesson Learned: Energization of "house" power outlet and switches is not allowed unless they are installed and protected as required or the conductor (Plug Tail connection) not exposed.

Energized, Incomplete Switch

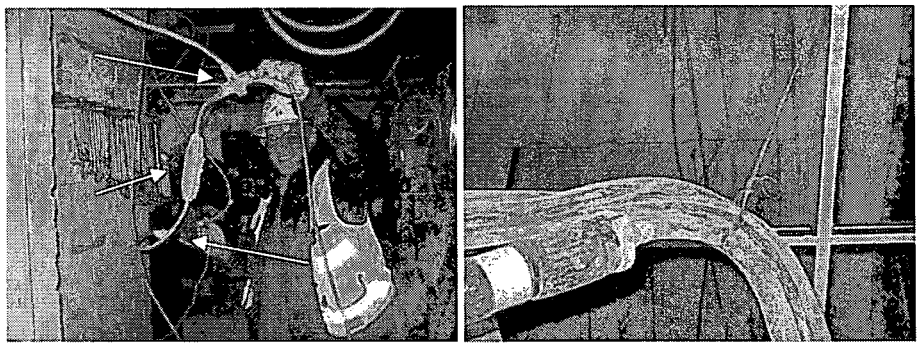
9. POWERED EQUIPMENT, POWER TOOLS – SOME PRECAUTIONS

Electrical equipment is defined as cord or plug-type electrical devices which include the use of flexible or extension cords. Examples of portable electrical equipment included powered hand tools, powered bench tools, fans, radios, etc. **The use of battery-powered tools is encouraged to eliminate cord handling, maintenance and provisions for keeping them off walking and working surfaces.** The following safety rules apply to portable electrical equipment:

- Portable electrical equipment shall be handled in such a manner as to not cause damage.
- Portable electrical equipment shall be visually inspected for damage, wear, cracked or split outer jackets or insulation, etc., before use.
- Ground type cord sets may only be used with ground type receptacles when used with equipment requiring a ground type conductor.
- Attachment plugs and receptacle may not be altered or connected in a way that would prevent the proper continuity of the equipment grounding conductor. Adapters may not be used if they interrupt the continuity of the grounding conductor.
- Only portable electrical equipment or tools that are double insulated or designed for use in wet areas may be used in those conditions.
- The use of "power/outlet strips" is not allowed.
- If temporary power passed through a wall, that penetration must be designed to protect the conductor from damage.
- Electrical equipment or tools must be protected by a ground fault circuit interrupter.
- Locking-type connectors shall be properly secured after connection to a power source. Battery packs for tool power cannot be charged when directly placed on a concrete surface.

Lesson Learned: Do not plug another power strip or surge protector into an existing power strip or surge protector. This practice is called "piggybacking" or "daisy chaining" as shown.

Lesson Learned: Power cords may not be stapled or otherwise hung (non-conductive method) in a way that may cause damage to the outer jacket or insulation as shown.



10. VERIFICATION OF CONTROLS – ELECTRICAL SOURCES AND POWERED TOOLS

A Tool for Planning and Training

The following controls must be in place prior to work:

- Verify – A sketch of the proposed temporary power system and those components will be submitted to the client for review prior to that work.
- Verify – An overall Hazardous Energy Control Program (HECP) will be developed for each project. This SWP and that HECP will be coordinated by ITSI and the client in regard to energization of systems or devices and include methods of notification developed so each worker is aware of controls, barriers or energization.
- Verify – When work is being planned for energization of panels for example, a step-by-step plan for that work would have been created by the Control of Hazardous Energy plan and may include the installation of self-closing doors to the room containing the panels, and steps for covering of those panels prior to energization.
- Water tight enclosure shall be used where there is possibility of moisture.
- Sump-type pumps placement requires a specific plan for their safe installation
- No temporary covers for panel protection will be allowed
- Permanent and temporary electrical distribution areas will be guarded against accidental damage
- A clear approach and 3 foot side clearance shall be maintained for all distribution panels.
- All conduit shall be fully supported throughout its length.
- All cords from a fixed device (like a pipe-threading machine or panel) shall be provided strain relief when the cord is great than 2' from a support.

- All combustibles shall be kept at least 30' from distribution boxes and never allowed to accumulate in electrical rooms or vaults.
- All electrical distribution panels, breakers, disconnect, switches, junction boxes shall be completely enclosed.
- Establish and maintain a weekly cord inspection program for extension cords and devices
- Verify – Conduct inspections to identify electrical safety deficiencies and correct all deficiencies promptly
- Verify – Contractors performing electrical work must hold a state contractor's license for the rated work
- New installations like electrical rooms or vaults will be sufficiently guarded with physical barriers, self-closing doors and warning signs to prevent unauthorized entry
- Access to electrical distribution rooms is limited to those employees who need to enter.
- Self-closing doors will be installed prior to energization of a room or vault with locks.
- All electrical control devices shall be properly labeled
- Work on energized circuits is prohibited
- All qualified employees will follow established electrical safety procedures
- Only authorized and qualified persons shall make repairs or work on electrical equipment.
- Working surfaces shall be kept dry when working with or near electrical equipment.
- All circuits or apparatus shall be considered live and proven de-energized with a test instrument
- Electrical source equipment or powered devices with damaged insulation, missing grounds, exposed wiring or conductors shall not be used and immediately tagged out of service when discovered.
- Never use water to put fire out around energized electrical equipment.
- A clear path to electrical panels, always
- The use of flexible cords in lieu of permanent wiring is prohibited.
- All cords are to be 12 gauge or larger and must be marked for heavy duty.
- All cords tools shall have their grounds and polarity verified and GFCI's tested prior to the first use on the job. See Cord Inspection Program for additional details
- Warnings and barricades shall be employed to alert those working in areas where electrical systems are being energized.
- Lesson Learned – Energization of "house" power outlet and switches is not allowed unless they are installed and protected as required or the conductor (plug tail connection) not exposed.
- Portable electrical equipment shall be handled in such a manner as to not cause damage.
- Portable electrical equipment shall be visually inspected for damage, wear, cracked or split outer jackets or insulation, etc., before use.

- Portable electrical equipment that remains connected once energized (area fan) need not be inspected until relocated. Any defects; such as cracked or split outer jackets or insulation must be repaired, replaced or placed out of service.
- Ground type cord sets may only be used with ground type receptacles.
- Attachment plugs and receptacle may not be altered or connected in a way that would prevent the proper continuity of the equipment grounding conductor. Adapters may not be used if they interrupt the continuity of the grounding conductor.
- Only portable electrical equipment or tools that are double insulated or designed for use in wet areas may be used in those conditions.
- The use of "power/outlet strips" is not allowed
- If temporary power passed through a wall that penetration must be designed to protect the conductor from damage
- Electrical equipment or tools must be protected by a ground fault circuit interrupter.
- Locking-type connectors shall be properly secured after connection to a power source. Battery packs for tool power cannot be charged when placed on a concrete surface
- Lesson Learned – Do not plug another power strip or surge protector into an existing power strip or surge protector. This practice is called "piggybacking" or "daisy chaining" as shown below.
- Lesson Learned – Power cords may not be stapled or otherwise hung (non-conductive method) in a way that may cause damage to the outer jacket or insulation.
- Properly inspect all electrical equipment prior to use – see cord inspection program
- Never use electrical related devices that are not in new or like-new condition
- Report electrical deficiencies immediately to a supervisor
- Not work on electrical equipment unless authorized and trained
- Should any worker or supervisor be found working with an electrical device that is not in new or like-new condition the appropriate level of retraining and accountability will be provided up to and including the potential for removal from the site for egregious violations like an unauthorized entry into a locked panel to obtain power or leaving an unprotected, electrified panel unprotected.
- Do not operate equipment if you suspect an electrical problem
- Hazards of water and electricity
- Even low voltages can kill or injure you
- The dangers of using cords or plugs if the ground prong is missing
- Overloading electrical receptacles or use residential outlet strips for connecting

Color Coding of Inspected Cords

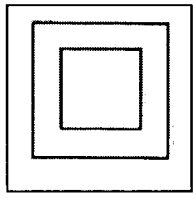
11. INSPECTION AND MAINTENANCE OF POWER CORDS AND TOOLS

Cords (and cords on equipment) are to be inspected before initial use at the task, whenever used. Once a week the each cord must be inspected and if intact, marked. A simple piece of colored tape will be wrapped around the male end of the cord to verify. Cords found not inspected (based on condition or color) will be removed from service. Inspection code will reflect:

Black	First Week of Month
Red	Second
Green	Third
Blue	Fourth
Yellow	Fifth

Cords shall be inspected per the manufacturer's guidance and that may include:

- The cord must be marked for medium or heavy duty use – S, ST, SO, and STO for hard service embossed on line or tagged and:
- Must be 12 gauge or larger
- Cord ends must not be pulled away from the conductor
- No exposed wiring, broken insulation or cords with broken or cracked insulation. No cuts through the insulation are allowed.
- Cannot be repaired with tape
- No evidence of any cord melting or arc damage
- Must have three wires cords are to be used
- Flexible cords, string lights and cables free of splices
- Clamps or other strain relief means provided on flexible cords or cables at plugs including receptacles, panels, tools, equipment, etc.
- If the cord is hanging from a fixture (like a panel) strain relief needed
- Is there a ground lug when needed on the line or cord to tools
- If the tool is double insulated is it marked as such →
- No cord can appear crushed
- Wiring correct for polarity and continuity of ground?
- Does the GFCI trip when tested?



Innovative Technical Solutions, Inc.

Ergonomics
Safe Work Procedures

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1. REGULATIONS

- 8 CCR 5110, Repetitive Motion Injuries

2. PURPOSE AND SCOPE

The purpose of this Program is to effectively eliminate or control ergonomic injuries and hazards in the workplace. *Ergonomics* is the science of fitting jobs to people. Ergonomic injuries arise when the job requirements or the work environment do not fit the capabilities, limitations, or physical attributes of the worker. Ergonomic injuries can be severely debilitating, especially because they may limit a worker's ability to work because the job itself causes an injury to the body part required to perform the job. Many ergonomic injuries involve extensive recuperation periods, resulting in increased workers' compensation costs and lost productivity. Ergonomic injuries may occur in any work environment, including construction, material handling, and office environments. This program applies to all personnel, including temporary workers.

3. RESPONSIBLE PERSONNEL

The Health & Safety Manager will maintain responsibility for the overall implementation of this program. The Health & Safety Manager should develop a team of personnel to handle the various aspects involved with managing ergonomic issues, including:

- Human Resources personnel to manage the medical, recordkeeping, and compensation issues surrounding existing injuries.
- Facilities personnel to implement workplace controls.
- Purchasing personnel to ensure newly-purchased products provide the best ergonomic fit for the job.
- Project Managers to engineer jobs according to ergonomic principles.

4. TYPES OF ERGONOMIC INJURIES

Ergonomic injuries encompass a wide range of symptoms and syndromes. Ergonomic injuries may occur quickly, as in sprains and strains, or may be of a chronic nature. Ergonomic injuries often are identified by names such as: Repetitive Motion Injuries (RMIs), Work-Related Musculoskeletal Disorders (WMSDs), and Cumulative Trauma Disorders (CTDs). These injuries are generally chronic in nature. Some of the more common specific chronic ergonomic injuries include:

- *Carpal Tunnel Syndrome*: compression of a nerve as it goes through the carpal tunnel in the heel of the hand.
- *Cubital Tunnel Syndrome*: compression of a nerve as it passes through the notch of the elbow.
- *Epicondylitis*: inflammation of tendons at the elbow, including tennis elbow (outside of elbow) and golfer's elbow (inside of elbow).
- *Raynaud's Phenomenon (White Finger)*: constriction of the vessels in the hands and fingers.
- *Rotator Cuff Tendinitis (Pitcher's Shoulder):* inflammation of one or more tendons at the shoulder.
- *Thoracic Outlet Syndrome:* compression of nerves and vessels between the neck and shoulder.
- *Trigger Finger:* inflammation of the tendon that causes locking of the fingers.

Other ergonomic injuries and symptoms may include chronic back pain, eye strain, blurred vision, headaches, stiffness and soreness, tingling nerves. These conditions vary in severity, and some may be precursors to more serious conditions.

5. ERGONOMIC RISK FACTORS

The presence of a number of risk factors can determine the potential for ergonomic injuries. These may include:

- Force
- Repetition
- Posture, awkward positions
- Duration of tasks, breaks

- Pace
- Vibration
- Contact with sharp surfaces
- Thermal stressors
- Poor lighting
- Non-work activities

The Ergonomics Evaluation form may be utilized in order to evaluate risk factors present in the work areas.

6. PROGRAM IMPLEMENTATION

6.1. Prioritization

The following priorities will be given in the implementation of this program:

1. Resolution of existing employee injuries and symptoms through:
   - Reporting of ergonomic symptoms by employees
   - Referral to a health care provider as appropriate and management of the health care process
   - Implementation of controls such as work restrictions, workstation redesign, and employee training in proper work practices.
2. Evaluation of the workplace and existing workstations for risk factors and appropriate ergonomic design.
3. During the planning of new projects and expansions, and purchasing of new products, ensuring that ergonomic principles are followed.

6.2. Implementation Steps

The following steps will be taken in implementing this program:

1. Identify and manage existing and developing injuries
2. Implement controls
3. Provide training to employees
4. Identify others potentially at risk
5. Future facility and task design
6. Accurate recordkeeping to comply with regulations, track personal injuries, and evaluate program progress
7. Evaluation/review of this Program

7. REPORTING

Employees will be encouraged to report all ergonomic symptoms to a supervisor or the Health and Safety Manager. All reports of ergonomic symptoms will be followed up on within one week. The Health and Safety Manager will fill out the Ergonomics Symptoms Survey form to aid in identifying symptoms.

If an employee is experiencing pain or loss of function, it will be handled as a potential workplace injury, referral to the employer's health care provider will be made, and the physician's recommendations will be followed during the course of treatment. If an employee is not experiencing pain or loss of function, but is experiencing discomfort or reports other risk factors, then referral to a physician will not be made, and evaluation and controls will be implemented by the Health and Safety Manager.

8. MEDICAL MANAGEMENT

Medical management of ergonomic injuries includes diagnosis, medical treatment, potential work restrictions, workplace controls, and follow-up. Both the employer and the employee are responsible for providing the physician complete information regarding work and off-hour conditions and activities which could have a bearing on the diagnosis and treatment. During all phases of the medical management process, strict confidentiality will be maintained in regards to the medical records, and the employer will only be entitled to review information which pertains to occupationally-relevant conditions.

8.1. Diagnosis and Treatment

During diagnosis and treatment, the health care provider evaluates the employee's actual medical condition, and may point to specific actions or conditions which could cause or aggravate the condition. The provider also determines the employee's capabilities and identifies work restrictions. The employee is responsible for following the treatment regimen, including physical and occupational therapies. The provider must use information from the employee's history and work activities in forming a course of treatment.

8.2. Work Restrictions

If a work restriction is recommended by the health care provider, the employer is responsible for reasonably providing the employee with appropriate work which will not interfere with the employee's rehabilitation, and which will not aggravate his or her condition. The employee is responsible for working within the restrictions.

Work restrictions will only be removed by the health care provider when the employee is recovered and able to return to the job, or the job is re-engineered to adequately remove or reduce the risk factors associated with the injury. The employee's earnings, seniority, and benefits must be maintained for the duration of the restrictions, or until there is a final medical determination that the employee is permanently unable to return to the job, or until 6 months have passed. Earnings may be reduced by workers' compensation or disability benefits.

9. WORKPLACE CONTROLS

Implementation of workplace controls will have a priority for employees with existing and developing ergonomic injuries, and will be implemented in a reasonable manner as soon as feasible upon the physician's recommendations. Controls consist of engineering, administrative and personal protective equipment.

9.1. Engineering Controls

Engineering controls are those which are done to redesign the work process, the work station, or otherwise change the work environment. These types of controls are preferable over administrative or protective equipment, as they eliminate the source of risk. Examples of engineering controls include:

- Tools
- Spacing
- Layout
- Changing surfaces
- Lighting

9.2. Administrative

Administrative controls are those which change how people accomplish their jobs. Examples include:

- Awareness and recognition of conditions
- Training in safe lifting techniques
- Job rotation, variation
- Reassignment
- Breaks

9.3. Safe Lifting Technique

The following steps should be followed during all lifting of heavy objects:

1. Those who have not been trained in proper lifting techniques shall not lift heavy objects.
2. If an object is large or not easily carried by one person, two (or more) properly trained people shall be utilized to lift the object.
3. Face the load squarely, get a firm footing and spread your feet 12-14 inches apart and, if possible, place one foot alongside the object being lifted.
4. Bend your knees and get a good grip on the object. Keep your back straight, vertical, and lift by straightening your legs.
5. Keep the load close to your body throughout the entire lifting process.
6. If it is necessary to turn, change your foot position, DO NOT TWIST YOUR BODY.
7. When the load is heavy or awkward, use teamwork. Lift slowly and evenly together.

9.4. Personal Protective Equipment

Personal protective equipment are controls which are worn by the employee, including braces, splints, and restrictive devices. Personal protective equipment is the least preferable form of control, as it relies on the employee to wear properly and diligently, and it does not eliminate or otherwise reduce the source of risk. Personal protective equipment should only be utilized on the advice and under the management of a health care provider.

A study by NIOSH found that back belts are not effective in reducing the risk of back injuries during lifting. Back belts may actually increase the risk due to an over-reliance on the belts, and due to lack of attention to engineering and administrative controls.

10. TRAINING

All employees will receive training in ergonomic principles through the following:

- Discussion of basic ergonomic issues during the employee orientation.
- Training in ergonomic risks and control measures specific to job assignment along with training in other job-specific hazards.
- In-depth training in management of ergonomic injuries as recommended by the health care provider.

Training elements should include:

- How to recognize ergonomic symptoms, and the importance of early reporting.
- How to make a report of ergonomic symptoms or injury.
- Potential ergonomic risks in the job.
- Job-specific controls and work practices.

11. IDENTIFYING OTHERS POTENTIALLY AT RISK

Several methods may be used in identifying individuals who may be at risk of developing ergonomic injuries, including review of records, employee surveys, and workplace evaluations.

11.1. Records Review

Patterns of injuries and risk factors may be identified through review of records such as:

- OSHA 300 log
- Worker's comp records
- First aid logs
- Accident/injury investigation records
- Employee complaints/reports
- Requests for job transfer

These records should be reviewed by the Health & Safety staff on at least an annual basis, and especially after new injuries are identified.

11.2. Employee Surveys

Employee surveys, utilizing the Ergonomic Symptoms Survey form, may be conducted for the general employee population as necessary, to proactively identify those individuals who may not otherwise come forward with ergonomic issues.

11.3. Workplace Evaluations

Workplace evaluations are conducted in the same manner as Job Hazard Assessments. The Ergonomics Evaluation form should be utilized to identify ergonomic-specific risk factors which may be present in the workplace. These evaluations must be performed at the workplace, with the employee present performing their job assignment. Other means to collect information, such as photographs, calculations, and specific measurements should also be utilized as necessary to collect the appropriate information.

12. WORKPLACE DESIGN AND PURCHASING

Ergonomic injuries will only be reduced over time if facility expansions, new projects, and new products are designed and purchased with the intent of reducing or eliminating ergonomic risk factors. Areas in which this may be accomplished include:

- Design of projects should include the health and safety staff in the planning process.
- Materials handling jobs should be evaluated for the potential of using mechanical assist devices.
- Job using hand tools should be evaluated for the benefit of tools with ergonomic grips.
- The Purchasing Department should be involved in the process of hazard reduction, and should consult with the Health and Safety Manager before making workstation and manufacturing-related purchases.

13. PROGRAM EVALUATION

Evaluation of the effectiveness of this Program should be conducted periodically. This process will include both baseline and ongoing measurements, including:

- Number of recordable injuries, number of lost workdays
- Workers' compensation severity rate and costs
- Medical costs in treating ergonomic injuries
- Number of employee reports of ergonomic symptoms
- Number of job transfer requests and turnover rate
- Employee absentee rates
- Time between employee report and response by the Health & Safety staff

- Number of symptoms surveys conducted
- Number of workplace evaluations conducted
- Number of hours (management and employees) devoted to this Program
- Expenditures on ergonomic risk reduction
- Number of employees trained and waiting to be trained

14. RECORDKEEPING

Ergonomic records will be maintained in the same manner as the other safety records, as listed in the Recordkeeping section. Records to be maintained include:

- Employee symptom reports and company responses
- Job hazard assessments and Ergonomics evaluations
- Program evaluations and results
- Occupationally-relevant medical management records.

Fire Prevention and Response
Safe Work Procedures

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1.0 EFFECTIVE REGULATIONS

- 29 CFR 1910, Subpart L, Fire Protection
- 29 CFR 1926, Subpart F, Fire Protection and Prevention
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1) September 2008
- National Fire Protective Association (NFPA)

The above regulations and standards are to be followed and not completely specified here. In addition to local or owner fire codes, the International Building Code, local building codes, common or practices or protocols. Should a conflict in interpretation occur, the most stringent will apply.

2.0 INTRODUCTION AND SCOPE

The purpose of this Fire Prevention and Response Program is to reduce or eliminate the hazard of fires on ITSI projects and offices and to provide for effective response to a fire in order to protect people and minimize property damage. The specific goals of this program are to recognize fire hazards, recommend safe work procedures, and assign individual responsibilities for fire prevention. In addition, this program provides information on fire protective equipment, response and training.

Additional fire prevention requirements for temporary offices and field work sites will be covered as part of the Site Specific Safety and Health Plans (SSHP) or Accident Prevention Plans (APP) or included within an Activity Hazard Analysis (AHA).

Specific fire prevention plans have been prepared for ITSI each office locations.

3.0 FIRE PREVENTION PLANS

Fire Prevention Plans will be created specific for each project and those unique exposures and incorporated into the AHA or SSHP. They will conform to the requirements of the USACE 385-1-1 Section 9, Fire Prevention and Protection, and referenced regulations and standards.

Following are best practices or areas of focus to consider when drafting Fire Prevention and Protection Plans, working on your project or in our offices.

4.0 RESPONSIBILITIES

The following paragraphs describe the responsibilities of each employee on the site.

4.1 Corporate Director, Health & Safety

The Corporate Director, Health & Safety and staff is responsible for administering this Program; assists in developing fire prevention plans for fixed facilities, and for assuring procedures are included in SSHPs, APPs and AHAs. Individual fire prevention plans must be reviewed and updated at least annually for effectiveness.

Through this program, training and sharing of information (for example ITSI Monday Safety Topics), ITSI will assist and advise field and office teams of changes in regulations, best practices or company policy improvements.

4.2 Site Supervisors/Safety and Health Officers (SHO)

Supervisors/SHO's are responsible at the site level for fire prevention and coordinating response to fire and will ensure inspections, permitting and education of the contractors and staff is effective. This will include hands-on training on the use of fire extinguishers where possible, recognition of fire hazards, maintenance of fire protection systems and equipment, coordination of protection when existing systems are affected by the work and the scheduling of drills and training as needed. These specifics will be discussed at orientations with arriving ITSI employees and our subcontractors.

4.3 Emergency Coordinators – Fixed Offices

An Emergency Coordinator (EC) will be identified at each office. At project job sites, the Site SHO or Supervisor will function as the EC. The coordinator must be familiar with the fire prevention plans, location of emergency exits, fire extinguishers and first aid kit/AED specific for their location. This will include monitoring of workplace conditions (including emergency exits), gathering areas, maintenance of fire extinguishing equipment and drills to assure an active fire prevention culture.

4.4 ITSI Employees

Employees are responsible for understanding this program, recognition of fire hazards, knowing evacuation protocols and routes including gathering points and the use of fire extinguishers when trained and if appropriate.

When traveling, it is critical that each employee understands what to do should a fire occur wherever they are. This includes taking the time to examine lodgings for safe routes out in a fire and knowing gathering points on projects when visiting.

5.0 FIRE HAZARD ASSESSMENT

5.1 Sources of Ignition

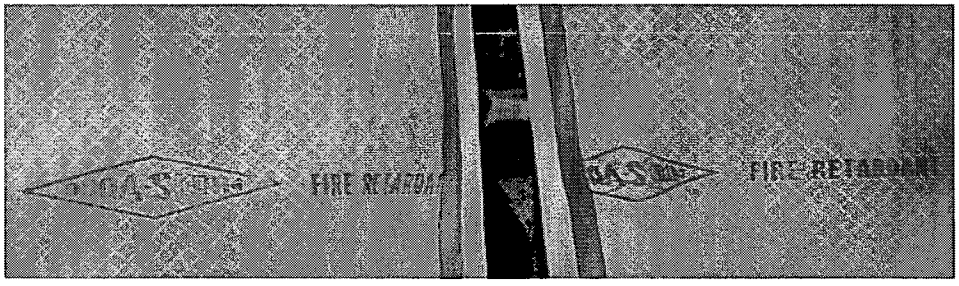
A permit system for monitoring heat producing tasks will be agreed upon at the site during planning. ITSI has a zero-tolerance for violating of fire prevention protocols. This may be a "Permit" derived by ITSI, the subcontractor, or facility or other agreements. Please refer to last page for specifics on permit protocols and expectations.
Common sources of ignition are debris and building materials from open flame and hot work or smoking, when fueling hot equipment or fires associated with damaged electrical cords and arcs. Recognition of fire hazards will be ongoing by focusing on prompt removal or protection of combustibles, care in heat producing work and clear expectations of those on the site including strict discipline for non-compliance.

6.0 FIRE PREVENTION TECHNIQUES

6.1 Fire Safety Inspections/Housekeeping Protocols and Surveys

Supervisors/SHOs are responsible for conducting regular site surveys for compliance with this program specifically *daily* coordination of the permit system. Inspections including fire hazards must occur across the site at least weekly, be documented and include:

- Ensuring combustibles like stored materials and paper backed insulation are not accumulating and only one day of material is available for installation;
- Proper storage and protection of flammable liquids and materials;
- Read and comply with all MSDS for stored materials;
- Equipment working in dry grass or brushy areas will use spark-arrestors;
- Availability of fire extinguishers and their condition;
- When working near grass or wooded areas, a 3-foot soil break will be maintained;
- During construction, fire doors and doors to electrical and control rooms will be installed as soon as practical. Such doors, if they are equipped as self-closing, must be installed with those devices working;
- Ensure only fire resistant polyethylene sheeting (clearly marked on film) is used.



The ITSI project team will ensure consistent communication with all workers on the specifics of the fire prevention plan, including the requirements of this program. Any associated permits will be posted in a public area and distributed to all contractors before their arrival and again during orientation. See last page for specifics.

7.0 SMOKE DETECTORS AND ALARMS

All temporary offices for ITSI project, including our subcontractors', must conform to local codes and regulations of temporary facilities. In addition, these office and any enclosed break areas will require carbon monoxide and smoke detectors in each room.

7.1 Fire Reporting and Response

In an event, the site specific plan created for each project will be followed. This will clearly define who will meet the responders to guide them to the fire site and to ensure the evacuation of the area is executed safely. All fires, regardless of size, will result in notification of fire services. In case of a fire, those in the area will be alerted, 911 or the local access number, and the caller will:

State there is a fire,
Identify the project area and exact location of the fire,
Explain what is on fire and how big or small it is,
State if there are any injuries or people trapped,
Stay on the line until the operator says you can hang up.

8.0 FIRE EXTINGUISHING – INDIVIDUAL ACTIONS AND STANDPIPES

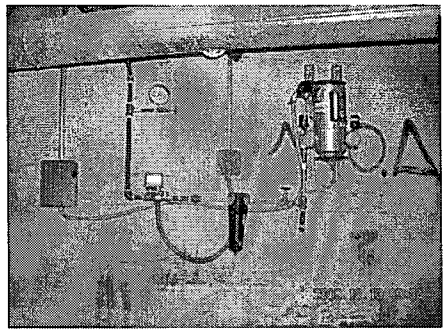
If a fire is small, an initial attempt to control the fire with a fire extinguisher may be attempted – after alerting others. Attempt to fight the fire ONLY if you are trained and feel you can extinguish the fire with no danger to yourself. Fire extinguishers will be sized and available, as defined by the task, but never more than 50 feet from any work. Portable fire extinguishers must be serviced annually by a licensed service company.

Where a hydrant system or manifold is required for the protection of building etc. including standpipes and risers, or sprinklers systems are impacted, coordination with the facility POC and local fire service will be arranged by ITSI for temporary systems or other protection(s) prior to mobilization. The NYC code offers guidance on the installation and monitoring of Temporary

Standpipes and may be used as reference to ensure the integrity of the system for the duration of its use or equivalent.

Fire hydrants and all connections shall always be kept clear of obstruction, working and available to apparatus.

Sprinkler Fire Truck Connections



Temp Standpipe Pressure Monitor and Alarm

9.0 EMPLOYEE EVACUATIONS

Equipment, planning and management of employee evacuations must comply with the provisions detailed in the site specific plan.

10.0 TRAINING

All personnel will receive training at least annually on fire prevention and basic fire safety and evacuation procedures. Evacuation drills should be held on at least an annual basis. Fire alarm locations, operating procedures and fire prevention plans will be reviewed with new employees during orientation with the Company. These elements will be reviewed with employees at least annually and after any updates or revisions.

At project locations, fire prevention and basic fire safety and evacuation procedures will be reviewed with all site workers during initial onsite orientation. Evacuation drills must be held periodically throughout the project and especially as new subcontractors mobilize to the site.

11.0 RECORDKEEPING

Recordkeeping for fire related inspections or activity will be maintained on the site.

Innovative Technical Solutions, Inc.
A Gilbane Company

Flammable Liquids Transfer
Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response
- 29 CFR 1910.102, Flammable and Combustible Liquids
- 29 CFR 1926.152, Flammable and Combustible Liquids

- 8 CCR 5192, Hazardous Waste Operations and Emergency Response
- 8 CCR 1930, Flammable and Combustible Liquids
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), October 2008

2. PURPOSE AND SCOPE

This procedure describes minimum requirements for safe work procedures during flammable liquids transfer, including bonding and grounding to prevent fires and

explosions caused by static electricity or sparks. This procedure applies to employees and subcontractors involved in transferring flammable liquids between drums, containers, vacuum trucks, tanks and/or piping.

3. DEFINITIONS

- *Bulking:* The process of combining the contents of small waste containers into larger containers.
- *Flammable Liquid:* OSHA defines flammable liquids as liquids with a flash point below 100° F (37.8° C). Flammable liquids may also be referred to as Class I materials.
- *Combustible Liquid:* OSHA defines combustible liquids as those with a flash point at or above 100° F (37.8° C). Combustible liquids may also be referred to as Class II or Class III materials.
- *Grounding:* Connecting a surface or object to the soil (ground) to drain off static electricity charges that have built up on the surface.
- *Bonding:* Connecting two surfaces or object with an electrically conductive cable to equalize the static electricity charges between them.
- *Static Electricity:* Electrical charges generated by contact and separation of two materials. Static electricity is generated when a liquid flows through a pipe or nozzle into a container. It can also be generated by compressed air, grit/sand blasting or gases spraying out of a hose or regulator.

4. RESPONSIBILITIES

4.1. Project Managers and Supervisors

A project manager or supervisor will be assigned to each project that involves flammable liquids transfer. The project manager or supervisor will prepare or request a coordination session with base operations to develop a plan for the safe control of fuels and their handling. In most cases the client will perform the transfer of fuels but that must be completed under the Control of Energized Sources program established for the work. In all cases ITSI will obtain approval from the clients Health & Safety Officer (HSO) or government designated authority before beginning to transfer flammables or combustible liquids.

Project managers and supervisors are responsible for ensuring that correct bonding and grounding procedures and other safe work practices are used. These procedures include:

- Proper identification and compatibility testing on wastes that will be bulked to classify them as flammables or combustibles
- Verification that existing earth-grounds are intact and provide a path to ground based on resistivity measurements.
- Verifying that a voltmeter or equivalent is used to check for static charges after bonding and grounding cables are in place and before liquid transfer begins;

- Ensure that employees use proper personal protective equipment (PPE) and respirators, as specified by the site safety and health plan or Activity Hazard Analysis (AHA).

4.2. Site Safety & Health Officer (SHO)

The site SHO or that on-site representative or the Corporate Health & Safety Manager is responsible for reviewing proposed bulking and flammable liquids transfer activities. These individuals will perform a hazard analysis on each activity and select appropriate PPE, respirators and other safety equipment, and will approve site health and safety plans and AHA's for bulking and flammable transfer projects.

4.3. All Employees

All employees are responsible for using safe work practices to characterize and transfer flammable wastes. This includes using correct bonding and grounding procedures when transferring flammable liquids. Employees will immediately notify their supervisor or the health and safety staff of unsafe conditions or defective equipment. This includes requesting additional equipment if working conditions change during flammable liquid transfers. Employees will also immediately notify their supervisor or the health and safety staff of any accidents, injuries, chemical exposures, spills, releases, fires or other reactions.

5. REQUIRED EQUIPMENT

- Spray paint for marking drums and containers;
- Permanent markers such as "Sharpies";
- Type ABC fire extinguisher (20 lb.);
- Spill absorbent and shovel;
- Funnels and paint screens;
- Vacuum truck with appropriate hoses, clamps and pumps;
- Non-Sparking Bung wrenches;
- DOT-approved waste containers for bulk materials;
- Bonding and grounding cables and clamps;
- Volt meter;
- Transfer equipment rated for movement of flammable or combustible liquids
- Manifests and drum inventory sheets;
- DOT labels and placards for waste transport;
- Field HazCat kit and HazCat SOP and forms (for unknown materials).

6. HAZARDS AND CONTROL MEASURES

6.1. Static Electricity/Bonding and Grounding

Static Electricity- Ignition of flammable vapors can occur from a number of sources, including frictional sparks, electrical motors, and static electricity. Static sparks can occur when there is not a good electrically-conductive path between two objects. This may occur especially when liquids are transferred between two containers or a hose and a container. This is especially dangerous when the sparks occur around tank exhausts, fill pipes, vacuum truck fill openings, open drums or containers, or other areas where high concentrations of flammable vapors exist.

Bonding- Is used to eliminate a difference in static charge between two objects. Grounding is used to drain a static charge into the earth. Proper bonding and grounding requires a metal, electrically conductive path between the bonded objects and to the ground conductor to the earth-ground. Paint, dirt, grease and rust will interfere with this path and make the bonding and grounding connections useless. *All grounding and bonding connections must be clean, metal to metal contacts.*

Grounding- rods must be firmly imbedded in the dirt at least eight feet deep. Concrete and asphalt will not provide proper grounding. Grounding rods driven through concrete or asphalt must be long enough to satisfy the USACE 385.1.1 11D-Grounding and include:

- Electrodes of rod or pipe shall be free from non-conducting coatings and, if practicable, shall be embedded below permanent moisture levels.

- Grounding rod and pipe electrodes shall be in unbroken 8-ft (2.4-m) lengths and driven to full depth. Where rock bottom is encountered, the electrode shall be driven at an angle not to exceed 45° from the vertical or shall be buried in a trench that is at least 2.5 ft (0.7 m) deep.

- A single electrode that does not have a resistance to ground of 25 ohms or less, shall be augmented by one additional electrode spaced no closer than 6 ft (1.8 m) to the first electrode.

- Electrodes of rods of iron or steel shall be at least 5/8 in (15 mm) diameter. Nonferrous rods, or their equivalent, shall be listed by a nationally-recognized testing laboratory and shall be at least ½ in (12 mm) diameter

- Electrodes of pipe or conduit shall be at least 3/4 in (1.9 cm) trade size. Pipes and conduit of iron or steel shall have the outer surface galvanized or otherwise metal-coated for corrosion control.

Fuel Tank Considerations

The fill rate for an empty (or nearly empty) tank must be reduced to prevent excessive turbulence, spraying and misting which results in high rate of static generation. The fuel velocity shall not exceed three feet per second until the liquid level is one foot above the inlet level. Floating roof tanks require the same precautions until the roof becomes buoyant.

Personnel will not be allowed in spaces located on top of underground or cut and covered or hardened tanks during fuel receipt, testing or transfers. Personnel are also restricted from on top of aboveground storage tanks during fuel receipt, testing or transfer.

6.2. Prohibited Activities

- Flammable liquids transfer must not be performed during thunderstorms or lightning activity.
- Top filling where the fuel free falls or splashes is prohibited. Electrostatic charges buildup very rapidly during this type of operation.
- Flammable and combustible liquids must not be bulked into open top containers unless a local exhaust ventilation hood is available to prevent inhalation exposures and to remove flammable gases and vapors.
- No ignition sources or smoking materials are allowed within 75 feet of areas where flammable liquids are present or in accordance with site specific requirements. sources of ignition may include items such as welding equipment, matches, lighters, heavy equipment, forklifts, electrical and sampling equipment that is not rated as explosion-proof or intrinsically safe.

6.3. Warning Labels

Flammable liquid and gas storage tanks and containers for transfer or storage of fuels must be labeled with flammable hazard warning signs, the name of their contents and a warning that ignition sources must be kept at least 75 feet away or in accordance with site specific requirements.

6.4. PPE and Respirators

The Site Health and Safety Plan and AHA should list specific PPE and respirators required for each work operation. PPE and respirators will be selected on the basis of the specific work operations and chemicals to be handled, and in accordance with the OSHA/USACE compliant PPE and Respiratory Programs.

6.5. Other Safety Equipment

At least two 20-pound types ABC, dry chemical fire extinguisher must be present in the immediate work area during flammable liquid transfer operations. A first aid kit must also be present in the work area. Spill control materials such as absorbents, pails, shovels and disposal containers must be present accessible and present in the work area during these operations.

7. OPERATIONAL PROCEDURES

7.1. Work Area Setup

When arriving at the site to perform flammable liquid transfer operations, contact ITSI Supervisor and Site POC before beginning work, to coordinate flammable liquid transfer with other site activities. This will prevent disruption of the other site activities and minimize the risk of exposures to unprotected personnel.

Flammable liquid transfer operations should be performed downwind of other personnel and work activities whenever physically possible.

Set the flammable liquid transfer work area out of the way of vehicle and foot traffic. Use barricades, cones or other devices to clearly identify the work area and to prevent unauthorized access.

7.2. Transfer Between Drums and Tanks

The following steps should be followed when transferring flammable liquids between drums and tanks:

- Verify that wastes are compatible by field HazCat testing or review of site contaminants
- Check all bonding and grounding cables and clamps to be sure that there are no breaks or defects;
- Do not open the drum or any valves or lines until all bonding and grounding connections are complete and have been checked for continuity and resistance at earth-ground;
- Ground the tank. Attach one end of a grounding cable to the tank and the other end to an approved grounding point as far away as possible from the tank. (This ground must be evaluated prior to use for adequate conductance to earth ground and resistivity.
- Bond the pump or fill pipe to the tank. Attach one end of a bonding cable to the tank and the other end to a metal part of the pump or fill pipe. (If there is direct metal to metal contact between the tank and the fill pipe or pump, it is not necessary to bond them together);
- Bond the pump or fill pipe to the drum. Attach one end of a bonding cable to the pump or fill pipe and the other end to the drum;
- When using a wand or "stinger" to pump liquid into or out of drums, the pump must be bonded to the stinger and the stinger must be bonded to the drum;
- Ground the drum. Attach one end of a grounding cable to the drum and the other end to a grounding point. Avoid placing grounding rods through concrete or asphalt;
- Check all connections with a voltmeter or continuity tester to be sure that there is no static charge at any point in the equipment;
- Open the drum and valves using non-sparking tools;
- Avoid pumping excess air while sucking liquids out of drums. This causes excessive turbulence and builds up additional static charges; drum bungs may be used if practical.

- When finished, use non-sparking tools to close the drum and valves. Remove the bonding cable between the drum and the pump or fill pipe first. Then remove the remaining bonding cables. The two grounding cables should come off last.

7.3. Transferring Liquids from Large Containers to Small Temporary Containers

The following steps should be followed when filling small temporary containers from larger drums or storage tanks:

- Verify that wastes are compatible by field HazCat testing or reviewing site contaminants;
- Ground the drum or large container;
- Bond the hand pump or filling hose to the drum;
- Bond the hand pump or filling hose to the smaller container;
- Ground the smaller container.
- Check for continuity in all connections before opening the drum;
- When finished, remove the bonding cable between the smaller container and the hand pump or filling hose first. Then remove the other bonding cables. Grounding cables are removed last;

NOTE: There will always be a small amount of residual liquid remaining in the larger container. This liquid and its flammable vapors will persist inside the container, and may result in a flammable atmosphere.

7.4. Pumping Drums into Vacuum Trucks

The following steps should be followed to transfer flammables into vacuum trucks from drums or containers. This process may also be referred to as "stinging" drums:

- Verify that wastes are compatible by field HazCat testing or reviewing site contaminants;
- Park the truck. Set brakes and chock wheels to prevent truck movement and spills; Ground the truck. Attach one end of a grounding cable to a metal point on the truck tank and the other end to a grounding rod or other remote metal grounding point that is buried per Grounding protocols;
- Bond the fill hose to the vacuum truck;
- Bond the fill hose to the drum or container;
- Ground the drum or container
- Check for continuity in all connections and ground to earth before opening the drum;
- Vacuum trucks must be filled and emptied only through the bottom.
- Vacuum trucks will not use pressure to transfer flammable liquids. These must be pumped out; DO NOT pump excess air when transferring flammable liquids, this causes turbulence and increases static charge buildup
- When finished, remove the bonding cable between the drum or container and the filling hose first. Then remove the other bonding cables. Grounding cables are removed last;

NOTE: there will always be a small amount of residual liquid remaining in the larger container. This liquid and its flammable vapors will persist inside the container, and may result in the development of a flammable atmosphere.

7.5. Transferring Flammable Liquids From Tanks Into Vacuum Trucks

The following steps should be followed to transfer flammables into vacuum trucks from tanks.

- Verify that wastes are compatible by field HazCat testing or reviewing site contaminants;
- Park the truck. Set brakes and chock wheels to prevent truck movement and spills;
- Ground the truck. Attach one end of a grounding cable to a metal point on the truck tank and the other end to a grounding rod or other remote metal grounding point that is buried at least two feet deep in the soil;
- Bond the fill hose to the vacuum truck;
- Bond the fill hose to the tank; If the tank does not have a built-in ground as part of its structure, ground the tank by attaching a grounding cable clamped to a metal rod imbedded in the dirt. Avoid placing grounding rods through concrete or asphalt;
- Check for continuity in all connections before opening the drum;
- Vacuum trucks must be filled and emptied only through the bottom. Over shot splash filling is not allowed;
- Vacuum trucks will not blow off flammable liquids. These must be pumped out;
- DO NOT pump excess air when transferring flammable liquids, this causes turbulence and increases static charge buildup;
- When finished, remove the bonding cable between the tank and the filling hose first. Then remove the other bonding cables. Remove grounding cables last.

7.6. Manually Bulking Small Containers into Drums

Manual bulking can be performed at Household Hazardous Waste (HHW) collection events:

- Verify that wastes are compatible by field HazCat testing or reviewing site contaminants;
- Ground the receiving drum and bond the funnel or screen to the drum;
- Bond each small container to the funnel or to the drum, while pouring;
- Check for continuity in all connections before pouring liquids into the receiving drum;
- Do not bulk volatile or flammable liquids into open top containers;
- Record the contents of each drum on a drum inventory sheet;
- Maintain 2.5 to 3 inches of headspace in each drum to allow for thermal expansion;

- When finished, remove the bonding cable between the small container and the drum first. Then remove the other bonding cables. Remove grounding cables last.

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Innovative Technical Solutions, Inc.

Hazard Communication (Chemical Product Safety) Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910.1000, Air Contaminants
- 29 CFR 1910.1200, Hazard Communication
- 29 CFR 1926.55, Gases, Vapors, Fumes, Dusts, and Mists
- 29 CFR 1926.57, Ventilation

- 8 CCR 5194, Hazard Communication
- 8 CCR 5141, Control of Harmful Exposure to Employees
- 8 CCR 5164, Storage of Hazardous Substances
- 8 CCR 5155, Airborne Contaminants

- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), November, 2003

2. INTRODUCTION

Chemical products stored and used at ITSI offices, on ITSI project sites, and stored on ITSI vehicles may present special hazards to its employees. These hazards include flammability,

corrosiveness, reactivity and incompatibility, and toxicity. Because of these potential hazards, special precautions must be taken which include:

- Tracking and controlling all chemical products received and stored at these locations,
- A hazard evaluation of each chemical product, using such sources as Material Safety Data Sheets (MSDSs),
- Informing workers of the potential hazards through training, MSDSs, and appropriate labeling of containers,
- Air monitoring in the case of potential respiratory hazards,
- Design and implementation of engineering controls such as ventilation and source control,
- Development of storage, handling, housekeeping and decontamination procedures,
- Assigning appropriate personal protective equipment such as eye and face protection, gloves, body protection, and respirators, and
- Training all personnel handling chemicals on safe handling procedures, personal protective equipment, and emergency and spill cleanup procedures.

Specific procedures, including area-specific safe work procedures, must be developed utilizing the Job Hazard Analysis process.

Hazardous waste materials that may be encountered on project sites are not covered by this program. Site Health & Safety Plans address chemical and other hazard assessment and mitigation associated with site contaminants including investigation and remediation of waste materials.

3. WHO IS COVERED BY THIS PROGRAM

This policy applies to all personnel at ITSI offices or ITSI-managed client sites, including contractors and visitors. This Program will be made available to all employees and contract employees who may be exposed to hazardous substances while performing duties at these facilities. The Chemical Safety Officer will maintain responsibility for the implementation of this Program.

4. CHEMICALS COVERED BY THIS PROGRAM

For the purposes of this program, chemicals considered to be hazardous are those:

- Listed in the OSHA Permissible Exposure Limits.
- Included in the American Conference of Governmental Hygienists (ACGIH) Threshold Limit Values for Chemical Substances.
- Found to be suspected or confirmed carcinogens by the National Toxicology Program in the latest edition of the Annual Report on Carcinogens, or by the International Agency for Research on Cancer (IARC) in the latest edition of the IARC monographs.

A list of chemicals included in this program, and for which MSDSs must be maintained, may be found in the Chemical Inventory for each office. Exceptions to this policy, by OSHA definition, include consumer products which are used in a consumer fashion and which pose no more of an exposure hazard than a consumer would face.

5. EMPLOYEE RIGHTS

The OSHA Hazard Communication Standards contain specific employee rights provisions, including the requirement that employees be informed of their rights under the standard. These rights include:

- Personal receipt of information regarding the substances to which they may be exposed;
- The ability of their physician or bargaining unit to receive information regarding the substances to which the employee may be exposed;
- Protection against discharge or disciplinary action for exercising the rights provided under the Standard;
- Receipt of information regarding the requirements of the standard;
- Notification of operations in the work area where hazardous materials are present;
- Notification of the location and availability of this written program and the MSDS's;
- Receipt of training in the nature of the chemical hazards, types of exposures, control and prevention of exposures, methods of detection of the presence of the material in the workplace air, and the use of MSDS materials.

6. RESPONSIBLE PERSONNEL

6.1. Chemical Safety Officer

The Chemical Safety Officer is responsible for the safe management of all chemical products entering ITSI offices and being used in the field. Specific duties include:

- Chemical purchase approval and tracking;
- Receipt, organization, updating and distribution of MSDSs;
- Tracking proper receipt and storage of chemical products;
- Ensuring proper labels, placards, and signs are in place in both storage and work locations;
- Ensuring proper chemical handling procedures are being followed, including storage, material transfer, bonding and grounding, etc.;
- Periodic inspection of areas where chemical waste is produced, treated, or stored;
- Coordination with outside contractors dealing with chemical waste;
- Maintain all necessary chemical storage and handling permits;
- Arranging for timely disposal of all chemical wastes, including those produced during spill response; and

- Ensuring all chemicals and chemical wastes to be transported from the office are packaged and labeled in accordance with all applicable regulations.

The Chemical Safety Officer will have or receive more in-depth training on chemical hazards and protective measures, including:

- Chemical risk assessment,
- Chemical protective equipment selection,
- Chemical storage and compatibility,
- Safe handling techniques,
- Spill control procedures, and
- Applicable regulations.

6.2. Chemical Inventory Technician

Each office shall have one employee assigned as the Chemical Inventory Technician who reports to the Chemical Safety Officer. Responsibilities include:

- Receiving delivered chemicals;
- Inspecting packages for evidence of damage or leakage, and refusing damaged packages as appropriate;
- If chemical leakage is observed, using basic spill control procedures and contacting the Chemical Safety Officer or Company Safety Officer;
- Recording chemical deliveries on the appropriate receiving paperwork;
- Collecting Material Safety Data Sheets received with chemical shipments, and delivering them to the Chemical Safety Officer ; and
- Preparing, packaging and labeling chemical containers for shipment off-site, according to direction given by the Chemical Safety Officer.

The Chemical Inventory Technician will receive Chemical Hazard Communication training with emphasis on chemical handling and storage, as well as:

- Chemical receiving protocol and recordkeeping,
- Package and container inspection, and
- First responder procedures, including emergency notification procedures.

Field technicians who store or transport hazardous chemicals on their assigned company trucks and/or use them in the course of their work at field sites (e.g. remediation system operations), will do so under the procedural supervision of the Chemical Safety Officer and the site-specific project manager. Field technicians will also be trained in the Hazard Communication Program.

7. CHEMICAL MANAGEMENT

7.1. Chemical Approval, Purchasing and Tracking

The Chemical Safety Officer must approve all chemicals to be purchased for or stored in the offices, on field vehicles, or at field sites. This approval is accomplished through use of the Chemical Approval Form. The Chemical Safety Officer reviews the hazard and safety data available for the chemical, and retains authority to refuse approval for purchase of the chemical if the hazards of the chemical make it inappropriate for use at the work location, based upon coordination with management personnel.

The hazard evaluation includes such factors as:

- Vapor pressure,
- Flash point and flammable range,
- pH,
- Incompatibilities,
- Reactivity,
- Toxic hazards, including Permissible Exposure Limits, and
- Target organs and symptoms of exposure

All chemicals must be purchased by the Chemical Safety Officer or office-specific Chemical Inventory Technicians to ensure compliance with the chemical approval process. The following exceptions are allowed:

- Office supply chemicals (copy toner, white-board cleaner, etc.)
- Field site-specific chemicals (remediation system operations)

Office supply chemicals may be purchased by the office manager or their representative provided the type and quantity are previously approved by the Chemical Safety Officer.

Field site-specific chemicals may be purchased by the assigned field technician provided the type and quantity are approved by the Chemical Safety Officer and the technician has been properly trained for use of that chemical.

No hazardous chemicals are to be purchased that have not been previously authorized by the Chemical Safety Officer by use of the Chemical Authorization Form.

The chemical approval process follows:

- The requesting employee fills out the appropriate sections of the Chemical Approval Form and submits it to the Chemical Safety Officer.
- The Chemical Safety Officer reviews and signs the Approval form, and either purchases it directly or assigns a trained technician to make the purchase (usually the Chemical Inventory Technician).

- When the Chemical Inventory Technician, or assigned field technician, receives an order for purchase of a chemical, they must check the order against the information supplied on the Approval form to ensure that quantities purchased are within chemical inventory and permit limits.

7.2. Chemical Receiving and Inventory

The following procedure is used when chemicals are received at the office:

- The Chemical Inventory Technician inspects the packages for evidence of damage or leakage, and refuses damaged packages as appropriate.
- If chemical leakage is observed, the Technician utilizes basic spill control procedures and notifies the facility emergency number.
- The Chemical Inventory Technician inspects containers for appropriate labeling, and informs the Chemical Safety Officer if containers are not labeled properly.
- If the package is intact, the Technician records the chemical type, quantity, and storage location on the Chemical Receiving Log. The Logs are submitted to the Chemical Safety Officer on a bi-weekly basis.
- The Technician collects the Material Safety Data Sheets received with the chemical shipments, and delivers them to the Chemical Safety Officer along with the Chemical Receiving Log.
- The Chemical Safety Officer assures that the chemicals listed on the Receiving Log are entered onto the Chemical Inventory.
- The Chemical Safety Officer makes copies of the MSDSs and places them in the appropriate binders. New MSDSs will be checked against existing MSDSs, and the most updated one will be retained.
- Additional training and controls are implemented, as necessary, based on information in the Chemical Approval Form, and on consultation with the Chemical Safety Officer.

Chemical supplies are included in the bi-weekly field supply inventory inspection. The Chemical Inventory Technician checks that:

- Quantities in stock do not exceed authorized amounts as indicated on Chemical Approval Form, and
- Storage and labeling have not been compromised.

7.3. Chemical Shipping

Shipping of all chemical containers, whether product or waste, will be coordinated through the Chemical Safety Officer. All DOT regulations will be followed, including provisions for packaging, labeling, and manifesting.

8. MATERIAL SAFETY DATA SHEETS (MSDSS)

8.1. MSDS Description

The MSDS is a detailed information bulletin prepared by the manufacturer or distributor of a chemical. Information on an MSDS aids in the selection of safe products and helps prepare employers and employees to respond effectively to daily exposure situations as well as emergency situations. The required sections of an MSDS are:

- Chemical identity,
- Hazardous ingredients,
- Physical and chemical characteristics,
- Fire and explosion hazard data,
- Reactivity data,
- Health hazards,
- Precautions for safe handling and use, and
- Control measures.

OSHA specifies the information to be included on an MSDS, but does not prescribe the precise format. The non-mandatory OSHA MSDS Form 174 provides a general format for MSDSs.

MSDSs are intended to be a comprehensive source of information for all types of employers. Although there may be information on an MSDS that is either generic or not specifically applicable to all employees, it is important to search for the pertinent information regarding the chemical, and to note any "red flags" which may show up. These "red flags" often point out extreme health hazards or specific reactivities or incompatibilities.

8.2. MSDS Maintenance

The company is entitled to obtain an MSDS with each purchase of a chemical. A central file of updated MSDSs will be maintained for each chemical used or stored at each facility, corresponding with the chemicals on the Chemical Inventory. The Chemical Inventory Technician will be responsible for verifying that MSDSs are included with the chemical shipment, and for delivering the MSDSs to the Chemical Safety Officer. The Chemical Safety Officer will assure that copies of the appropriate MSDSs are placed in the binders in the areas where the specific chemicals are used. Each chemical cabinet will also have its own inventory list. Copies of all MSDSs will be maintained in the Health & Safety files according to the schedule in the Recordkeeping Procedures section.

If a chemical supplier fails to send an MSDS with the chemical delivery, the Chemical Safety Officer will arrange to receive one from the supplier. The MSDS Request Form may be used for this purpose. When new and significant information becomes available concerning a product's hazards or protective measures, the chemical supplier must add this information to the MSDS within three months and provide it to customers with the next shipment of the product. In addition, if the MSDS does not contain clear or complete enough information in order to protect the health of the employees, the supplier must provide additional information upon request. If the supplier fails to provide the appropriate information, a written complaint may be made to

OSHA. OSHA will then contact the supplier to obtain the information, and take enforcement action as necessary.

8.3. Trade Secrets

Some product trade secret information is protected. However, in all cases the supplier is required to provide enough information for the Health & Safety Department to make informed decisions to protect the employees' health.

8.4. Other Chemical Safety Information

ITSI may also develop In-House Chemical Safety Sheets for employee use. These sheets will summarize the hazard information, and provide company-specific information regarding safe work practices required of employees.

9. CONTAINER LABELING

The Chemical Safety Officer will ensure that all hazardous chemicals stored in the office are properly labeled with at least the following information, in English, as a minimum, and the language of non-English-speaking employees who may use the product, as appropriate:

- The identity of the product and chemical components,
- Appropriate hazard warnings, and
- Name and address of the manufacturer, importer or other responsible party.

Hazard warnings will also be transmitted in the form of the NFPA or HMIS color-coded warnings, which are ranked on a 0-4 scale. Containers received at the office will be checked by the Chemical Inventory Technician to ensure that all are initially labeled. When chemicals are transferred to a portable container, labels containing chemical identification and hazard warnings must be affixed to the portable container.

10. EXPOSURE MONITORING

When the Chemical Approval process reveals chemicals which may pose a potential respiratory hazard, the Company Safety Officer will initiate personal exposure monitoring to determine the extent of the hazard. Personal exposure levels will be compared to the appropriate Cal-OSHA Permissible Exposure Limits (PELs), as listed in 8 CCR 5155, in order to determine the appropriate control measures such as increased ventilation, revised procedures, or respiratory protection. At no time will employees be permitted or required to be exposed in excess of the PELs without the appropriate respiratory protection. In addition, regardless of the actual exposure level, if an employee experiences health effects from a chemical exposure, additional control measures will be implemented in order to eliminate the health effect.

11. CHEMICAL HAZARD CONTROLS

11.1. Engineering Controls

Engineering controls are those that seek to control the work environment. These controls should always be considered first when seeking to protect from chemical hazards. These may include:

- Ventilation of the work area, including the use of localized ventilation,
- Control of ignition sources around flammable chemicals,
- Bonding and grounding between containers during flammable liquid transfer,
- Proper storage techniques, and
- Substitution with less toxic or more dilute chemicals.

11.2. Chemical Storage Procedures

Proper chemical storage procedures include:

- Storing chemicals so that the potential for incompatible chemicals to come in contact is prevented. Flammables and corrosives must be stored in the appropriate cabinets;
- Storing chemicals only in areas and locations which will not be damaged by the chemicals stored within;
- Secondary containment around chemical containers and storage areas to contain spills;
- Venting of flammables cabinets to prevent accumulation of explosive levels of flammable vapors within the cabinet;
- Quantities of stored chemicals should be kept to the minimum necessary for the operations;
- Chemical stocks should be rotated to avoid out of date or expired chemicals; and
- Containers must be inspected to ensure their integrity.

11.3. Chemical Storage Markings and Signs

Chemical storage markings and signs will comply with OSHA, NFPA and local agency regulations. Specifically, the requirements of NFPA 704 will be met whenever stored quantities exceed threshold limits. It is ITSI's intent to maintain stored quantities below these thresholds.

11.4. Safe Work Procedures

Employees must follow the following safe work procedures both in the office and in the field to minimize the potential for accidents. These include:

- Plan your work, including having the proper tools and emergency equipment on hand;
- Inform co-workers of special conditions;
- Avoid working alone when possible;
- Use proper transporting techniques;
- Never transfer liquids by mouth;
- Never use damaged equipment;

- Open containers and hoses away from the face;
- Treat waste with the same respect and precautions as raw chemicals;
- Only authorized personnel wearing appropriate protective equipment may handle hazardous materials;
- No smoking or eating in areas where hazardous materials are stored;
- Check with your supervisor before handling any chemicals, hazardous materials or equipment;
- All materials shall be appropriately labeled;
- Smoking is prohibited in areas where flammable liquids are used or stored;
- Appropriate ventilation is required wherever flammable liquids are used, stored or dispensed;
- Store flammable liquids in safety cans or flammable liquid cabinets only;
- Stand clear of boiling or splashing liquid and its vapors. Boiling and splashing always occur when charging a warm container, or when inserting warm objects into a liquid. Always perform these operations slowly to minimize boiling and splashing; and
- Rupture of containers, pipelines or systems, and asphyxiation are the primary hazards of inert gas systems. In case of gas leak or release of inert gases, leave the area to avoid asphyxiation.

11.5. Zones/Segregation

In order to avoid the spread of chemical contamination outside of the area of use, and to prevent exposure to other individuals, chemical use areas must be segregated from other areas. Procedures to ensure this include:

- Food or drink must not be consumed in chemical areas;
- Personal protective equipment must be left in chemical use areas; and
- Employees must wash their hands after chemical use.

11.6. Housekeeping

Basic housekeeping procedures can decrease the potential for chemical exposures or emergencies. These procedures include:

- Keep walkways clear;
- Keep emergency equipment accessible;
- Promptly clean up spills; and
- Be considerate of housekeeping staff by not throwing contaminated materials into the trash.

12. PERSONAL PROTECTIVE EQUIPMENT (PPE) AND RESPIRATORS

12.1. Specific Issues

PPE and respirators will be selected and utilized in accordance with the Personal Protective Equipment instructions on MSDS forms and Site Safety Plans. Specific issues to be considered for chemical protection include:

- PPE should only be used in conjunction with engineering and administrative controls. Reliance upon PPE alone can put employees at undo risk;
- Selection of PPE must be based on a hazard assessment of the chemicals to be used, utilizing the Chemical Approval Form;
- Employees must be trained in the proper use, limitations, and care of PPE;
- Storage, inspection, and maintenance procedures must be established;
- The PPE program must be evaluated to verify its effectiveness.

12.2. PPE Selection

Supervisors are responsible for assuring the proper PPE is selected and used by the employees. However, PPE selection may be complex; as such, it is important to have input from a variety of personnel, including the employees, the Company Safety Officer, qualified consultants, and vendors. Protective equipment selection is reviewed by the Health & Safety Officer. Factors to be considered in PPE selection include:

- Body part(s) exposed,
- Compatibility of the equipment with the type and concentration of chemical used,
- Respirators are selected based upon measured airborne concentrations of the chemical(s),
- Compatibility of the PPE with the work to be performed, and
- Employee preferences and worker acceptance.

13. CHEMICAL EMERGENCY RESPONSE

13.1. First Responders

Employees who may be the first on the scene of a chemical emergency, generally referred to as First Responders, must:

- Know the chemicals in their area;
- Identify hazardous chemicals and read labels and MSDSs;
- Know how chemicals move, act, and react with other chemicals and materials;
- Know how they or others can be exposed;
- Know the symptoms of exposure;
- Know how to protect self and others *in a defensive manner;*
- Know how to initiate the appropriate responders; and
- Know how to get self and others out.

13.2. Chemical Spill Response

1. Evacuate surrounding personnel and keep others out. The extent of the evacuation will depend upon the vapor pressure and hazards of the chemical spilled;
2. Identify the spilled materials if possible;
3. Notifiy the appropriate responders by calling the facility emergency number;
4. Extinguish ignition sources if the spilled chemical is flammable; and
5. Contain the spilled chemical if safe to do so.

13.3. Chemical Exposures

1. Remove exposed person to safe area;
2. Immediately flush exposed area with water immediately, especially if eyes are affected;
3. Remove contaminated clothing;
4. Identify the chemical; and
5. Notify appropriate responders.

14. TRAINING

A review will be made of the chemicals in each employee's work area. Employees who work with or are potentially exposed to hazardous chemicals will receive initial training on the elements of this Hazard Communication Program, including:

- Content and requirements of this Program and the OSHA Hazard Communication Standard,
- The potential physical and toxic hazards of the chemicals used in their work location, and especially the hazards of non-routine tasks,
- Chemical inventory and tracking procedures,
- Location of this Program, the chemical inventory, and the Material Safety Data Sheets,
- How to read Material Safety Data Sheets,
- Methods to detect the release of or exposure to chemicals in their area,
- Content and interpretation of labels,
- Safe use and handling of chemicals,
- Required personal protective equipment, and
- Basic emergency procedures.

Additional training will be provided on an annual basis, whenever a new chemical is added to the workplace, and when non-routine tasks are planned.

15. CONTRACTORS AND VISITORS

To ensure that outside contractors work safely on company jobsites, it is the contractor's contact person's responsibility to provide the following information:

- Hazardous substances that may be present in the area where the contractor may be working in.
- Precautions that may be taken; such as personal protective equipment, to reduce or prevent exposure to hazardous chemicals.
- Emergency procedures to be followed in case of an emergency such as an evacuation, fire, chemical spill, injury or illness.

Before a job is assigned to an outside contractor, the worksite will be surveyed to identify hazardous substances that may be encountered by the contractor's crew. The information obtained by this survey will be conveyed to the contractor in the specification of work or other appropriate document. MSDSs will also be provided to these personnel. The survey will reasonably identify hazards workers may be exposed to during the period of work. The contractor must be cognizant of all work conditions and hazards to employees, and must exercise appropriate precautions.

Each contractor bringing chemicals onsite must provide the Company Safety Officer with MSDSs for these materials. All containers used on site must be appropriately labeled and stored properly.

16. RECORDKEEPING

All records relating to this Program will be maintained in accordance with the Recordkeeping Program. Exposure records shall be retained for 30 years or as required by law. Training records shall be forwarded to the Health & Safety Officer for retention, with a copy retained by the supervisor.

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Innovative Technical Solutions, Inc.

Hazardous Waste Site Operations
Safe Work Procedure

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1. REGULATIONS

- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response
- 8 CCR 5192, Hazardous Waste Operations and Emergency Response
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), November, 2003

This Program is intended to meet the requirements of OSHA's Hazardous Waste Operations and Emergency Response (Hazwoper) Standard during project activities. The Hazwoper standard applies to work activities conducted in the following situations:

- Hazardous waste sites (defined in sections (a)(1)(A) through (C) of the Standard, with requirements outlined in sections (b) through (o)).
- Treatment, Storage and Disposal (TSD) facilities (defined in section (a)(1)(D), with requirements outlined in section (p)).
- Emergency response to chemical spills or releases (defined in section (a)(1)(E), with requirements outlined in section (q)).

ITSI's project work entails work on hazardous waste sites, and as stated in section (a)(2)(C) of the Standard, "Hazardous substance clean-up operations within the scope of subsections (a)(1)(A) through (a)(1)(C) of this section must comply with all subsections of this section except subsections (p) and (q)." Chemical spill response procedures on project sites are covered in the Site-Specific Health & Safety Plans prepared for each project. Emergency response to chemical spills at ITSI's offices, which are expected to be minor in scope and within the capabilities of employees to clean up directly, is covered in the Hazard Communication Program.

2. PURPOSE AND APPLICABILITY

This Hazwoper Program, and the programs associated with it, is intended to function as the part of ITSI's Corporate Health and Safety Program which is directly applicable to project sites. The following table outlines the requirements of the OSHA Hazwoper Standard, and the corresponding sections of this CHSP which address them. In addition to the sections of the CHSP which address these requirements, site-specific Health & Safety Plans are prepared for each site, which address site hazards directly.

Hazwoper Requirement	CHSP Section
Organizational structure	03 Roles & Responsibilites
Workplan and site-specific health and safety plan	19 Site Health & Safety Plans
Training program	07 Training
Medical surveillance program	15 Medical Monitoring
Standard Operating Procedures to address specific hazards	Safe Work Practices (SWPs)
Excavation safety program	Excavations SWP
Contractors & subcontractors	Addressed in Site-Specific Health & Safety Plans
Inspections to ensure efficacy of programs	11 Inspections
Analysis of site hazards	10 Job Hazard Assessments 19 Site Health & Safety Plans
Monitoring	16 Employee Exposure Monitoring
Site control measures, and personal protective equipment	17 Personal Protective Equipment 18 Respiratory Protection
Drums and containers	Drums and Containers SWP
Decontamination	Site Control, Decon, Sanitation SWP
Emergency response	13 Emergency and First Aid
Illumination	Lighting SWP
Sanitation	Site Control, Decon, Sanitation SWP
New technology programs	Addressed in Site-Specific Health & Safety Plans

Innovative Technical Solutions, Inc.
A Gilbane Company

Hearing Conservation
Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910.95 Occupational Noise Exposure
- 8 CCR 5095 - 5100 Control of Noise Exposure
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 2008

2. INTRODUCTION

The purpose of this Hearing Conservation Program is to protect employees from hearing loss that may result from excessive noise exposure that may occur in the work environment. Where feasible, exposure to harmful noise levels will be eliminated through the use of engineering controls such as enclosure, or administrative controls such as work relocation or worker rotation. When effective engineering and administrative controls are not feasible, or while they are being instituted or evaluated, appropriate hearing protective equipment may be required.

3. SCOPE

This program applies to all ITSI offices and projects. Any questions regarding this written program or the use of hearing protective equipment should be directed to the employee's supervisor, project HSM or the Corporate Director, Health & Safety.

4. DEFINITIONS

- *Action level (AL):* An 8-Hour Time-Weighted Average (TWA) of 85 dBA, integrating all sound levels from 80 dBA to at least 130 dBA.
- *Audiogram* is a chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.
- *Audiologist* is a professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association or licensed by a state board of examiners.
- *Decibel (dB)* is the unit of measurement of sound level or intensity.
- *DBA:* Decibels A-weighted. A unit of measurement for sound level, corrected to give more weight to high frequency sounds. High frequency sound is potentially more damaging to human hearing.
- *Hearing Threshold:* The minimum level of sound required before the employee can hear a specific sound frequency. Hearing thresholds are measured in dB.
- *Hertz (Hz):* The unit of measurement for sound *frequency*. Audiograms commonly measure hearing thresholds at 125, 250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hertz.
- *Noise dosimeter* is an instrument that integrates a function of sound pressure over a period of time in such a manner that it directly indicates a noise dose.
- *Noise Exposure Survey* means recording noise levels and exposure duration as well as to record as much meaningful information as possible about the noise source, instrumentation, and the work environment.
- *Permissible Exposure Limit (PEL)* An 8-Hour TWA of 90 dBA, integrating all sound levels from 90 dBA to at least 140 dBA.
- *Reportable Hearing Loss:* A negative change in hearing sensitivity, relative to an employee's baseline audiogram, of an average of 25 dB or more at 2000, 3000 and 4000 Hz in either ear.
- *Representative Exposure* means measurements of an employee's noise dose or 8 hour TWA sound level that the employers deem to be representative of the exposures of other employees in the workplace.
- *Sound level meter* is an instrument for the measurement of sound level.
- *Standard Threshold Shift:* As used by OSHA, a standard threshold shift is a significant change in the employee's hearing threshold compared to his baseline audiogram. If the employee's hearing threshold has increased an average of 10 dB or more at 2000, 3000, and 4000 Hz, OSHA considers this to be a significant change.
- *Threshold* is the lowest level of sound consistently heard by an individual.
- *Threshold Limit Value (TLV) ACGIH* An 8-Hour TWA of 85 dBA.
- *Time-weighted average sound level* is that sound level which if consistent over an 8-hour exposure, would result in the same noise dose as is measured.

5. RESPONSIBILITIES

5.1 ITSI Health & Safety Department

The Health & Safety Department is responsible for administering the Hearing Conservation Program.

Specific responsibilities include the following:

- Training employees on aspects of this Hearing Conservation Program, including the hazards of noise, the proper selection, use and limitations of protective equipment, and the meaning of their audiograms.
- Performing and/or supervising noise monitoring and noise exposure surveys as needed.
- Assisting project managers and supervisors in selecting appropriate hearing protection and noise reduction measures
- Arranging for audiometric testing for employees as required.

5.2 Supervisors

Supervisors are critical to the effectiveness of the Hearing Conservation Program. Their responsibilities include:

- Recognition, identification and notification of potential noise hazards;.
- Implementation of engineering and administrative controls when feasible;
- Assuring compliance with noise reduction measures when implemented;
- Primary responsibility for enforcing the proper wearing of hearing protective devices; and.
- Ensuring participation of affected employees in annual training and hearing tests.

5.3 Employees

Employees are responsible for protecting their own hearing. Specific responsibilities include:

- Wearing hearing protective devices properly, in areas of hazardous noise exposure or when performing activities which exceed the TWA levels.
- Inspection and care of hearing protective devices
- Requesting replacement hearing protection from supervisors as necessary
- Employees are prohibited from damaging or removing noise reduction devices such as insulation, vibration dampeners, mufflers and equipment enclosures designed to minimize noise exposures.

6. NOISE MONITORING

The monitoring strategy shall be designed to identify all employees who may be exposed at or above the allowable limits and to provide for the proper selection of PPE. Exposures will be determined without adjustment for the use of any hearing protection at the time and will reflect

the employee's full work shift. Monitoring of noise levels will be repeated whenever a change in operations, process, equipment, or controls may cause an increase employees' exposure to noise, or when an employee is concerned about potential exposure to noise.

All noise monitoring will be performed by a qualified person overseen by a certified industrial hygienist (CIH), utilizing equipment calibrated both before and after the sampling event. The following settings will be used on noise meters:

- A-weighting
- Slow-response
- 85-dB criterion level
- 3-dB exchange rate

Noise survey results will be recorded as specified by the CIH reviewing the data.

A noise survey, utilizing a calibrated noise survey meter, will be performed at the discretion of the project HSM.

ITSI safety and health staff will evaluate the need for personnel monitoring, using noise dosimeters, when information from either general surveys, client notification or from other operations indicate that employee 8-hour average exposures may exceed 85 dBA. Employee complaints or noisy conditions that make normal conversation difficult may also initiate noise surveys.

All ITSI employees monitored will be notified, in writing, of the results of noise measurements, within 15 days after receipt of such results. The HSM is responsible for sending out these notices. Copies of the actual noise surveys will be available at the site for other parties. Noise monitoring results will be maintained as exposure records in accordance with standard OSHA recordkeeping.

7. EXPOSURE LIMITS

Two primary exposure limits are applicable to noise exposure: the Action Level (AL) and the Permissible Exposure Limit (PEL) or 8 hour exposure limit. OSHA PEL and ACGIH TLV noise exposure limits vary. While OSHA PEL is 90 dBA with an 85 dBA Action Level, ACGIH TLV is 85 dBA. The USACE sets 85 dBA as the acceptable limit for DoD personnel, with an 80 dBA Action Level and 90 dBA limit for non-DoD personnel. ITSI has selected an 8-hour TWA noise exposure limit of 85 dBA in accordance with the more stringent ACGIH limit.

Employees exposed to sound levels exceeding this limit shall be protected through engineering controls or administrative measures. If these controls fail to reduce employee exposures below the listed limits, personal protective equipment must be provided, and its use required, to reduce the sound levels to within the allowable limits.

7.1 Threshold Limit Value

The TLV is 85 dBA on an 8-hour TWA basis. If employee exposures are in excess of the TLV, immediate measures must be taken to reduce their exposures, including the mandatory use of hearing protection.

If exposure durations are not 8 hours, the following table may be used to calculate the applicable TLV. It should be noted that the calculated TLVs in this table assume that the exposure for the remainder of the work shift is below 70 dBA.

Exposure Duration	ACGIH TLV- TWA, dBA
24 hours	80
16 hours	82
8 hours	85
4 hours	88
2 hours	91
1 hour	94
30 min.	97
15 min.	100
7.5 min.	103
3.75 min.	106
1.9 min.	109
Ceiling	140

Footnote (1): When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: C(1)/T(1) + C(2)/T(2) C(n)/T(n) exceeds unity, then, the mixed exposure should be considered to exceed the limit value. Cn indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level.

Exposure to impulsive or impact noise should not exceed **140 dB** peak sound pressure level.

8. ENGINEERING CONTROLS

Engineering and administrative controls will be implemented whenever possible, as the preferred methods of reducing noise exposures. Examples of engineering controls include:

- When new equipment or machinery is evaluated for purchase, the Health and Safety Department should be consulted to conduct an evaluation from a health and safety standpoint. One criteria of the evaluation should include the amount of noise the equipment will produce and how it will affect personal noise exposures.
- Activity Hazard Analysis created for noise producing work must consider this hierarchy of controls when determining appropriate controls.
- Substitution of quieter equipment.
- Increasing the distance (work station) from the source of the noise (compressor).
- Remote locations of noise producing equipment and/placement behind barriers.
- Noise reducing baffles and compartments/cabinets including enclosed cabs on motorized equipment.

- Installing rubber pads under machinery or other measures to limit vibrations.

9. ADMINISTRATIVE CONTROLS

Administrative controls consist of employee work practices which, when followed, reduce their exposure to noise. Examples of these controls include:

- Keeping employees out of high noise areas whenever possible.
- Rotation of employees in and out of high noise areas during their shift.
- Maintenance and repair schedules on equipment to reduce noise generation

When administrative controls are utilized at an operation, each affected employee will be trained in the applicable work rules, and a copy of the rules will be made available to each employee.

10. POSTINGS

Warning signs will be placed in the work areas when noise is expected to be in excess of 85 dBA, to alert employees to the hazard and to notify them of the need to wear hearing protection in such areas. In areas where posting is not feasible, open field Hazwoper sites, the requirement for hearing protection will be discussed during daily tailgate meetings and incorporated into the site specific rules. The site SHO is responsible for ensuring that warning signs are in place and legible. Copies of the OSHA Hearing Conservation Standard and this program will be available where noise hazards have been identified.

11. HEARING CONSERVATION PROGRAM

Employees whose noise exposure actually or potentially equals or exceeds 8Hr TLV of 85dBA shall be enrolled into a Hearing Conservation Program. This Program will include:

- An ongoing noise exposure assessment program.
- Training of employees.
- Audiometric testing.
- Provisions for the use of hearing protection.

12. HEARING PROTECTIVE EQUIPMENT

12.1 When Required

Potentially exposed employees will be provided with, and required to wear, hearing protection until engineering and administrative control measures are in place and noise levels are adequately reduced. Where engineering and administrative controls cannot be implemented, employees will continue to wear hearing protection as long as noise levels exceed 85 dBA.

Hearing protection is optional but recommended for employees whose exposure is below the TLV and who have not experienced a standard threshold shift.

Hearing protection is mandatory for employees who are exposed to noise levels exceeding a TWA of 85 dBA or working in posted areas.

Dual hearing protection (use of ear plugs and ear muffs) may be required in certain limited situations where noise levels exceed 115 dBA. The HSM will provide additional guidance and direction in these conditions.

12.2 Selection of Hearing Protective Equipment

Hearing Protective Equipment consists of either plugs or muffs. OSHA requires that a variety of hearing protectors be available for employees to choose (both a variety of plug and muff-type hearing protectors). Each plug or muff has a noise reduction rating (NRR) as evaluated by the USEPA. This NRR is the theoretical reduction in the noise exposure of the wearer. For example, if a work area has an ambient noise exposure of 96 dBA, an earplug with an NRR of 26 would theoretically reduce the exposure to 70 dBA. However, due to practical considerations of hearing protection use, the NRR should normally be reduced by approximately 7 dB to result in a more realistic estimate of protection.

Hearing protection should generally reduce employee exposure to at or below the TLV.

12.3 Use of Hearing Protectors

All personnel shall properly wear the prescribed hearing protectors while working in or traveling through any section of a location that is posted as Hearing Protection Required. The following rules will be enforced:

- Personal entertainment devices such as iPods, MP3 players, etc., will not be permitted
- An assortment of hearing protectors will be provided and maintained by the company.
- Hearing protectors and replacements will be provided free of charge.
- Users must be trained in the use and care of hearing protectors, ensure the proper initial fitting of the protectors, and supervise the use of hearing protectors by employees.

13. TRAINING

Employees who may potentially be exposed to high noise levels must receive initial training and annual refresher training in at least the following topics:

- Contents of the OSHA Hearing Conservation Standard;
- Requirements of the company Hearing Conservation Program;
- The effects of noise on hearing and hearing loss;
- Description of any equipment or work activities known or suspected to produce high noise levels;
- Methods of detecting excessive noise levels;
- Applicable engineering and administrative controls;
- Audiometric testing program;
- Procedures for obtaining noise monitoring and audiometric testing results;
- Instruction on selection, fitting, care and limitations of hearing protectors.

Training will be presented by the HSM, designated site SHO or other qualified personnel. Training records will be kept in the project and/or Corporate Health and Safety files.

14. EMPLOYEE POLICIES AND PROCEDURES

14.1 Work Rules

- All employees working in potentially high noise areas will be issued hearing protection.
- When employees change tasks, hearing protection will be issued as required.
- All employees working in the vicinity of high levels of noise must have hearing protection immediately available.
- If the wearing of hearing protection becomes troublesome, the required hearing protection will be worn until your supervisor has provided an alternative means of protection or you have left the affected area.

14.2 Work Rules Enforcement

Safety personnel and supervisors shall monitor and enforce the administrative controls and the wearing of hearing protection. Safety personnel and supervisors will implement the ITSI Employee Compliance and Disciplinary policy for employees who refuse to wear hearing protection.

15. AUDIOMETRIC TESTING

15.1 Policy

All ITSI employees who may potentially be exposed to high noise levels will receive pre-employment (baseline) and follow up audiometric exams at no cost. These tests are conducted by a licensed audiometric technician in accordance with standard audiometric testing protocols at an approved local medical provider.

15.2 Evaluation of Audiograms

The Corporate Medical Provider serves as the medical review officer (MRO), and will evaluate worker fitness. The evaluation will include:

- Audiogram validity
- Threshold shifts
- Need for follow-up evaluations

15.3 Notification of Results

The MRO is responsible for notifying the ITSI Safety and Health department and the employee of any standard threshold shift detected in the employee's audiograms. Employees will be notified within 10 working days of the receipt of the results or follow-up evaluation.

15.4 Required Corrective Actions

Workers exhibiting evidence of Standard Threshold Shifts are required to wear hearing protection in all potentially high noise areas of their job sites. Those employees' work areas and job assignments must be carefully reviewed by the project manager and the HSM, to determine if additional control methods can be implemented.

16. RECORDKEEPING

All records produced in relation to this program, will be maintained and provided to employees in accordance with the ITSI Recordkeeping Program. These records will include:

- Noise survey and exposure monitoring results
- Exposure notifications
- Corrective action reports
- Training records
- Audiometric testing results

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Heavy Equipment
Safe Work Procedures

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1. EFFECTIVE REGULATIONS

- 29 CFR 1926, Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations
- 29 CFR 1926, Subpart W, Rollover Protective Structures; Overhead Protection
- 8 CCR 1590-1596, Haulage and Earth Moving
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 15, 2008

2. PURPOSE AND SCOPE

This procedure describes minimum safety requirements for heavy equipment operations at ITSI project work sites. The requirements apply to ITSI employees and subcontractors involved in heavy or mobile equipment operations including, but not limited to: bulldozers, compactors, graders, scrapers, backhoes, excavators, quarry dumps, and dump trucks.

3. DEFINITIONS

- **Rollover Protection Structures (ROPS's):** Structurally designed bars, cages, or framework over the equipment cab that protects the operator from being crushed when a piece of heavy equipment rolls over.
- **Swing Radius:** The hazardous area within reach of a rotating cab and operating attachments of a piece of heavy equipment. This includes the area within the reach of attachments such as the boom on a crane or the arm on an excavator, when the attachment is fully extended. It also includes the area within reach of a swinging suspended load; and the area within reach of the back end of a heavy equipment cab when it moves.

- **Clearance:** The amount of open space required between heavy equipment and safety hazards such as electrical power lines or a pinch point for man vs. machine.
- **Suspended Loads:** Materials lifted above the ground by a crane, fork-type vehicle, excavator bucket or bulldozer blade or similar devices.

4. RESPONSIBILITIES

4.1 Health & Safety Manager

The Health and Safety Manager is responsible for assisting Site Supervisors and Safety and Health Officers (SHOs) in safe work practices, incorporation of best practices and lessons learned, training requirements for heavy and mobile equipment operations, and planning for their safe use and assistance when reviewing any incident or unsafe acts.

4.2 Site Supervisors/SHOs

Site Supervisors/SHOs are responsible for verifying that equipment operators have the required training and experience to perform their assigned work task and any certifications or license(s) required to operate. Site supervisors must ensure inspection of heavy equipment operations, monitor for unsafe work practices and immediately work with the competent person to correct unsafe situations or conditions.

The subcontractor responsible for equipment is responsible for establishing a routine maintenance schedule for its care and assuring that maintenance is completed on time. The responsible subcontractor must also arrange for required repairs and major servicing and verify to ITSI that such repairs and service have been properly completed before the equipment is returned to work operations.

4.3 Equipment Operators/Drivers

Drivers and operators are required to perform documented daily/shift equipment inspections and tests prior to running any heavy equipment, which will include fluid checks, operational checks, and cleaning windows and mirrors and any other item as described by the manufacturer.

Drivers and operators must maintain heavy equipment cabs in a clean and orderly condition, including removal of trash and debris, and removal of personal belongings at the end of each work shift. Any item like a lunch box must be secured while the equipment operates.

Drivers and operators are responsible for either refueling or contacting on-site supervision to obtain refueling for heavy equipment before turning over the unit to another employee.

Heavy equipment operators and drivers are responsible for identifying safety hazards such as power lines and structures that are present within the travel path or swing radius of their equipment. Operators and drivers will position their equipment with the required clearance to prevent contact with such hazards.

Drivers and operators must maintain vigilance for ground personnel, and slow or stop equipment movement to avoid accidents. **Only personnel *required* to be within reach of equipment will be allowed in the area.**

The use of any hand-held device, cell phone, including Bluetooth devices or music player, is prohibited when any equipment is being operated.

The operator's manual must be available on each piece of equipment when arriving and during its use on the site.

The use of heavy or mobile equipment to elevated personnel in lift baskets, etc., is prohibited.

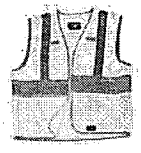
The use of "spinner knobs" or "suicide-knobs" (devices attached–after market–to steering wheel which allows for single point of operation–one hand vs. two) on steering wheels is not allowed.

Visible dust is to be avoided by using appropriate controls including, but not limited to, wetting of travel routes, soil binders, vehicle speeds, mechanical sweeping and maintenance of travel surfaces.

Water trucks will be filled from the ground–not the top–and hoses completely disconnected prior to movement. Fill hatches must not exceed 8 inches in any dimension.

4.4 Ground Personnel

Ground personnel are responsible for maintaining a safe distance from operating equipment at all times. This includes observation of equipment routes and swing radius; maintaining eye contact with operators and receiving permission to enter the travel path; and staying out from under suspended loads or equipment buckets. Ground personnel must wear approved ANSI (min Class 2) high-visibility vests at all times on site.



ANSI Class 2 Vest

4.5 All Employees

All employees are responsible for complying with this procedure, the subcontractor's health and safety plan, regulation in effect, and manufacturers' instructions. Employees are prohibited from operating equipment without authorization.

Employees are prohibited from removing fire extinguishers, guards covering moving parts or pinch points, or other safety equipment, unless for repair, replacement or inspection.

Employees are prohibited from horseplay around heavy equipment, and must report all unsafe conditions or actions to the site supervisor.

5. OPERATOR QUALIFICATIONS AND TRAINING

Operators and drivers are required to demonstrate adequate training and experience with each piece of equipment they could operate. This will require submittal for ITSI review of training certificates and licenses (as required) specific to the equipment that would be operated. Copies of training documentation provided by equipment operators shall be maintained by the SHO in the project files.

6. REQUIRED EQUIPMENT

6.1 Seat Belts

All heavy equipment will be equipped with seat belts and must be worn at all times when operating or riding in heavy equipment. Riders are prohibited on mobile equipment unless a manufacturer's approved seat and seat belt are provided.

NOTE: Replacement of seat belts will be based on the manufacturer's requirements and inspected when the equipment first arrives.

6.2 Backup Alarms

All equipment must be equipped with working backup alarms with the exception of some remotely operated units. **If any operator is discovered using equipment equipped with a back-up alarm and it is found to be switched off, unplugged or not-functioning – the operator will be prohibited from operating equipment.**

6.3 Fire Extinguishers

All heavy equipment will be equipped with a 10-lbs. ABC-type portable fire extinguisher in or on the equipment cab.

6.4 Rollover Protection

Heavy and mobile equipment cabs must be equipped with rollover protection.

6.5 Lifting/Load Capacities

When using fork-truck like equipment, lifting under the tines or free-rigging is prohibited Heavy equipment and their attachments and all rigging must be marked with the maximum rated lifting or load capacity and in new or like new condition.

7. PERSONAL PROTECTIVE EQUIPMENT

All personnel must wear, at a minimum, long pants, shirt with sleeves (at least 4-inch sleeves), hardhat, protective-toe safety boots with a sharply-defined heel, safety glasses with sideshields, and ANSI (min Class 2) high-visibility vests. Everyone working on or who may cross the work site must wear an ANSI-rated (min Class 2) high-visibility vest/clothing on the outside of all clothes and protective equipment. Brightly colored shirts or jackets are not acceptable.

Health and Safety Plans for Hazwoper sites may also specify chemical-resistant clothing, long sleeve shirts and respirators for specific work tasks. This may include chemical-resistant boots, gloves, and coveralls.

Hearing protection must be worn for work operations where noise levels have not been measured and where noise levels are known to exceed 85 dBA (decibels). Equipment operators, and ground personnel within 10 feet of heavy equipment operations, are required to wear hearing protection.

8. OPERATING SAFETY REQUIREMENTS

8.1 Mounting and Dismounting Equipment

Personnel should use three-points of contact when mounting or dismounting from heavy equipment. This requires continuously facing the equipment and keeping either two hands and one foot, or one hand and two feet, in contact with the equipment at all times. Jumping out of cabs or off other surfaces of heavy equipment is prohibited. Climbing onto equipment carrying any material is prohibited. All working and climbing surface must be non-slip.

Drivers and operators must remain properly seated while running heavy equipment, unless the equipment is specifically designed for the operator to stand.

8.2 Traffic Flow

Heavy equipment has a much greater stopping distance than passenger vehicles and pedestrians. For this reason, heavy equipment will have the primary right-of-way on field work sites. Traffic patterns should be established to prevent pedestrian crossings and passenger vehicle traffic in heavy equipment work areas.

Facilities and work sites will have a maximum speed limit of 15 miles per hour, unless otherwise designated by the client, conditions, property owner, or contractual agreements. Speeds will be dropped to 5 mph when troops are present on travel paths, including roads.

Heavy equipment must be shut off, with the parking brake set and attachments lowered to the ground when parked or unattended. Engines may be left running if required to operate or if the equipment operator is dismounting temporarily to examine his work area.

When practical a viewing area for the work will be created for the protection of observers.

8.3 Ground Personnel

The following work rules will apply to all ground personnel during heavy equipment operations:

- **Only personnel *required* to be within reach of equipment will be allowed in the area.**
- Ground personnel should observe equipment paths and movement prior to entering the site.
- Ground personnel will stand clear of the travel path and swing radius of heavy equipment, and avoid becoming boxed in between equipment and buildings or other structures.
- Personnel will remain in a position where they are clearly visible to the driver or operator and will obtain eye contact and an all clear signal from the operator before approaching the cab or entering the travel path or swing radius of the equipment.
- Ground personnel and spotters are prohibited from standing or walking under suspended loads or lifted blades or buckets on heavy equipment.

- All ground personnel must wear approved ANSI-rated (min Class 2) high-visibility vests/clothing while on site and the ANSI rating is dependent on condition like lighting, snow, etc.
- Personnel will never approach a machine from the blind side of the equipment or work in this area while the equipment is running.

Example: Workers in the Blind Side of the Equipment Operator

8.4 Spotters

Spotters will be provided where high ambient noise levels or poor visibility interfere with a driver or operator's ability to see or sense objects on all sides of the equipment.

Spotters and equipment operators should discuss and agree on hand signals to be used during heavy equipment operations at each work site. These signals must be from a standardized source like the USACE EM 385.1.1 Section 16.1., posted and communicated to all affected personnel before work operations begin. Hand signals should be reviewed periodically to avoid confusion and accidents.

8.5 Overhead Power Lines

All overhead power lines and other overhead hazards must be identified in advance. If possible, overhead power lines must be de-energized, grounded, and locked out to prevent re-energizing while heavy equipment is working nearby. ITSI will assist in the coordination with the local utility or property owner responsible for each power line to request shutdowns. The use of protective "insulation" on lines is not an acceptable barrier.

Where de-energizing power lines is impractical, the heavy equipment and booms, towers or other attachments must maintain the following minimum clearances from overhead power lines to prevent arcing and electrical shock:

Powerline Voltage	Minimum Clearance for Operating Equipment
50,000 volts or less	10 feet
Greater than 50,000 volts	10 feet plus 4 inches for each additional 10,000 volts in the powerline

In transit, with buckets, booms and other attachments lowered, heavy equipment must maintain the following minimum safety clearances from overhead power lines:

Powerline Voltage	Minimum Clearance for Equipment Rigs in Transit
50,000 volts or less	4 feet
50,000 volts to 345,000 volts	10 feet
345,000 volts to 750,000 volts	16 feet
750,000 volts to 1,000,000 volts	20 feet

If power lines are in the work area or equipment will be driven underneath them, signs will be posted warning those approaching of the hazard from all directions.

8.6 Buried Utilities

All underground utilities (811 or host nation system) must be located before any penetrating work begins, including initial marking with stakes. This includes fiber-optic cables, water, natural gas, electrical, sewer, and process lines. Local utilities will be contacted to request location and marking of their lines.

Refer to ITSI SWP Trenching and Excavation for guidance.

9. INSPECTIONS

Required inspections include site audits, observance of equipment and work practices, and operational inspections of equipment.

9.1 Site Inspections

Site Supervisors must coordinate with equipment owners (or if rented) for the initial on-site arrival inspection of heavy and mobile equipment.

Observations of equipment operation for unsafe practices and overall operator performance will conducted and documented by ITSI and the subcontractor's supervisor on at least a weekly basis.

9.2 Equipment Inspections

All equipment must be inspected prior to its operation on site by a competent mechanic with ITSI oversight. Equipment must be in new or like-new condition. Any alterations or modifications must have been approved by the manufacturer or the equipment will not be allowed on the site. These inspections must be documented.

Drivers and operators are required to perform pre-startup equipment checks prior to running any heavy equipment, on at least a daily basis. These are to be documented. These must include verifying the safe operating condition of at least the following devices:

- Lights and beacons as specified;
- Horn;
- Brakes;
- Steering;
- Tires or tracks;
- Operable fuel gauge;
- Turn signals;
- Gauges and labels working and legible;
- Hydraulic systems, if applicable;
- Backup alarms;
- Windows and windshield wipers;
- Adequate rear mirror(s);
- Non-slip surface on climbing or walking areas;
- Windshield defrosters;
- Seat belts;
- Fire extinguisher;
- Seat adjustments;
- Guards covering moving parts and pinch points;
- Operating controls for booms, buckets and other applicable attachments; and
- Equipment used for demolition/hammering/shearing, etc., must be supplied with operator protection as specific by the implement manufacturer.

Dump trucks shall be inspected and in compliance with the USACE EM 385.1.1 Section 18.A.03 before being placed into service. This inspection must be documented and those records maintained on the site.

Drivers and operators must check and refill (if necessary) the fuel, oil and coolant levels in each unit at the beginning of their work shift, prior to job task startup. Operators should also clean the windows of each cab to assure clear visibility. Broken or excessively scratched windows on equipment will require the unit be taken out of service.

Damaged or defective heavy equipment will be immediately tagged out-of-service until such problems are corrected. Any piece of equipment found not in new or like new condition will be removed from service and tagged out until corrections are made or the equipment is replaced.

10. REPAIRS AND MAJOR SERVICING

Contractors supplying the equipment are responsible for establishing a routine maintenance schedule for each piece and assuring that maintenance is completed on time. Operators and/or their supervisors must also arrange for required repairs and major servicing and verify that such repairs and service have been properly completed before the equipment is returned to operation.

Equipment repairs and major servicing must be performed by properly qualified personnel only. Employees must not perform repairs, modifications or major servicing on rented equipment without written authorization from the rental company.

Guards covering moving parts and pinch points must be replaced before returning the equipment to work operations.

Written records of repairs and major service are to be maintained for each piece of heavy or mobile equipment and available to ITSI when requested.

11. FUEL STORAGE

Temporary fuel storage tanks at field work sites must be labeled with Flammable Hazard and "NO SMOKING" warnings. Ignition sources are prohibited within 75 feet of fuel storage tanks. An operational and inspected fire extinguisher of the appropriate size and class must be located adjacent to the storage area but a reasonable distance from the source(s) of a likely fire.

Tank in use or storage must be protected from damage by traffic by physical, solid barrier and placed away from the path of moving vehicles and equipment or lifted material. Spill response materials must be stored at the fueling locations and be readily available for anyone to use.

Example of Protection

All fuel containers must be placed within a secondary containment based on the USACE EM 385.1.1 09.B Flammable and Combustible Liquids, including the required fire extinguisher sizes, containment and handling precautions described.

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ITSI Gilbane

Heat Producing or Hot Work
Safe Work Procedures

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1. REGULATIONS AND STANDARDS THAT MAY APPLY

- 29 CFR 1910.101, Compressed Gases
- 29 CFR 1926.253, Gas Welding and Cutting
- 29 CFR 1910, Subpart L, Fire Protection
- 29 CFR 1926, Subpart F, Fire Protection and Prevention
- ANSI Z.49.1 Welding, Cutting and Allied Processes
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), November, 2008

2. INTRODUCTION AND SCOPE

This program provides minimum requirements for safe work practices, both for planning and during hot work activities at construction and hazardous waste remediation sites. Hot work activities include welding, cutting, burning and brazing, as well as abrasive operations that may generate sparks. This program is intended to assure compliance with the requirements of OSHA/ USACE and related standards for these activities. Instructions are included for completing Hot Work permits before such activities begin.

Subcontractors must have their own standard operating procedures for hot work activities that comply with OSHA regulations and are at least as protective as this program.

This SWP has been arranged for use as an audit to confirm its provisions are being followed in the field.

3. DEFINITIONS

- **Hot work.** Hot riveting, welding, burning, abrasive blasting, or other fire, heat or spark-producing operations.
- **Hot Work, Confined Space.** Any activity involving riveting, welding, burning, powder-actuated tools, or similar fire-producing operations. Grinding, drilling, abrasive blasting, or similar spark-producing operations are also considered hot work, except when such operations are isolated physically from any atmosphere containing more than 10% of the lower explosive limit of a flammable or combustible substance.
- **Hazardous Area.** Locations where flammable or combustible materials are handled or stored. This includes fuel laden (contaminated) soils, water and excavations where vapors may accumulate.
- **Government Designated Authority (GDA).** Responsible party representing the base, terminal or facility. Often referred to as the Point of Contact (POC).

4. RESPONSIBILITIES

4.1 Site Supervisors and Safety and Health Officers (SHO)

The Site Supervisor and SHO are responsible for assuring that all hot work activities are done in a safe manner and in compliance with this program. The contractor performing the work must ensure the planning, precautions, and preparations are in place to eliminate the threat of fire. The provisions and expectations of the Permit System that will be used must be discussed by the SHO during on-site orientation and understood by the ITSI staff and contractors. The government designated authority (GDA) or Point of Contact (POC) may define additional areas where permits will apply at the facility.

4.2 Employees

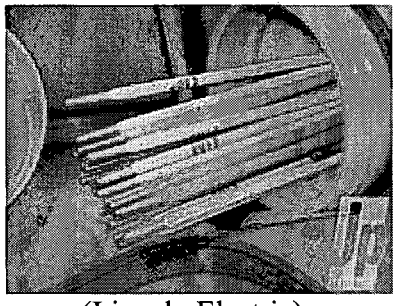
Employees are responsible for complying with this program and for notifying their supervisors of any questions or unsafe situations involving hot work activities.

5. EQUIPMENT REQUIREMENTS

Welding, burning, cutting and brazing equipment must be chosen specifically for the intended work. This includes selection of equipment properly constructed for unusual environmental conditions such as high temperatures or weather conditions that may occur during hot work operations. The following applies:

- Compressed gases, welding rods and filler metals, electrodes and other equipment appropriate to the specific hot work activity.
- Minimum 20 pound ABC-type fire extinguishers.
- Welding screens for welding operations.
- Empty, Full and Partially Full tags for compressed gas cylinders.
- Welder's helmet or face shield with an eyeshade meeting the requirements of Table 1 (attached) for the specific activity.

- Heat-resistant materials, like long-sleeved shirt and pants, to prevent skin exposure to ultraviolet radiation and metal fumes.
- Protective toed boots with minimum 6-inch-high tops.
- Hearing protection (ear plugs or muffs).
- The use of a mobile stand or wheeled cart is required for all tank handling. Bottles will never be carried by hand.
- Cylinders will always be restrained by a fire-resistant material-like chain.
- Respiratory protection as defined by the Accident Prevention Plan, site-specific Safety and Health Plan, and/or Activity Hazard Analysis.
- When working underground, local gas tests (air monitoring) shall be made prior to and continuously during any welding, cutting, or other hot work. Acetylene, LP-Gas, and methylacetylene propadiene stabilized gas (MAPP) may be used underground only for welding, cutting, and other hot work. No more than the amount necessary for work conducted during the next 24-hour period shall be permitted underground.
- Best Practice: Only plastic—no metal— "cans" or containers for welding rods will be allowed to eliminate the hazard of hand cuts.



(Lincoln Electric)

6. OPERATIONAL PROCEDURES

6.1 Permits

All heat producing work requires a permit system acceptable to the POC for the project. Regardless of Base or client permitting procedures, superintendents or SHOs will control hot work using the ITSI permit system. See attached flow chart pertaining to the ITSI hot work permit process. Permits needed by the installation or client to approve the work must also be obtained in addition to any required ITSI permits.

Subcontractors will obtain Hot Work permits from the Site Supervisor or SHO, or others authorized to sign these permits. Hot Work permits are good for one work shift and one day only. If hot work is interrupted for more than one hour, a new permit is required before work resumes. The daily requirement for an ITSI Hot Work Permit is applicable even when the Facility or client issues a Hot Work Permit for a longer period of time. Hot Work Permits must meet the requirements of NFPA 51B, be complete, the work area inspected and signed before beginning any hot work. The only exception to this requirement is for hot work performed in

specialized areas specifically set up for this purpose, where no hazardous conditions are present like a maintenance shops with designated burning and welding areas.

6.2 The Permit Process

The creating contractor will prepare the ITSI Hot Work permit. The ITSI superintendent or SHO will review the specific area and precautions, ensure the conditions of the permit are met, and sign the permit. The permit shall be posted in that area and one copy retained by ITSI with the following precautions:

- A permit specific for one work area and one task must be prepared by the person creating the heat and signed by ITSI field management.
- The immediate work area cleared of all debris, flammable and combustible materials (50').
- Materials that cannot be removed must be protected with fire resistant covers.
- Hot work activities require posting a fire watch to look for smoldering fires that may be caused by the operation. The fire watch must remain in the immediate area of the hot work for at least 60 minutes after the activity stops, to ensure that no smoldering fires are present.
- Where work adjoins, is above or will impact grass, shrubbery or natural materials, planning with the POC for the protection of those lands including the coordination of a potential response to a wildland fire and the installation of soil barriers at least three feet wide between the work area and wild area is required.
- Where floor openings or cracks exist near hot work activities, these openings must be closed to prevent sparks and hot metal from falling to lower levels and igniting fires.

  Where complete protection is impractical, all flammable and combustible materials below the hot work area must be protected with fire resistant covers and a specific fire watch person must be posted to look for potential fires on the lower level. The fire watch must remain in effect for at least 60 minutes after hot work ends.
- Welding screens or other fire resistant barriers must be placed around all welding and cutting operations to prevent exposure of nearby personnel to sparks, hot metal and ultraviolet radiation. For small areas to be welded and areas at height, welding umbrellas are recommended for arc shielding.

6.3 Prohibited Areas and Activities

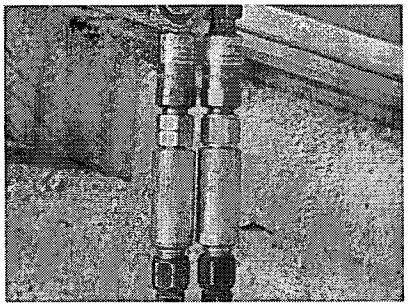
- When working in any space with a fire protective system, approval and coordination with the POC is required prior to any work.
- Hot work is prohibited in the presence of flammable or explosive atmospheres, and in areas where large quantities of readily ignitable materials. These materials may include paper, pallets, stored items, open outside areas (grass or wooded areas), etc.
- Hot work is prohibited on drums, cylinders, containers and tanks of any kind until and unless they have been appropriately prepared in coordination with ITSI, and the POC.
- Use of electrical welding equipment is prohibited when employees must stand or work in puddles or other wet areas.

6.4 *Compressed Gas Cylinders Safety*

- Compressed gas cylinders will be labeled with their contents and tagged to show whether they are full, partially full or empty.
- Compressed gases must be shut off as soon as welding, burning and cutting operations are completed. Compressed gases must be transported on cylinder carts and never carried. Cylinders must be chained to the cart during movement. Where local ground is too rough to permit the use of cylinder carts, employees will carefully roll one cylinder at a time into place.
- All compressed gas cylinders must be kept upright and tied to a stationary object when they are stored or in use. Vehicles and mobile equipment are not acceptable as tie-off locations for gas cylinders.
- Oxygen regulators must be oil and grease-free and restricted to use with oxygen gas only. All regulators must be removed and cylinder safety caps must be screwed on as soon as compressed gas use is finished. Employees are prohibited from storing gas cylinders with the regulators attached.
- Oxygen and fuel gas cylinders must be stored at least 20 feet apart unless they are separated by a noncombustible barrier at least five feet high with a minimum fire-resistance rating of one hour.
- Storage of compressed gas cylinders must be in an agreed upon location, outside of buildings and closed containers, protected from weather, vehicle traffic and ignition sources.
- Cylinders will never be stored on their sides.
- Valve wrenches will be attached to all bottles when in use.

6.5 *Equipment Selection and Maintenance*

- All hoses, electrical cords and electrodes must intact and neatly stored when not in use.
- All welding and cutting equipment must be properly bonded and grounded.
- Material Safety Data Sheets for each type of welding rod, filler metal and fusible granular material used must be present in the work area during hot work.
- Containers and packages of welding rod, filler metals, and fusible granular materials must be labeled with their metallic composition and appropriate hazard warnings in compliance with OSHA Hazard Communication Standards.
- All equipment used for hot work must be visually inspected for damage and defects before each use.
- Damaged or defective equipment must be tagged out of service immediately and must not be used until the faulty parts have been repaired or replaced.
- Welding equipment require "boots" to protect the terminals from shorting.
- Flashback arrestors must be used on all regulator systems leading to a combustible or flammable gas. See photo below.



7. PERSONAL PROTECTIVE EQUIPMENT AND RESPIRATORS

- Forced air, natural ventilation or local exhaust ventilation will be used whenever possible to control toxic or flammable atmospheres generated by welding, cutting, brazing or other hot work activities.
- In situations where these measures are not sufficient, respiratory protection will be used to prevent exposure to welding fume and toxic gases and vapors.
- Safety glasses with side shields or goggles are required for employees performing hot work, their helpers and for other personnel near the hot work area. Welder's eyeshades will be worn by employees performing hot work to protect against ultraviolet radiation and flying metal. Other personnel near the hot work area must also wear welder's eyeshades unless they are protected by welding screens. Eyeshades will be selected in accordance with the task underway. Refer to Table 1, attached.
- Employees are prohibited from wearing loose clothing and jewelry, or oil-soaked clothing during hot work activities.
- Protective clothing consisting of heat resistant materials will be worn during hot work activities. Leather aprons and jackets may be added to these items.
- Cotton caps or flame resistant hats must be worn to protect the head, ears and face from UV radiation, sparks and flying metal.
- Synthetic clothing is prohibited due to its tendency to melt or cause flash fires when hit by flying sparks and hot metal.
- Chemical-resistant clothing such as Tyvek, PolyTyvek and Saranex will be removed prior to hot work activities. These materials pose the same fire hazards as other synthetic clothing materials.

8. CONFINED SPACES

Hot work activities in confined spaces will require specific planning between ITSI and the POC and are not covered by this SWP. Specific provisions can be found in the ITSI Confined Space SWP. Following are considerations when planning for that type of work.

- The use of local exhaust ventilation to remove fumes, gases and vapors will be required.

- Compressed gas cylinders and welding machines must remain outside the confined space. Hoses and electrodes must be long enough to reach the work area inside the confined space without kinking, tangling or stretching.
- Confined spaces must be cleaned and flammable gases, vapors, purge gases and liquids must be completely removed before hot work begins. The space must be tested and in the case of above and below ground storage tanks, certified, to be free of flammable gases, vapors, mists and dusts prior to performing hot work.
- Continuous air monitoring with direct-reading instruments must be performed during hot work in confined spaces. This must include oxygen, flammable atmospheres, carbon monoxide, toxic gases and vapors, as a minimum.
- Torch valves and cylinder valves must be closed and the torches removed from the confined space during lunch breaks and whenever hot work operations stop for one hour or longer.
- Welding machines must be disconnected from the power source, electrodes removed from their holders and the holders positioned to prevent accidental contact during lunch breaks and whenever hot work operations stop for one hour or longer.

Table 1
Glass Shielding Shade Chart

Welding/Cutting Operations	Electrode Size (inches)	Minimum Protective Shade*
Shielded metal arc welding	1 1/16	10
	3/32	10
	1/8	10
	5/32	10
Gas-shielded arc welding (non-ferrous)	1/16	11
	3/32	11
	1/8	11
	5/32	11
Gas-shielded arc welding (ferrous)	1/16	12
	3/32	12
	1/8	12
	5/32	12
Shielded metal arc welding	3/16	12
	7/32	12
	1/4	12
	5/16	14
	3/8	14
Atomic Hydrogen welding		14
Carbon arc welding		14
Soldering		2
Torch brazing		3 or 4
Light cutting, up to 1 inch		3 or 4
Medium cutting, 1 to 6 inches		4 or 5
Heavy cutting, over 6 inches		5 or 6
Gas welding (light) up to 1/8 inch		4 or 5
Gas welding (medium) 1/8 to ? inch		5 or 6
Gas welding (heavy) over ? inch		6 or 8

9. VERIFICATION OF CONTROLS – HOT WORK

A Tool for Planning

The following controls must be in-place prior to work:

SET-UP:

- A permit specific for one work area and one task must be prepared by the person creating the heat and signed by ITSI.
- Containers and packages of welding rod, filler metals and fusible granular materials must be labeled with their metallic composition and appropriate hazard warnings in compliance with OSHA Hazard Communication Standards.
- Material Safety Data Sheets for each type of welding rod, filler metal and fusible granular material used must be present in the work area during hot work.
- All equipment used for hot work must be visually inspected for damage and defects before each use.
- Damaged or defective equipment must be tagged out of service immediately and must not be used until the faulty parts have been repaired or replaced.
- The immediate work area must be cleared of all flammable and combustible materials (50 ft.).
- Materials that cannot be removed must be protected with fire resistant covers.
- Hot work activities require posting a fire watch to look for smoldering fires that may be caused by the operation. The fire watch must remain in the immediate area of the hot work for at least 60 minutes after the activity stops, to ensure that no smoldering fires are present.
- Where work adjoins, is above or will impact grass, shrubbery or natural materials, planning with the POC for the protection of those lands including the coordination of a potential response to a wildland fire and the installation of soil barriers at least 3 feet wide between the work area and wild area.
- Where floor openings or cracks exist near hot work activities, these openings must be closed to prevent sparks and hot metal from falling to lower levels and igniting fires. Where complete protection is impractical, all flammable and combustible materials below the hot work area must be protected with fire resistant covers and a specific fire watch person must be posted to look for potential fires on the lower level. The fire watch must remain in effect for at least 60 minutes after hot work ends.
- When <u>underground,</u> local gas tests shall be made prior to and continuously during any welding, cutting, or other hot work. Acetylene, LP-Gas, and methylacetylene propadiene stabilized gas (MAPP) may be used underground only for welding, cutting, and other hot work. No more than the quantity of compressed gas necessary for work during the next 24-hour period shall be permitted underground.

EQUIPMENT:

- Welding screens or other fire resistant barriers must be placed around all welding and cutting operations to prevent exposure of nearby personnel to sparks, hot metal and ultraviolet radiation. For small areas to be welded and areas at height, welding umbrellas are recommended.
- Compressed gases, welding rods and filler metals, electrodes and other equipment appropriate to the specific hot work activity.
- Minimum 20 pound ABC-type fire extinguishers.
- Welding screens for welding operations.
- All welding and cutting equipment must be properly bonded and grounded.
- Welders require "boots" to protect the terminals from shorting.
- Flashback arrestors must be used on all regulator systems leading to a combustible or flammable gas.

COMPRESSED GAS:

- The use of a mobile stand or wheeled cart is required for all tank handling. Bottles will never be carried by hand.
- Cylinders will always be restrained by a fire-resistant material like chain.
- Compressed gases must be shut off as soon as welding, burning and cutting operations are completed. Compressed gases must be transported on cylinder carts and never carried. Cylinders must be chained to the cart during movement. Where local ground is too rough to permit the use of cylinder carts, employees will carefully roll one cylinder at a time into place.
- All compressed gas cylinders must be kept upright and tied to a stationary object when they are stored or in use. Vehicles and heavy equipment ARE NOT acceptable as tie-off locations for gas cylinders.
- Oxygen regulators must be oil and grease-free and restricted to use with oxygen gas only. All regulators must be removed and cylinder safety caps must be screwed on as soon as compressed gas use is finished. Employees are prohibited from storing gas cylinders with the regulators on.
- Oxygen and fuel gas cylinders must be stored at least 20 feet apart unless they are separated by a noncombustible barrier at least five feet high with a minimum fire-resistance rating of one hour.
- Storage of compressed gas cylinders must be in an agreed upon location, outside of buildings and closed containers, protected from weather, vehicle traffic and ignition sources.
- Tanks will never be stored on their sides.

- O Valve wrenches will be attached to all bottles when in use.
- O Empty, Full and Partially Full tags for compressed gas cylinders.

WORKER PROTECTION:

- O The immediate work area is cleared of all debris, flammable and combustible materials or protected by appropriate covers within 50 feet.
- O Welder's helmet or face shield with an eyeshade meeting the requirements of Table 1 for the specific activity.
- O Fire resistant coveralls or long-sleeved shirt and pants, to prevent skin exposure to ultraviolet radiation and metal fumes.
- O Protective-toe safety shoes or boots with minimum 6-inc-high tops.
- O Hearing protection (ear plugs or muffs).
- O Respiratory protection as defined by the site-specific Safety and Health Plan.
- O No metal, only plastic "cans" or containers for welding rods will be allowed to eliminate the hazard of hand cuts.
- O All hoses, electrical cords and electrodes must intact and neatly store when not in use.
- O Housekeeping: The area is free of debris, trash and trip hazards.
- O Employees are prohibited from wearing loose clothing and jewelry, or oil-soaked clothing during hot work activities.
- O Protective clothing consisting fire resistant fabric will be worn during hot work activities.
- O Cotton caps or flame resistant hats must be worn to protect the head, ears and face from UV radiation, sparks and flying metal.
- O Synthetic clothing is prohibited due to its tendency to melt or cause flash fires when hit by flying sparks and hot metal.
- O Chemical-resistant clothing such as Tyvek, PolyTyvek and Saranex will be removed prior to hot work activities. These materials pose the same fire hazards as other synthetic clothing materials.

Audit conducted by: _____

Audit conducted by: _____ Date: _____

COMMENTS:

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Innovative Technical Solutions, Inc.
A Gilbane Company

Materials Handling and Storage
Safe Work Procedures

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1. REGULATIONS

- 29 CFR 1910, Subpart N, Materials Handling and Storage
  29 CFR 1926, Subpart H, Materials Handling, Storage, Use and Disposal
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 2008

2. PURPOSE AND APPLICATION

This SWP applies to all operations where materials and equipment are received, removed, installed or disposed. The goal is to limit the amount of materials handled, make handling easier, and reduce or eliminate injuries while increasing efficiency and safety. The focus is "*Nothing Hits the Ground*" as planning occurs. Material handling best practices and lessons learned are detailed and several examples provided for planning.

Material handling and management must reflect the USACE order of controls as follows:

- Elimination of material handling by engineering – prevention through design.
- Movements by a mechanical device like a floor jack or motorized wheelbarrow.
- Movements by manual means like a dolly, carts or rollers.
- The last option is someone moving materials by hand.

The proper management of materials will eliminate contributors to trips, slips, falls and fire. Critical to materials handling is not the material ***but the management of materials***.

3. POTENTIAL HAZARDS

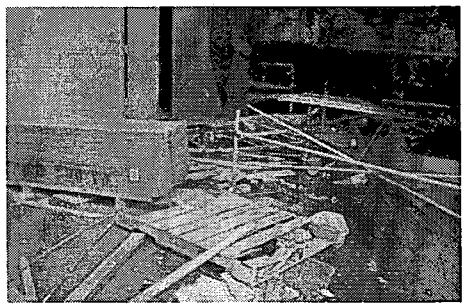
Improper materials handling poses a serious risk to employees, our projects and public, including:

- Fire from the accumulation of staged combustibles, debris and waste packaging;
- Slips, trips and falls from materials on walking or working surfaces;
- Falls when tarping or unloading trucks and trailers;
- Equipment tipping over when traveling over debris; and
- The improper use of equipment when handling materials.

Some hazards of improperly staged materials include:

- Materials falling into holes on workers in excavations and in shafts;
- Unrestrained glass or forms falling on workers;
- Materials flying off buildings or work site injuries to others;
- Floor failure from the accumulation of materials;
- Restricting access for emergency responders;
- Injuries during the movement and use of materials; and
- Impeding occupants and workers escape routes in an emergency.

Fall Hazards Created



Material Blocking Exit

4. RESPONSIBILITIES AND CONTROLS

4.1 Superintendents

Proper materials management is an operational practice that eliminates a safety concern. Superintendents are responsible for coordinating the work and controlling the subcontractors. They also shall oversee scheduling arrival of materials to reduce accumulation (more than two days) and provide adequate, safe areas for loading and unloading of materials. Should materials storage complaints or concerns by trades or the client occur, the superintendent shall work with the contractors and resolve the concern immediately and ensure the condition is not repeated.

The superintendent's first and last responsibility is that all waste materials are immediately containerized and not allowed to accumulate.

4.2 Safety and Health Officer (SHO)

The SHO must evaluate all materials handled or moved and continually search for alternative approaches to the work to limit the potential for injury or accumulation of waste or stored material. The SHO must work and plan with subcontractors prior to the delivery of any material, *before mobilization* to ensure materials and their handling are not a threat to the project.

4.3 Subcontractor Supervision and Workers

Subcontractors are responsible for coordinating all deliveries through ITSI management and planning that materials are received correctly at the project, installed promptly and waste containerized and removed immediately.

5. MATERIAL HANDLING – STAGING

The following requirements must be considered when planning:

- All loads moved on wheels must be secured (glass, countertops and mirrors, etc.) from tipping;
- Flat material staged on edge for installation must be secured and not laid flat, consuming walking area;
- Sheetrock and like materials will be moved on dollies or devices designed for that material,
- Materials cannot be staged on scaffolds overnight;
- Pipe, conduit, and like materials must be staged on wheeled racks with protruding ends covered if they are within 2 feet of a walkway;
- Materials cannot be stacked higher than 20 feet;
- Placing of materials or equipment atop storage containers is not allowed;
- Any light material exposed to the wind shall be secured at all times; and
- All piping shall be on mobile racks or if too heavy staged on dunnage and dogged.

NOTE: For specific limits on piling or stacking of wood, brick, bags etc. contact ITSI.

6. MATERIAL MANAGEMENT – LIFE SAFETY

- Walkways and exit paths must always be clear of any materials;
- Combustible materials are not to accumulate in any area;
- Gloves will be required for all handling tasks and chosen specific to the material handled;
- Trash, debris or staged materials will never be placed on stairs, landings, aisles or exits;
- Material cannot be staged on walking or working surfaces, including fixed and mobile scaffolds; and
- Lumber, dumpsters and waste materials must be staged at least 10 feet from a building.
- Materials cannot be staged within 10 feet of a shaft or edge of the building;

- Materials like rebar stock will never be placed on or across a walking surface;
- When materials weigh >70 lbs., those materials (sheetrock paste) should be transferred to smaller containers. This does not include bagged materials.

7. WASTE MANAGEMENT – CONTROLS

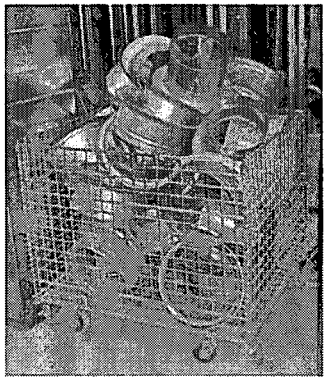
- Waste materials will never be tossed or piled on the ground or floor or work will stop until that condition is corrected.
- Debris and excess material like stud and pipe ends will be captured at the point of generation.
- Barricades must be installed around chutes leading to dumpsters and extend twice the height of the base of the chute from the ground. Refer to OSHA and EM385 for specifics.
- Piles of trash or debris in work areas or outside are not allowed or work will stop until corrected.
- All wood must have nails bent over or removed before handling.
- Drums and buckets are not allowed for lifting of any load.
- If dumpsters are located on the ground, a solid, non-slip ramp will be provided.
- Workers will never climb on debris to dump more debris in a dumpster.
- No material will be thrown from a height of more than 6 feet.
- Trash and waste material containers must meet the daily production of waste material or work will stop until additional containers are obtained.

Uncontrolled Waste Handling

8. MATERIAL HANDLING – OPERATIONS

- All materials delivered will be placed on wheeled carts, tubs, pallets or totes.
- Loading areas shall be designed for safe material unloading or loading.
- Only ladders designed for trailer access shall be used to get on trailers.
- Tarping racks will be installed for dump trucks, based on the scope of work.
- Do not walk backward with a hand truck, unless going up stairs or ramps.

- Only trained pallet jack operators may operate pallet jacks and never ride on one.
- Store hand trucks with the tongue under a pallet or along a wall.
- If wheelbarrows are used, they shall have two wheels.
- Materials shall never be allowed to exceed the capacity of the floor like sheetrock paste, elevator weights, or nested welders.
- When loading a building, the maximum capacity should be painted on destination floor.
- When unloading trucks, stand to the side when releasing a load that may roll and to be clear of binders or straps.
- Material handling must consider the storage but also the position of those working.
- No work will be completed on the floor and completed at a neutral position work station when possible.
- Loading of upper floors:
  - Requires a dedicated landing spot with a corral and self-closing gate entrance
  - Fall protection or an inward swing gate will be required
  - The capacity of the floor in square feet shall be posted
  - The lower areas and floors will be barricaded so workers are not under loads



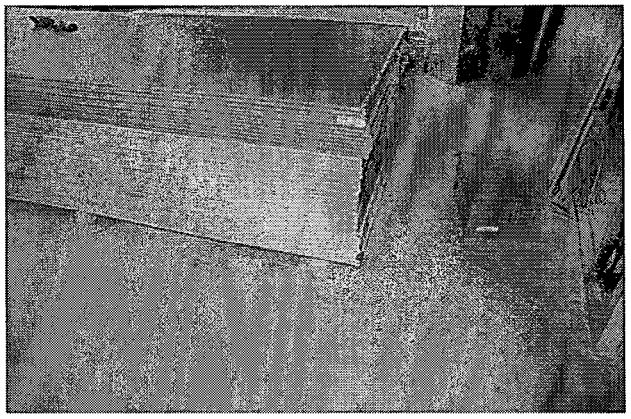
Proper Wheeled Tote

9. INSPECTIONS

All equipment for material handling must be inspected prior to arrival to ensure it meets original manufacturer's condition. All equipment, including fabricated devices must be marked with the maximum capacity and, if fabricated, designed by a professional engineer and documented.

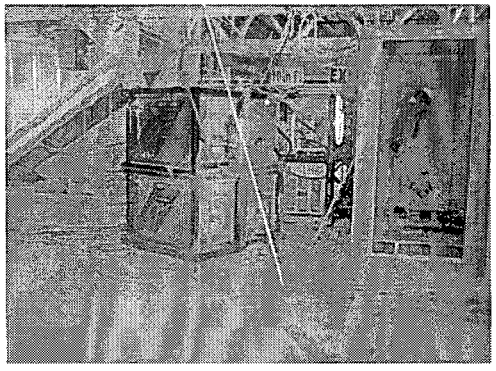
10. BEST PRACTICES AND EXAMPLES – STORAGE

Best Practice

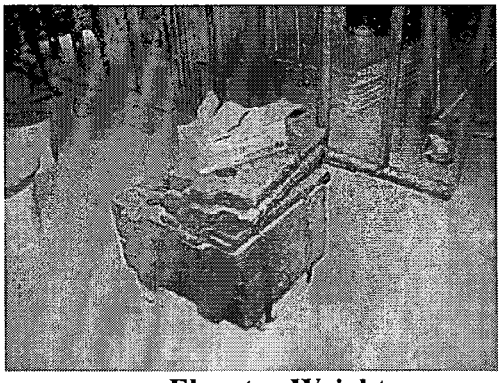


Proper Marking of Floor (34 sheets max)

Unsafe Practice



Generator Nest
(480 lbs. per wheel)

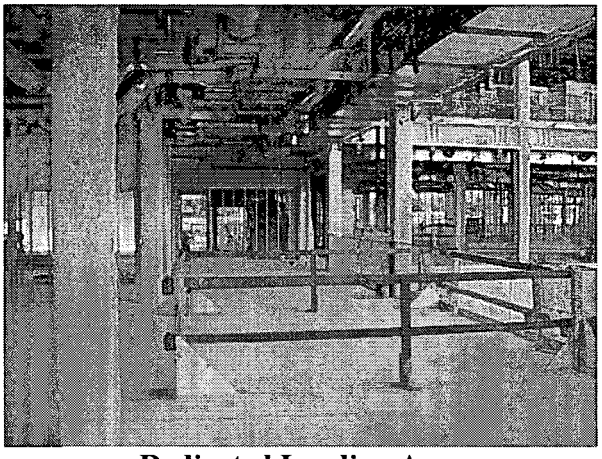


Elevator Weights
(600 lbs. per square foot)

Unsecured Mirrors

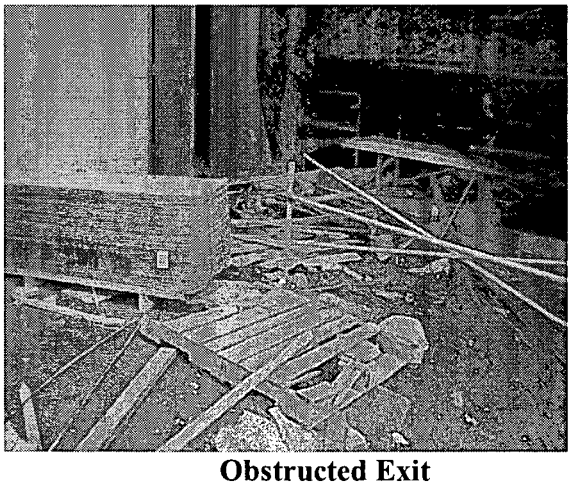
Unsafe Storage on Containers

11. BEST PRACTICES AND EXAMPLES – LIFE SAFETY

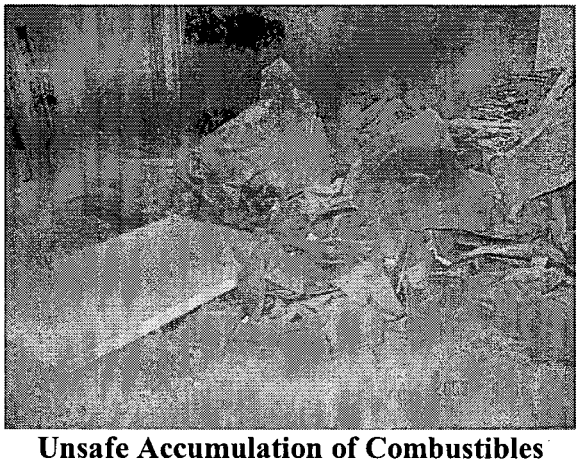


Dedicated Loading Area

Fall Hazard to Access Stored Materials



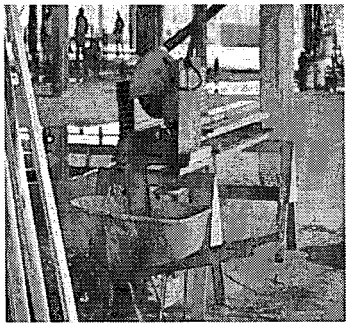
Obstructed Exit



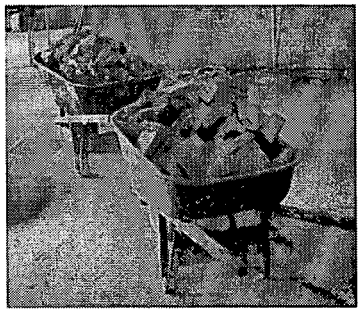
Unsafe Accumulation of Combustibles

12. BEST PRACTICES AND EXAMPLES – WASTE AND DEBRIS

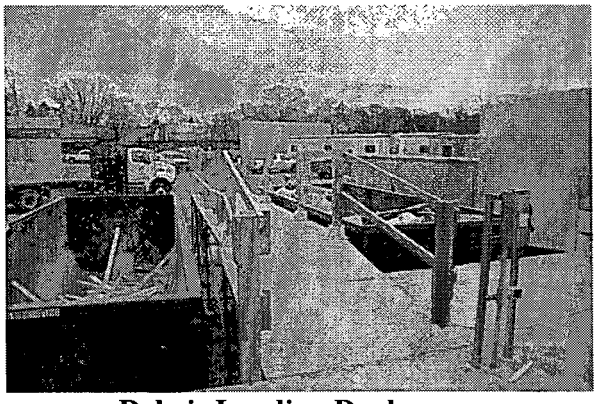
Lack of Materials Management



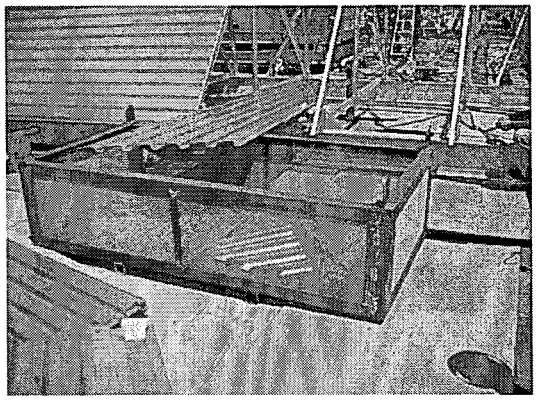
Simple Work Station



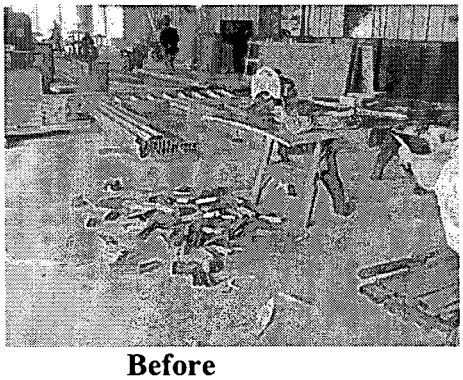
Unsafe Debris Handling
(Capacity 170 lbs. actual 410 lbs.)



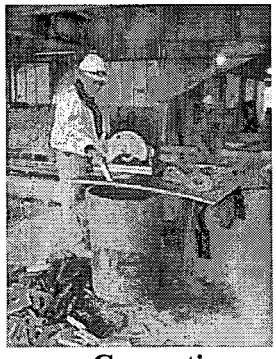
Debris Loading Dock



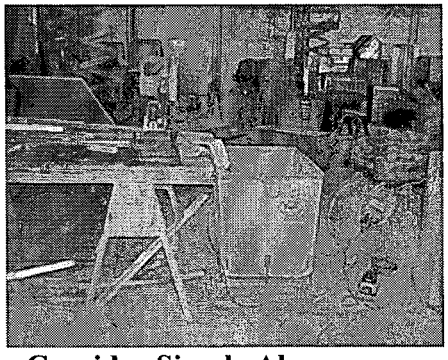
Container for Waste at Source



Before

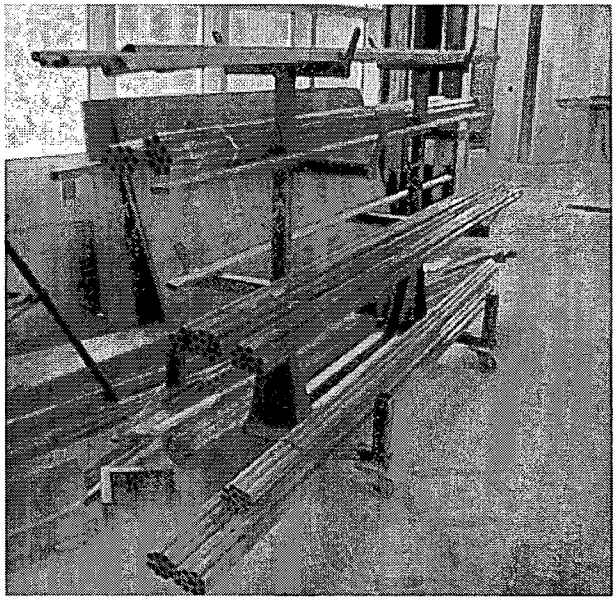


Correction

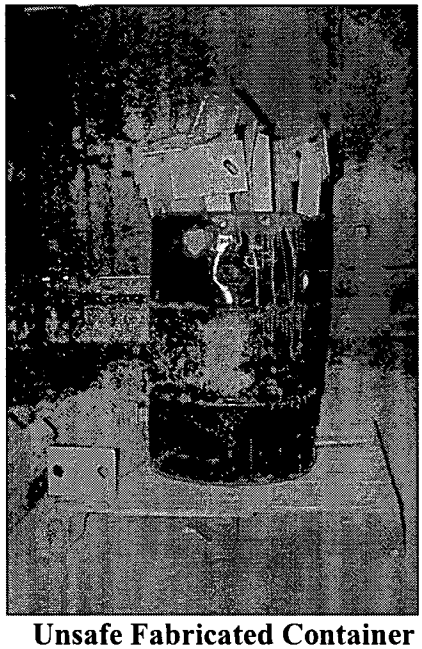


Consider Simple Always

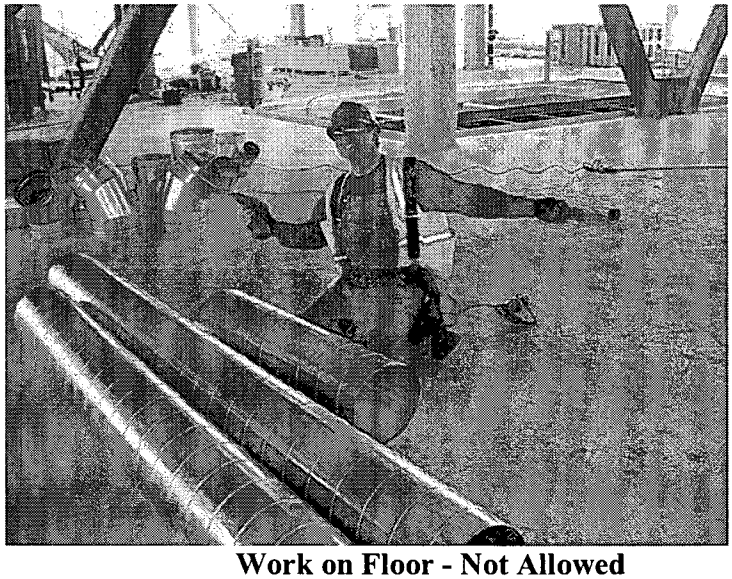
13. BEST PRACTICES – MATERIAL HANDLING



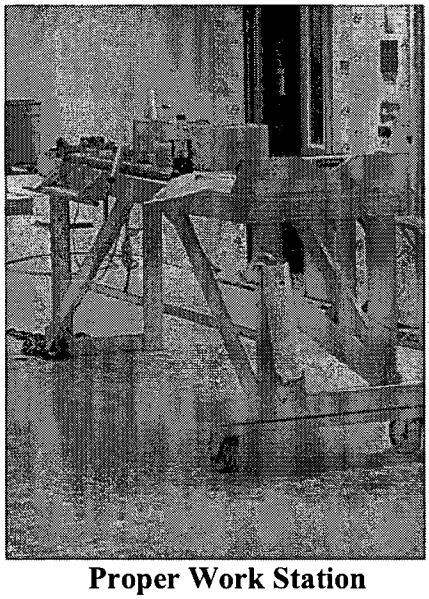
Proper Wheeled Storage



Unsafe Fabricated Container (Note hole for hook lifting)



Work on Floor - Not Allowed



Proper Work Station

14. VERIFICATION OF CONTROLS – MATERIAL MANAGEMENT TOOL

Planning for Material Managing

The following controls must be planned and in-place prior to work:

Material Staging

- All loads moved on wheels must be secured (glass, countertops and mirrors etc.) from tipping.
- Flat material staged on edge for installation must be secured and not laid flat, consuming walking area.
- Sheetrock and like materials will be moved on dollies or devices for that material.
- Lumber, dumpsters and waste materials must be staged at least 10 feet from a building.
- Materials cannot be staged on scaffolds overnight.
- Pipe, conduit, and like materials must be staged on wheeled racks with protruding ends covered if they are within 2 feet of a walkway.
- Materials cannot be stacked higher than 20 feet.
- The storage of materials (or equipment) atop containers is not allowed.
- Any material at height, exposed to the wind, shall be secured at all times.
- All piping shall be on mobile racks or, if too heavy, staged on dunnage and dogged.

Material Handling

- All materials delivered will be placed on wheeled carts, pallets or steel-totes.
- Loading areas shall be designed for prompt and safe material unloading or loading.
- Only ladders designed for trailer access shall be used to get on trailers.
- Tarping racks will be installed for dump trucks based on the scope of work.
- Do not walk backward with a hand truck, unless going up stairs or ramps.
- When loading a building, the maximum capacity should be painted on destination floor.
- Only trained pallet jack operators may operate pallet jacks and never ride on one.
- Store hand trucks with the tongue under a pallet or along a wall.
- If wheelbarrows are used, they shall have two wheels.
- Materials shall never be allowed to exceed the capacity of the floor like sheetrock paste, elevator weights, or nested welders.
- When unloading trucks, stand to the side when releasing a load that may roll and to be clear of binders or straps.
- Material handling must consider the storage, but also the position of those working.
- No work will be completed on the floor and completed at a neutral position work station when possible.

- Loading of upper floors:
  - Requires a dedicated landing spot with a corral and self-closing gate
  - Fall protection or a swing gate will be required
  - The capacity of the floor in square feet shall be posted
  - The lower floors will be barricaded so workers are not underneath

Life Safety

- Walkways must always be clear of materials.
- Combustible materials are not to accumulate in any area.
- Trash, debris or staged materials will never be staged on stairs, landings, aisles or exits.
- Material cannot be staged on walking or working surfaces including fixed and mobile scaffolds
- Materials cannot be staged within 10 feet of a shaft or edge of the building.
- Materials, like rebar stock, will never be placed on or across a walking surface.
- When materials weigh >70 lbs., those materials (sheetrock paste) could be transferred to smaller containers. This does not include bagged materials.
- Waste materials will never be tossed or staged on the ground.
- Debris and excess material, like stud and pipe ends, will be captured at the point of generation.
- Barricades must be installed around chutes leading to dumpsters and extend twice the height of the base of the chute from the ground.
- Piles of trash or debris in work areas or outside are not allowed or work will stop until corrected.
- All wood must have nails bent over or removed before handling.
- Drums and buckets are not allowed for lifting of any load.
- If dumpsters are located on the ground, a solid, non-slip ramp will be provided.
- Workers will never climb on debris to dump more debris in a dumpster.
- No material will be thrown from a height of more than 6 feet.
- Trash and waste material containers must meet the daily production of waste material or work will stop until additional containers are obtained.
- If dumpsters are located on the ground, a solid, non-slip surface for access will be provided.
- Workers will never climb on debris to dump more debris in a dumpster.

COMMENTS:

Audit conducted by:_____

Audit conducted by:_____ Date:_____

Innovative Technical Solutions, Inc.
A Gilbane Company

Sample Handling
Safe Work Procedures

Contents

1. Regulations 1
2. Purpose and Scope 1
3. Definitions 1
4. Requirements 1
5. Personal Protective Equipment (PPE) 2

1. REGULATIONS

- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response
- 8 CCR 5192, Hazardous Waste Operations and Emergency Response
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 2008

2. PURPOSE AND SCOPE

This procedure defines minimum requirements for safe handling of groundwater, soil and waste samples by all field employees.

3. DEFINITIONS

- *DOT:* U.S. Department of Transportation
- *Sample:* Material collected for the sole purpose of analytical testing to determine its composition or hazardous characteristics. Regardless of the hazardous nature of a sample, it is NOT considered a hazardous waste during collection, shipping and analysis. However, samples ARE subject to the DOT shipping regulations found in 49 CFR.

4. REQUIREMENTS

- All samples shall be packaged and shipped in accordance with DOT regulations in 49 CFR 106-180.
- Sample preparation and packaging for shipment shall be done at the collection site whenever possible. These activities should not occur in office buildings unless each sample is maintained in a clean, sealed container at all times.

- Samples shall not be transported in passenger vehicles unless packaged in appropriate DOT containers. Samples must not be transported in the passenger compartment of the vehicle.
- Samples should be shipped using methods such as private courier, Federal Express or UPS. Samples which may be hazardous may not be shipped via passenger carriers such as aircraft, trains or buses. If applicable, samples must be identified as Hazardous Materials on courier packing slip.
- Analytical laboratory contracts and service agreements shall include the requirement for the lab to properly dispose of unused and residual samples without returning these materials to ITSI, unless specifically required by the project contract.
- Personnel collecting samples must be adequately trained in proper sampling methods, Chain-of-Custody documentation, personal protective equipment, respirators, the hazards of the material to be sampled (if known), DOT shipping requirements and appropriate Quality Assurance/Quality Control (QA/QC) procedures.

5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

Sample collection methods and levels of PPE will be detailed in the Activity Hazard Analysis (AHA) for that work. Details are dependent on the type of suspected materials to be collected and the location of the work.

Note: Numerous sample techniques require the use of additional hazardous materials for tool cleaning between samples and in some cases, hazardous chemical are in laboratory prepared sample bottles as preservatives. Additional precautions are needed should these conditions or materials be needed for sampling. Those additional hazards and controls are to be spelled out in the AHA.

1. At minimum chemically protective gloves, head and eye protection will be worn.
2. If splash hazards exist, face protection, rubber aprons and gauntlet-type gloves may be required
3. Radiological samples will require additional precautions not listed here
4. If those sampling are in contact with contaminated soils proper skin protection will be worn in addition to prevention of saturation of that protection and the user when kneeling or collecting in standing or running water.
5. Should sample preparation, collection or shipping operations take place where vehicles are present or passing a retro-reflect vest will be worn.

Note: Glass containers provide a unique hazard from breakage during opening, closing and handling. Caution and care when working with glass is required.

Innovative Technical Solutions, Inc.
A Gilbane Company

Spill and Release Prevention, Response and Control
Safe Work Procedures

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4.2 Site Supervisors/Superintendents 2
4.3 Spill Response Personnel 3
5. Spill Prevention Measures **3**
6. Spill Response Procedures **4**
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6.2 Spills to Water 4
6.3 Spills in Structures 5
6.4 Spill Cleanup 5
7. Recordkeeping **6**

1. PURPOSE AND SCOPE

This procedure describes minimum safety requirements for the elimination of conditions that may result in a spill or a release of controlled or hazardous materials. Should a spill occur, the following are guidelines to the response but specific spill information is provided by the manufacturer in the Materials Safety Data Sheet for the product.

This safe work procedure is targeted to small spills that may occur on a project and not operations that entail a formal response to a spill by others. The requirements of this program apply to ITSI employees who may be involved in a spill and that response on site. Contractors that have the potential to store (diesel tanks) or use such materials (line paint) must have a program that meets the minimum requirements outlined in this program in addition to any other regulation or standard that might apply.

2. REGULATIONS

- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response

- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), November, 2008

Whenever a spill occurs, regardless of the quantity, the ITSI project superintendent shall be notified.

Containers and equipment that may spill materials on projects include:

Compressors - oil and contaminated condensate	**Elevators - hydraulic oil**	**Generator - fuel, oil, battery acid and coolants**
Oil/water separators	**Transformers – dielectric oil**	**Machinery - oil**
Under slab heating (offices) or cooling (cold storage buildings)	**Demolition materials like refrigerators – Ammonia and Freon**	**Vacuum truck contents**
Oil cooled switches – Dielectric oil	**Equipment like Drilling Rigs - fuel, oil, battery acid and coolants, transmission oil, hydraulic oil**	**Refrigeration and Cooling – Freon, Ammonia and Glycol**
Collected samples of groundwater from monitoring wells	**Chemicals being injected into contaminated subsurface**	**Equipment calibration standards**

3. DEFINITIONS

- *DOT* U.S. Department of Transportation
- *PPE* Personal Protective Equipment
- *SSHP* Site Specific Health and Safety Plan
- *APP* Accident Prevention Plan
- *AHA* Activity Hazard Analysis

4. RESPONSIBILITIES

4.1 Health and Safety Staff

The Health and Safety officer and ITSI site Supervisors/Superintendents are responsible for enforcing safe work practices and provide training and guidance for spill prevention and response activities.

4.2 Site Supervisors/Superintendents

Site Supervisors/Superintendents are responsible for verifying that contractors have a spill response protocol and that required training, PPE and spill response equipment is readily available to respond aggressively and successfully to a spill. Site Supervisors/Superintendents will oversee spill response activities and will observe operations for unsafe work practices. They will coordinate and perform other response or reporting activities with the owner/client. Superintendents will also schedule random drills to test the effectiveness of the response plan, availability of resources, etc.

4.3 Spill Response Personnel

All personnel involved in responding to a spill are responsible for complying with the Accident Prevention Plan, Activity Hazard Analysis and SSHP (if applicable) and safe work practices.

5. SPILL PREVENTION MEASURES

The goal on each project is zero spills. To reduce or eliminate the chance of a spill, the following must be considered:

- Ensure each piece of equipment or container with the potential to cause a spill is in good condition.
- Install barriers over manholes, floor-drains, sewers, etc., when working to confine a release.
- Consider fueling of equipment by service vehicles, rather than using skid-type fuel tanks and the hazards of that storage.

If materials of spill concern are stored, limit the amount on the project to what will be used for the following day. Per the USACE "*09.B.13 Flammable and combustible liquids in quantities greater than that required for 1 day's use shall not be stored in buildings under construction...*"

All sources of ignition must be prohibited within 50 feet of a combustible or flammable material.

Use self-closing containers to transport or store fuels or materials saturated with fuel. Only containers approved by a nationally-recognized testing laboratory (i.e.: UL, FM, etc.) shall be used for the storage of flammable and combustible liquids. Ordinary plastic containers are not allowed, due to their quick failure when exposed to a fire.

Portable tanks of less than 660 gallons shall be provided with emergency venting to limit internal pressure under fire conditions.

The design, construction and use of all storage tanks for flammable and combustible liquids must meet the requirements of NFPA 30.

Storage areas or tanks must be protected with a curb or other impermeable barrier to contain the contents of the liquids stored plus 10 percent. Provisions must be made to drain off rainwater to ensure their capacity to hold a spill is maintained.

All dispensers and tanks are to be protected against collisions by equipment with a physical barrier like a Jersey barrier or K-rail. Propane storage areas specifically must be protected by a substantial barrier to prevent contact and spilling of this fuel.

Should temporary heat be supplied by oil, all supply lines are to be inspected daily.

Fueling of equipment and devices shall not occur closer than 20 feet to a body of water, mechanical sump, monitoring well or drinking water well.

Owner/Client directed testing of petroleum lines with fuel provides the potential for a catastrophic release. Advise the owner/client of the hazards and recommend alternate, safer methods, like pressurizing with an inert gas or pulling a vacuum on the system.

Locks shall secure all fuel dispensers on mobile equipment or skid-type.

Clearly post emergency response phone numbers in all project fuel storage areas.

6. SPILL RESPONSE PROCEDURES

Specific spill response requirements for ITSI projects will be addressed in each SSHP and/or AHA. For fuel related work that response will also be coordinated with the owner/client. Each project site will have specific spill response protocols and these will be communicated to site workers during their site orientation. These spill response requirements will address spill hazards, control measures, spill containment clean-up procedures and reporting requirements. *In general*, spill response will be performed as follows:

The first step in spill response is to secure the affected area. This is especially important when dealing with flammable, corrosive, or toxic materials. Securing the area may include simply placing barricades around the spill area and restricting access to trained and authorized personnel only, or in the case of a severe emergency where bystanders in the area may be affected, evacuation may be necessary. In the case of severe emergencies or when the spilled/released material is unidentified, the owner/client will likely work with local regulatory agencies and emergency service agencies and may direct the overall response.

Proper PPE based on the material (consult MSDS and other references such as Quick Selection Guide to Chemical Protective Clothing, DOT Emergency Response Guide, etc.) and quantity spilled shall always be worn. ITSI personnel will not engage in any spill control operations involving unknown chemical, biological, or radioactive agents. PPE used by ITSI personnel for spill control of known materials may include levels D through Level B. ITSI personnel will not participate in spill response which would require Level A protection.

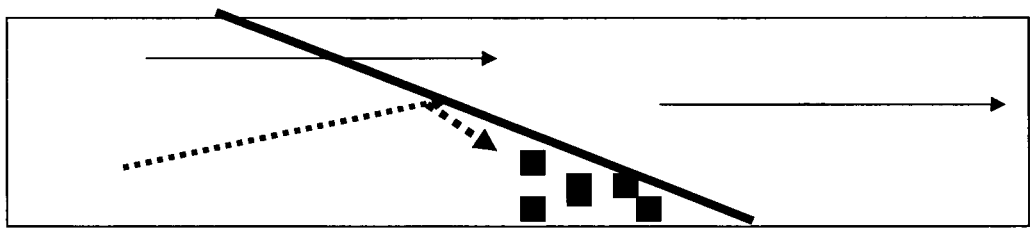
6.1 Spills to Ground

First, attempt to eliminate the source of the release. This may range from shutting a control valve to putting a bucket under a leaking hydraulic line. Second is to restrict the spill to the immediate area. This may include digging a small depression to catch the flow or a machine built berm around a storm drain to confine a larger release. Last is to collect the spilled material that is immediately available using sorbents and other methods. The type of spilled material may limit response (gasoline) due to the inherent dangers of the material. The MSDS will define a more specific response.

6.2 Spills to Water

A release to water is, in most cases, an emergency for the potential to spread to other receptors and environmental damage. Prompt reporting (as the response is conducted) is critical to muster other resources that may be needed. Note that a spill to water also includes releases into storm systems. Attempts to control the material to the area by booms or sorbents and booms is the best

first step, but in some cases water-soluble materials like alcohol or glycol capture will be impossible. Should moving water be affected and a boom deployed, it should be anchored well on both sides *but at an angle to the flow.* See diagram showing the boom installation and capture/sorbent area for floating liquids.



6.3 Spills in Structures

Due to the confining space of a structure, a spill of a flammable material or gas may pose a life safety threat. Based on the spilled material (LP-gas, gasoline, etc.) immediate evacuation may be necessary. If life safety is not a direct concern, first attempt to eliminate the source of the release. This may range from shutting a control valve to putting a bucket under a leaking coolant line. Second is to restrict the spill to the immediate area. This may include covering floor drains or applying spill materials like Spedi-Dri around the area. Depending on the material, ventilation may also be important to ensure vapors do not affect others from a toxicity concern or accumulate to a concentration which poses a flammability/explosive hazard.

Spill kits will be located near operations that have a spill potential. For example, if a line painting operations takes place on a taxiway, the spill kit shall be in the cab or on that equipment.

6.4 Spill Cleanup

The final step in spill response is removal of the spilled material, restoration of the area and waste disposal. Cleanup may require manual techniques (hand shoveling, wiping, etc.), mechanical techniques (excavators, loaders, etc.), or both. The cleanup may require owner/client or agency approval. Prior to any removal or disposal of any materials associated with a spill, ITSI will coordinate a meeting of all responsible parties to determine cleanup procedures, standards and approval of cleanup or remediation goals and waste material disposal processes. Approved (by DOT and the disposal facility) disposal containers will be utilized for collection of spill clean-up waste and materials. Containers must be compatible with the waste being generated.

Disposal of hazardous waste materials will be in accordance with all Federal, State and local regulations.

Hazardous waste manifests must only be completed by trained and authorized individuals. Typically, it is the owner/client who is authorized to sign Hazardous Waste Manifests.

7. RECORDKEEPING

During spill response, a record should be generated which contains:

- Project site and location of spill;
- Type of material and estimated quantities released and to what media like soil, water, concrete floor, the mechanism of release and responsible contractor;
- Personnel present, including both ITSI, outside agencies, public, press, etc.;
- Response actions taken, with times;
- Air monitoring readings;
- PPE utilized by response personnel;
- Any exposures or reported symptoms; and
- Any other information which may be used later to assess the impact of the spill or evaluate response actions.

After spill response is complete, the record should be reviewed specifically for the purpose of evaluating the response, making any changes to the AHA and preparing a lesson learned.

Note: Should the owner decline to report a spill to a government agency ITSI may be required to. The ITSI project manager will oversee this notification or documentation of the occurrence.

Innovative Technical Solutions, Inc.
A Gilbane Company

Traffic Control
Safe Work Procedures

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1. REGULATIONS

- U.S. DOT Manual of Uniform Traffic Control Devices (MUTCD).
- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM-385-1-1), September 2008.
- American National Standards Institute (ANSI) Standard for high-visibility clothing.

2. PURPOSE AND SCOPE

ITSI, our subcontractors, and other site personnel perform many tasks on project sites where work must be performed in and around vehicles and equipment traffic patterns and puts personnel at increased risk from being struck. Many site activities also take place in or along the shoulder of active roadways on bases and highways. In addition, our activities may impact the safety of drivers, bicyclist and walkers using the roadways, due to unexpected roadway conditions, unclear traffic controls, emergency vehicle access to areas and collisions with our equipment, etc.

The following guidelines should be used to develop specific traffic control measures for field work, which will be detailed in a Traffic Control Plan (TCP), if required, for each project. The TCP will be designed and submitted prior to the commencement of any contract operations. ITSI and the exposing contractor will develop the proposed TCP for the safe passage of traffic through while providing safe access to the contract work area. ITSI will coordinate with the client and obtain approval from local authorities prior to closing or restricting any roads.

This SWP includes references to the Army Corps of Engineers USACE EM 385.1.1 (*Safety and Health Requirements Manual),* but each contractor affected by the TCP must read and understand the entire "manual" and requirements. Should there be a conflict between a subcontractor's health and safety plan, the TCP, state or federal Manual of Uniform Traffic

Control Devices (MUTCD) and the USACE manual, the strictest guidance will apply. Host nation requirements must be included for OCONUS projects.

3. DEFINITIONS

- **Traffic Pattern** – overall pattern of controls, flaggers and devices to guide traffic through or around an entire work area. The area between the **CONSTRUCTION ZONE** signs.
- **Traffic Package** – specific deployment of a discrete set of controls within the traffic pattern, for example an area for trucks to enter a work area, midway, along the traffic pattern.
- **Reflective** – a surface where light will reflect but continue at that same angle (a mirror).
- **Retro-reflective** – occurs when light bounces from a surface that is engineered to return light in the direction of its source (like cat's eyes) at night or light from a safety vest reflective stripe.
- **Manual of Uniform Traffic Control Devices (MUTCD)** – nationally adopted standard for controlling traffic, shapes and colors of signs etc.

3.1 Personnel Qualifications

Each person whose actions affect temporary traffic control zone safety, from management through the site teams, must be trained appropriate to the job decisions each individual is required to make. Only those individuals, who are trained **from an accredited organization** in proper temporary traffic control practices, and work zone safety, flagging techniques, etc., and have a clear understanding of those principles, should design TCPs or work under the direction of the TCP. These accredited personnel shall also supervise the selection of control techniques, placement, and maintenance of temporary traffic control devices.

4. TRAFFIC CONTROL (INCLUDING USACE EM 385.1.1 SECTION 08 REQUIREMENTS)

Traffic control planning, lights, barricades, road markings, signs, and signalpersons for the safe movement of traffic shall be provided in accordance with the DOT Federal Highway Administration's "*Manual on Uniform Traffic Control Devices*" and this section. For OCONUS projects EM 385 1-1, host nation requirements and this section will be used.

The Contractor shall conduct his operations in such a manner as to offer the least possible obstruction to the safe movement of traffic over the existing roads during the life of the contract.

The Contractor shall be responsible for providing, erecting, maintaining, and removing all traffic signs, barricades, and other traffic control devices necessary for maintenance of traffic.

All barricades, warning signs, lights, temporary signals, other devices, flagmen, and signaling devices shall meet or exceed the minimum requirements of the MUTCD local DOT requirements.

Barricades, danger, warning and detour signs, as required, shall be erected before any roads are closed.

5. SITE OPERATIONS

In order to minimize the risk of struck-by accidents during site work, field personnel should consider the following guidelines when developing and implementing work site traffic control plans:

- Review the site specific safety plan and Activity Hazard Analysis (AHA) for any special traffic control details or hazards, like overhead power for the tasks that will be performed.
- Conflict avoidance planning. Keep people and machines apart by separating equipment and pedestrian routes, whenever possible, with barriers and install warning sign as needed. **Especially when workers cross equipment routes, for this is a continual high hazard condition**.
- Verify that all necessary traffic-control devices are available based on the approved TCP prior to installation of any traffic control pattern or "package" with that pattern.
- Using the traffic control devices, establish work zone as per the TCP and make any necessary adjustments based on traffic flow. Update the plan to reflect any changes in devices or controls.
- Attempt to set up control devices with field personnel facing/looking toward traffic, if possible have one person responsible to monitor that traffic (equipped with an air horn) to alert everyone in case of emergency (car enters pattern by mistake etc.)
- Consider blocking/warning vehicle or attenuator trucks when installing packages.
- Conduct a pre-job site safety meeting to ensure all workers are aware of site-specific traffic control measures and sign-off acknowledging that information.
- Assure that all personnel are wearing the appropriate high-visibility, retro-reflective garments. Colored shirts, etc., are not allowed in lieu of conventional safety vests.
- Wear the appropriate PPE for the work to be performed as indicated in the AHA with vests always closed, including retro-reflective striping on hardhats.
- When entering the site, get a feel for movement of vehicles before leaving your vehicle and ensure you have parked in a dedicated, protected area.
- Stay alert at all times, since vehicle or equipment traffic routes may change unexpectedly at any time. Be sure to look at all possible directions from which traffic may approach, including vehicles backing up. Never assume any established pedestrian pathway to be "safe."
- **Only perform work within the delineated work zone or traffic package.**
- Clear the work area and break down the traffic control system only after all work has been completed, and pick up the package only as specified in the TCP.

6. WORK ALONG ROADWAYS

Site work is dangerous but active public roadways increase risk based on the higher vehicle speeds and lack of control over those driving by. Whenever possible, replace people with a suitable device for traffic control to eliminate that threat. Per the USASE:

> *"A flag person or other controls shall be provided when operations or equipment on or next to a highway create a traffic hazard. An exception shall be made only when an adequate mechanical signaling or control device is provided for safe direction of the operation."*

Example - Effectiveness of Contrasting Color

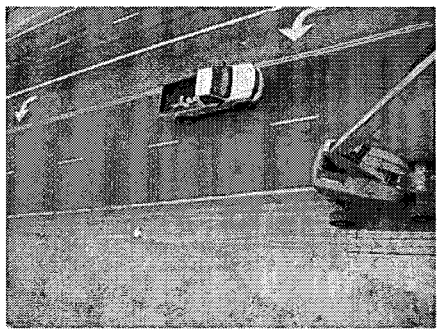
EXAMPLE: Always consider (and test) how a driver views traffic controls. In this example a flagger wearing an orange vest, orange hard hat and carrying an *orange* flag stepped out from among orange warning signs and barrels, was not seen and struck by a car.

6.1 Primary Considerations

Road user movement should be inhibited as little as practical, based on the following considerations:

- Temporary traffic control at work sites should be designed on the assumption that drivers will only reduce their speeds if they clearly perceive a need to do so.
- **DO NOT FOLLOW** signs should be considered for trucks entering the package from uncontrolled roadway or public vehicle may follow them in.
- Avoid frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions that require rapid maneuvers.
- Provisions should be made for the reasonably safe operation of work, particularly on high-speed, high-volume roadways including the installation of solid barriers.
- Yellow beacons or warning lights high on vehicles shall be provided for those entering the traffic pattern and these activated **well before** turning into traffic and when leaving the public highway to the work areas.
- Road users should be encouraged to use alternative routes that do not include temporary traffic control zones.

- Bicyclists and pedestrians should be provided with access and safe passage through the temporary traffic control zone.
- Roadway occupancy should be scheduled during off-peak hours and, if necessary, night work should be considered.
- Physical solid, concrete barriers should be placed between traffic and those to be protected.



Uncontrolled, Unplanned and Unprotected Activity

6.2 Traffic Control

The following principles should be applied:

- Drivers, bicyclists, and pedestrians should be guided in a clear and positive manner while approaching and passing temporary traffic control zones.
- Adequate warning, delineation, and channelization should be provided to assist in guiding road users in advance of and through the temporary traffic control zone by using proper pavement marking, signing, lane widths or other devices that are effective under varying conditions.
- Temporary traffic control devices inconsistent with intended travel paths through temporary traffic control zones should be removed or covered. However, in intermediate-term stationary, short-term, and mobile operations, where visible permanent devices are inconsistent with intended travel paths, devices that highlight or emphasize the appropriate path should be used.
- Flagging procedures, when used, should provide clear guidance to road users traversing the temporary traffic control zone.
- Construction areas shall be posted with legible traffic signs at points of hazard in accordance with the MUTCD.
- Signs required to be seen at night shall be reflectorized.
- Traffic flagging procedures (and flag colors) shall be in accordance with the DOT Federal Highway Administration's MUTCD.
- Those involved in TCP maintenance shall not ride on equipment through the package unless designed for that task (cone truck).

- When roads are temporarily closed to public access, barricades or gates shall be used that are highly visible in day or night conditions. At a minimum, barriers shall be coated with reflective paint or be applied with highly reflective tape on both sides, and be signed with 'ROAD CLOSED'.
- Affected roads shall also be posted with appropriate warning signs a minimum of 100 ft before the barrier. Size and placement of signs depends on viewing distance and speed limit of roadway.

Uncontrolled Traffic Protection

NOTE: If a flagger is found using a hand-held device, like a cell phone or reading text messages, while controlling traffic, he or she will be removed from the site for the balance of the project.

6.3 Inspections and Updating of the Traffic Control Plan

To provide acceptable levels of operations, routine day and night inspections of temporary traffic control elements should be performed as follows:

- Individuals who are knowledgeable (for example, trained and/or certified) in the principles of proper temporary traffic control should be assigned responsibility for safety in temporary traffic control zones. The most important duty of these individuals should be to check that all temporary traffic control devices of the project are reasonably consistent with the temporary TCP and are effective in providing safe conditions for drivers, bicyclists, pedestrians, and our workers.
- As the work progresses, temporary traffic controls and/or working conditions should be modified in order to provide safe and efficient road user movement and to promote worker safety. The individual responsible for temporary traffic control should have the authority to halt work until applicable or remedial safety measures are taken.
- Temporary traffic control zones should be carefully monitored (by driving through the pattern) under varying conditions of road user volumes, light, and weather to check that applicable temporary traffic control devices are effective, clearly visible, clean, and in compliance with the temporary TCP.

- When warranted, an engineering study should be made (in cooperation with law enforcement officials) of reported crashes occurring within the temporary traffic control zone. Crash records in temporary traffic control zones should be monitored to identify the need for changes in the temporary traffic control zone.

6.4 Ongoing Considerations

Attention should be given to the maintenance of roadside safety during the life of the temporary traffic control zone by applying the following principles:

- To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical.
- Channelization of road users should be accomplished by the use of pavement markings, signing, and crashworthy channelizing devices.
- Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.
- As the work progresses, temporary traffic controls and/or working conditions should be modified in order to provide safe and efficient road user movement and to promote worker safety. The individual responsible for temporary traffic control should have the authority to halt work until applicable or remedial safety measures are taken.
- If troops are in formation along or within the confines of the traffic controls speeds, all vehicles shall be reduced to 5 mph and that warning posted.
- Should a driver threaten a flagger or anyone controlling traffic, including verbal threat, horn use, or the threatening advance of a vehicle, etc., the flagger shall:
    - Never physically or verbally engage the operator;
    - Contact their supervisor or ITSI immediately in regard to the incident as soon as practical;
    - Do not attempt to stop the vehicle;
    - Record the license number and description of the vehicle; and
    - ITSI or the flaggers supervisor shall contact authorities, not the flagger.

7. HAUL-ROADS – SITE OPERATIONS PLANNING

Prior to construction, ITSI will review the TCP and coordinate those controls with an Access/Haul Road Plan for review and acceptance by the client. Work on the haul road shall not commence until the client has accepted the Access/Haul Road Plan.

The Access/Haul Road Plan shall reference the TCP (common intersections etc.) and address the following items:

- Equipment usage, traffic density, and hours of operation;
- Road layout and widths, horizontal and vertical curve data, over-travel protection, and sight distances;
- Sign and signalperson requirements, road markings, and traffic control devices;

- Drainage controls;
- Points of contact between vehicles and the public, and safety controls at these points of contact;
- Maintenance requirements, including roadway hardness and smoothness and dust control;
- Hazards adjacent to the road, such as bodies of water, steep embankments, etc.
- Traffic control lights, barricades, road markings, signs, and signalpersons for the safe movement of traffic shall be provided in accordance with the DOT Federal Highway Administration's "*Manual on Uniform Traffic Control Devices*" and this section;
- Roadway hardness, smoothness, and dust control shall be used to maintain the safety of the roadway; and
- All roads shall be maintained in a safe condition and eliminate or control dust, ice, and similar hazards.

8. HIGH-VISIBILITY GARMENTS

A minimum of ANSI Class 2 (or equivalent) apparel (vests, coveralls etc.) shall be worn by all site workers unless they pose a hazard to a task, like working around rotating equipment.

If conditions warrant high-visibility apparel for workers; based on visibility, vehicle speeds, or related conditions, that determination shall be made by the SHO. Determination shall be based on a risk assessment, as to whether ANSI Performance Class 3 (or equivalent) is needed. If Class 3 apparel is determined to be needed, then it shall be worn.

No colored tees or similar non-reflective materials will be worn in lieu of ANSI apparel vests, and all reflective garments must be zippered, buttoned or otherwise closed whenever in use.

For early dawn and dusk operations, ANSI Class 3 level garments shall be worn, due to low light conditions. If nighttime work is anticipated, the TCP shall reflect an increased level of protection per the ANSI standard.

For operations within controlled zones or those directly involved with traffic control(s), reflective strips shall be worn on hardhats, per standard protocols.

ANSI class vests must be clean, undamaged, 100% of the original reflective surface intact, and less than three years in service or they will be removed from service.

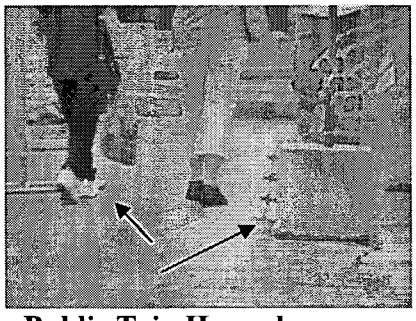
8.1 Public Relations

Good public relations and protection should be maintained by applying the following principles:

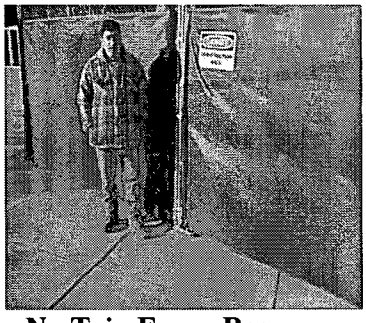
- The cooperation of the various news media should be sought, as necessary, in publicizing the existence of and reasons for temporary traffic control zones – news releases can assist in keeping the road users well informed.
- The needs of abutting property owners, residents, and businesses should be assessed and appropriate accommodations made.

- The needs of railroads and transit, emergency service providers (police, fire, and medical) should be assessed and appropriate coordination and accommodations made.
- All temporary traffic control devices shall be removed as soon as practical. When work is suspended for short periods of time, temporary traffic control devices that are no longer appropriate shall be removed or covered.
- Temporary fence bases shall not intrude into public walkways.
- Stored materials cannot extend into public walkways.
- Where a sidewalk or travel route cross an active equipment crossing, warning sign well in advance of that intersect are needed. Additional controls like a flagger may be required based on site conditions like a nearby school.
- Where a fence runs along a sidewalk and it is covered, viewing slots shall be installed to allow those walking by and those approaching in vehicles increased visibility.

Public Trip Hazard



Public Trip Hazard

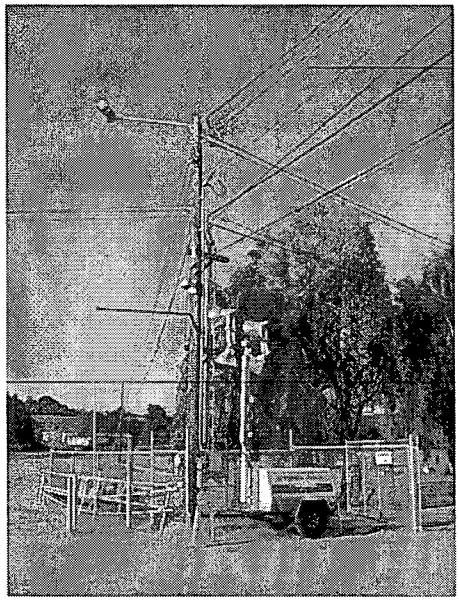


No Trip Fence Base

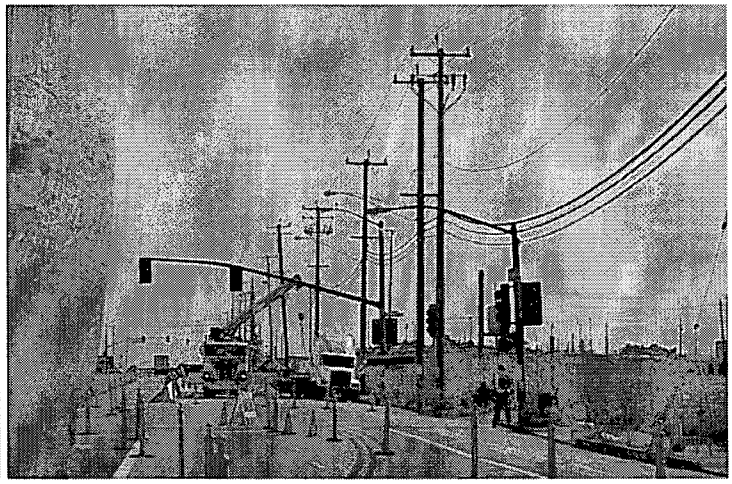
9. ADDITIONAL HAZARDS – OVERHEAD AND UNDERGROUND

Particular care to overhead power line and placement of traffic controls is critical. No telescoping or similar equipment shall be placed with 10 feet (distance over the highest piece of the equipment when operating) or within 10 feet of **utility line** when raised.

Signs will be posted highlighting overhead hazards where equipment crosses under or will park alongside.



Unsafe Placement of Light Set



Unsafe Installation of Traffic Barriers

Notification of underground utilities will be made (811 or host nation equivalent) before any sign or traffic control or marking stake is driven or anchored into the ground.

10. VERIFICATION OF CONTROLS – TRAFFIC CONTROLS

The following controls must be in-place prior to work:

- Assure that all personnel are wearing the appropriate high-visibility, retro-reflective garments. Colored shirts etc. are not allowed in lieu of conventional safety vests.
- Wear the appropriate PPE for the work to be performed as indicated in the AHA with vests always closed, including retro-reflective striping on hardhats.
- **Only perform work within the delineated work zone or traffic package.**
- Clear the work area and break down the traffic control system only after all work has been completed and pick up the package only as specified in the plan.
- **DO NOT FOLLOW** signs should be considered for truck entering the package from uncontrolled roadway or vehicle may follow them in.
- Frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions that require rapid maneuvers should be avoided.
- Yellow beacons or warning lights high on vehicles shall be provided those entering the traffic pattern and these active **well before** turning into traffic and when leaving the public highway and entering the package.

- Road users should be encouraged to use alternative routes that do not include temporary traffic control zones.
- Bicyclists and pedestrians should be provided with access and reasonably safe passage through the temporary traffic control zone.
- Roadway occupancy should be scheduled during off-peak hours and, if necessary, night work should be considered.
- Physical solid, concrete barriers should be placed between traffic and those to be protected
- Individuals who are knowledgeable (for example, trained and/or certified) in the principles of proper temporary traffic control should be assigned responsibility for safety in temporary traffic control zones. The most important duty of these individuals should be to check that all temporary traffic control devices of the project are reasonably consistent with the temporary traffic control plan and are effective in providing safe conditions for drivers, bicyclists, pedestrians, and workers.
- Temporary traffic control zones should be carefully monitored (by driving through the pattern) under varying conditions of road user volumes, light, and weather to check that applicable temporary traffic control devices are effective, clearly visible, clean, and in compliance with the temporary traffic control plan.
- When warranted, an engineering study should be made (in cooperation with law enforcement officials) of reported crashes occurring within the temporary traffic control zone. Crash records in temporary traffic control zones should be monitored to identify the need for changes in the temporary traffic control zone.
- No colored tees or similar non-reflective materials will be worn in lieu of ANSI apparel
- To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical.
- Channelization of road users should be accomplished by the use of pavement markings, signing, and crashworthy channelizing devices.
- Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.
- All road signage shall be installed, in original condition and maintained to take any wind load including storm winds that may arise overnight or weekends.
- If troops are in formation along or within the confines of the traffic controls speeds of all vehicles shall be reduced to 5 mph and that posted.
- Should a driver threaten a flagger controlling traffic including verbal threat, horn use or threatening advance of a vehicle etc., the flagger shall:
    - Never physically or verbally engage the operator,
    - Contact their supervisor or ITSI immediately in regard to the incident as soon as practical,
    - Do not attempt to stop the vehicle by stepping in front,

- Record the license number of the vehicle, and
- ITSI or the flaggers' supervisor shall contact authorities, not the flagger.

- ANSI Class 2 (or equivalent) apparel (vests, coveralls etc.) shall be worn by workers all site workers unless they pose a hazard to that task like rotating equipment.
- If conditions warrant based on visibility, vehicle speeds or related conditions a determination shall be made by the SHO, based on a risk assessment, as to whether Performance Class 3 (or equivalent) high-visibility apparel is needed for higher visibility of workers and if so, they shall be worn.
- Vests and all reflective garments must be zippered, buttoned, or otherwise closed whenever in use.
- For early dawn and dusk operations ANSI Class 3 (or equivalent) level garments shall be work due to low light conditions. If nighttime work is anticipated, the TCP shall reflect the increase level of protection per the ANSI standard.
- For operations within, or those directly involved with, traffic control(s), reflective strips shall be worn on hardhats per standard protocols.
- ANSI class vests must be clean, undamaged, 100% of the original reflective surface, intact, and less than three years in service, or they will be removed from service.
- Particular care to overhead power line and placement of traffic controls. No telescoping or similar equipment shall be placed within 10 feet (distance over the highest piece of the equipment when operating) or within 10 feet of **utility line** when raised.
- Notification of underground utilities will be made (811 or host nation equivalent) before any sign or traffic control or marking stake is driven or anchored into the ground.
- Signs will be posting of overhead hazards where equipment crosses under or will park alongside.

Appendix C

Safety Forms

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Innovative Technical Solutions, Inc.
A Gilbane Company

ACCIDENT REPORTING CHECKLIST

Accident Description: _____ Date: _____

- ❑ When an accident occurs, employees should notify the supervisor or call the emergency number directly, and give first aid according to their level of training.
- ❑ Supervisor coordinates with medically-trained persons (first-aid trained personnel or paramedics) to arrange for transport of any victims to the closest hospital or clinic. If an injury is life-threatening, or could worsen en route to the hospital, the fire department or paramedics should be contacted.
- ❑ Supervisor fills out the Authorization for Medical Treatment form and sends it to the hospital or clinic with the injured employee. If a chemical exposure is suspected, the MSDSs or Site Health & Safety Plan should also be sent.
- ❑ If the injured person refuses medical care, they must fill out a Refusal of Medical Care form.
- ❑ If the accident involves a fatality, serious injury (amputation, etc.), or hospitalization other than for observation, the Supervisor must call the Health & Safety Manager **immediately** after the accident (OSHA must be notified within 8 hours in these cases). If in doubt, call the H&S Manager.
- ❑ Supervisor should assure that the appropriate client contacts are also notified.
- ❑ Supervisor fills out the Accident Report form and faxes or emails it to the Health and Safety Manager **no later than 8 hours after the accident.**
- ❑ Supervisor must collect and forward to the H&S Manager all relevant medical treatment information, such as diagnosis, treatment, return visits for medical re-evaluation, work restrictions, and return to work date.
- ❑ Supervisor works with the employee to complete the Employee's Claim for Workers' Compensation Benefits form. Supervisor and employee both retain copies. Supervisor faxes or emails the form to the H&S Manager, who forwards a copy to the insurance company. Original form should be mailed to the H&S Manager.
- ❑ Supervisor completes the Accident Investigation form within 1 week, and sends a copy to the H&S Manager. The Investigation form should outline the corrective actions implemented to prevent further accidents. Preliminary corrective actions should be implemented prior to completion of the final report.

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CONTRACTOR SITE SAFETY REQUIREMENTS

Project: _____ Contractor: _____

Task: _____ Supervisor: _____

Task Description: _____

Equipment Used:
- ❑ Trucks
- ❑ Cranes
- ❑ Welding/torch cutting
- ❑ Chain saws
- ❑ Drilling equipment
- ❑ Earthmoving equipment
- ❑ Generators
- ❑ Other: _____

Hazards

- ❑ Environmental: ❒ Heat ❒ Cold ❒ Storms ❒ Lightning
- ❑ Trip/slip/fall
- ❑ Noise
- ❑ Hand hazard
- ❑ Foot hazard
- ❑ Head hazard/falling objects
- ❑ Eye/face hazard: ❒ Particles ❒ Splash ❒ Gases/vapors ❒ Radiation (UV, laser)
- ❑ Falling/elevated work surface
- ❑ Fire (source): _____
- ❑ Welding/torch cutting/grinding
- ❑ Manual material handling
- ❑ Confined space
- ❑ Excavation (depth): _____
- ❑ Underground utilities (types): _____
- ❑ Aboveground electrical lines (voltage): _____
- ❑ Other electrical (source, voltage): _____
- ❑ Mechanical/moving machinery
- ❑ Heavy equipment/vehicles
- ❑ Chemical: ❒ Splash/Contact ❒ Airborne ❒ Flammable ❒ Corrosive ❒ Reactive ❒ Toxic
- ❑ Biological hazards: _____
- ❑ Radiation: Source: _____
- ❑ Other: _____

Written Programs (to be submitted to ITSI prior to work)

- ❑ Site-specific H&S plan
- ❑ Chemical inventory, MSDSs for all chemical products, including gasoline & diesel
- ❑ Corporate safety program – hazard communication
- ❑ Corporate safety program – respiratory protection
- ❑ Corporate safety program – confined space
- ❑ Corporate safety program – lockout/tagout
- ❑ Corporate safety program – excavation
- ❑ Corporate safety program – hot work/fire prevention
- ❑ Corporate safety program – other: _____

Permits/Notifications

- ❑ Excavation permit
- ❑ Asbestos demolition notification

- ❑ Noise permit
- ❑ Hot work
- ❑ Other: _____

Project Postings

- ❑ OSHA & other required postings
- ❑ Safety signs – specify: _____

Training and Medical Monitoring

- ❑ Site-specific training
- ❑ Daily tailgate meetings
- ❑ First aid/CPR (at least 1 per work area)
- ❑ Hazardous waste (Hazwoper)
- ❑ Excavation competent person
- ❑ Confined space
- ❑ Fall protection
- ❑ Forklift
- ❑ Crane operator
- ❑ Lockout/tagout
- ❑ Other – specify: _____

On-Site Equipment

- ❑ Portable toilet
- ❑ Handwash
- ❑ Potable water
- ❑ First aid kits
- ❑ Fire extinguishers
- ❑ Eyewash
- ❑ Spill kits for diesel, gasoline, other: _____

Protective Equipment (minimum required)

- ❑ Level D (minimum for ALL site employees): hardhats, safety boots, safety glasses, reflective vest, plus hearing protection as necessary
- ❑ Modified D: Level D plus chemical-protective clothing
- ❑ Level C: Modified D plus cartridge respirator
- ❑ Level B: Modified D plus air-supplied respirator
- ❑ Level A: Fully-encapsulating suit plus SCBA
- ❑ Fall protection (harness/lanyard)
- ❑ Goggles
- ❑ Faceshield
- ❑ Glove (type): _____
- ❑ Other: _____

Monitoring Equipment

- ❑ Confined space (oxygen, combustibles, carbon monoxide, hydrogen sulfide)
- ❑ Organic vapor (PID or FID)
- ❑ Other: _____
- ❑ Calibration equipment for daily calibration

Inspection Requirements

- ❑ Daily site safety inspection by supervisor
- ❑ Daily inspection of equipment
- ❑ Monthly inspection of emergency equipment
- ❑ Weekly safety audit
- ❑ Daily excavation inspection by competent person
- ❑ Other: _____

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CRANE SAFETY INSPECTION

Location: _____ Unit No.: _____ Owner: _____

Inspected by: _____ Title: _____ Inspection Date: _____

Instructions: Check off every item as "OK" or "Not OK". All "Not OK" items must have an explanation of corrective actions and date completed.

Inspection Item	Check	OK	Not OK	Corrective Actions	Date Corrected
Operating Mechanisms	Visual for function				
Limit Switches	Visual & operational for function				
Air Systems	Visual for leaks				
Hydraulic Systems	Visual for leaks				
Hooks	Visual for deformation and cracks				
Chains	Visual for wear, elongation and twist				
Wire Ropes	Visual for wear, broken wires, kinks				
Slings	Visual for wear, broken wires, kinks				
Rope Reeving	Visual for proper seating in drum and sheave grooves				
Chain Drive Sprockets	Check for wear; broken teeth				
Drive Chain	Check for stretch, deformation				
Brake System	Visual for operation brake drift (hoist)				
Sheaves	Lower block sheaves visual for wear				
Drums	Check for wear and cracks				
Fasteners	Check for tightness				
Electrical Apparatus	Check electrical components for function, loose connections & deterioration				
Lock and Clamp Mooring Devices	Visual for function and wear Check for wear, distortion and fractures				
Cab	Check hangers and fasteners				
Load, Wind and Other Indicators	Check for accuracy				
Power Plants	Performance and safety requirements				

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EQUIPMENT & TRUCK INSPECTION CHECKLIST

Project: _____ Project No.: _____

Equipment: _____ ID Number: _____

Inspected by: _____ Date of Inspection: _____

Mark √ , No or N/A for inspection items. .Explain any damage or defects, and what action was taken to correct them.

Inspection Item	OK? (√ , No or N/A)	Damage/Defects	Corrective Actions
Fire extinguisher			
Seat belts			
Gauges			
Battery charged			
Horn			
Brakes			
Steering			
Lights and signals			
Windshield wipers			
Windows clean			
Fluid levels full			
Engine belts			
Tire pressure and wear			
Steps, hand grips clean			
Back up alarm			
Tracks clean			
Guards on moving parts			
Load/lifting capacity marked			
Other:			
Other:			

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FIELD ACTIVITY REPORT

Project:	Date:	Page of
Client:	Contract No.:	Project No.:
Work Description:		
Subcontractors/Visitors:		
Weather:		

DESCRIPTION OF FIELD ACTIVITIES AND EVENTS

Prepared by:		Signature:		Date:	

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FORKLIFT INSPECTION

Forklift I.D.: _____ Type of Truck: _____ Area Used: _____ Performed by: _____

		Fluid Levels					Leaks					Inspect						Check								
Date	Check By	Battery	Oil	Hydraulic	Coolant		Hydraulic	Steering	Brakes	Radiator		Hoses	Belts	Tires	Mast/ Forks	Battery		Horn/ Alarm	Lights	Gauges	Safety Equip	Controls	Fuel		Ready to Use	Problems Noted

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HOT WORK PERMIT

SITE: _____ **PROJECT#:** _____

ISSUED TO: _____
LOCATION: _____
DATE: _____

HOT WORK ACTIVITY (check appropriate box):

YES	NO	
		Welding (electric or gas)
		Oxy-acetylene torch
		Abrasive Grinding
		Heat treatment
		Cutting
		Other

SAFETY CHECKLIST (check appropriate box):

		Material to be worked on has been evaluated for hazardous emissions
		Work area free of flammable or combustible materials
		Fire extinguishers on hand and full
		Fire watch posted (if required) Name: _____
		Emergency exit routes clear
		Ventilation provided (if confined area or poor natural ventilation)
		Worker has appropriate eye protection, face shield, clothing, respirator, etc.
		Compressed gas cylinders are secured
		Equipment has been inspected and is free of defects
		Others in immediate area have been notified of hot work activity
		Welding or cutting work performed behind shielding (where practical)
		Fall protection provided (where applicable)
		Potential hazardous atmospheres checked:
		_____ % LEL _____ % Oxygen

When applicable, this permit may be used in conjunction with a confined space Entry Permit

Valid from: _____ **To:** _____

I have verified that all requirements of the hot work procedure and permit have been met and therefore issue this permit.

ISSUED BY: _____

TITLE: _____

DATE:

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WORKER ACKNOWLEDGEMENT OF SITE HEALTH AND SAFETY REQUIREMENTS

(fill in/modify as necessary prior to project)

Project Name: _____
Project Location: _____
Project Number: _____
Client/Contract No.: _____

EMERGENCY CONTACTS *(also attach table, and map to hospital, from H&S plan)*

Function	Contact	Phone
Fire Response		
Medical Response		
Hospital		
Police		
Project Manager		
Site Supervisor		
Site H&S Officer		
H&S Manager		
Client		
Agency		

EMERGENCY PROCEDURES

Reporting	Report **ALL** accidents, injuries and near misses to the site supervisor/HSO immediately.
Medical emergency	Secure the area and the victim. Call the emergency number, have someone meet responders. Render first aid if trained. Transport by ambulance if the injury is serious.
Fire	Evacuate the area. Call the emergency number, have someone meet responders. Use fire extinguisher if you are trained and have a safe exit route.
Chemical spill	Evacuate the area. Call the emergency number as necessary. Have someone meet responders. Contain/cleanup the spill if you are trained and have the right equipment.
Site evacuation	Meet at the rally point for head count. Supervisor/HSO will arrange for off-site evacuation as necessary

SITE HAZARDS

Physical & Biological Hazards	*Chemical Hazards (include chemical products)*

SITE SAFETY PROCEDURES/WORK RULES

Changes/Exceptions	Exceptions to rules are allowed only after approval by site supervisor/HSO.
Check-In Procedures	All personnel must check in with site supervisor/HSO upon entering site.
Work Zones	
Training/Medical Monitoring	
PPE Required	Minimum Level D: hardhat, safety glasses, steel-toed boots, reflective vest. Other:
Work rules	Follow all site-specific security measures. No alcohol, illegal drugs, or weapons on site. Site speed limit is 15 mph. Construction equipment has the right-of-way. Smoking in designated areas only. No eating, drinking, chewing gum, or smoking in exclusion zones. Use the buddy system while working on site. MSDSs must be maintained and accessible for all chemical products. Decon and washup procedures must be used upon exiting exclusion zones.

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WORKER ACKNOWLEDGEMENT OF SITE HEALTH AND SAFETY REQUIREMENTS

(fill in/modify as necessary prior to project)

Project Name: _____

Project Location: _____

Project Number: _____

Client/Contract No.: _____

WORKER ACKNOWLEDGEMENT

I have been briefed on and understand the requirements of the Site Health and Safety Plan for this project. By signing below, I acknowledge and agree to follow the Site Health and Safety requirements, as outlined in the Plan.

Date	Name (Printed)	Company	Signature

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JOB HAZARD ASSESSMENT

Area: _____ Task Description_____ Daily Task Duration: _____ hours

Prepared by: _____ Title: _____ Date Prepared: _____ Page 1 of 2

Reviewed by: _____ Title: _____ Date Reviewed: _____

Job/Task Description

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Physical Positioning and Demands

❒ Walking	❒ Twisting
❒ Climbing	❒ Reaching
❒ Standing	❒ Stretching
❒ Sitting	❒ Lifting
❒ Squatting	❒ Carrying
❒ Kneeling	❒ Grasping
❒ Stooping	❒ Pushing
❒ Bending	❒ Pulling

Job Hazards (check and describe specific hazards)

❒ Electrical (source, voltage): _____	❒ Head hazard: _____
❒ Mechanical: _____	❒ Falling/elevated work surface _____
❒ Moving machinery: _____	❒ Noise: source(s): _____
❒ Caught in or between: _____	❒ (Speech difficult at arm's length)
❒ Impact: _____	dBA @ 3 ft.: _____
❒ Chemical: _____	❒ Radiation: Source: _____
❒ Splash/Contact ❒ Airborne ❒ Flammable	❒ Ergonomic: _____
❒ Corrosive ❒ Reactive ❒ Toxic	❒ Vibration: _____
❒ Incompatibilities: _____	Environmental
_____	❒ Heat ❒ Cold ❒ Wet ❒ Outside ❒ Inside
❒ Eye/face hazard: _____	❒ Trip/slip/fall: _____
❒ Particles ❒ Splash ❒ Gases/vapors	❒ Confined space: _____
❒ Radiation (UV, laser, other _____)	❒ Other: _____
❒ Hand hazard: _____	❒ Other: _____
❒ Foot hazard: _____	❒ Other: _____

Engineering Controls

❒ Ventilation: _____	❒ Other: _____
❒ Shielding: _____	❒ Other: _____
❒ Guarding: _____	❒ Other: _____
❒ Other: _____	❒ Other: _____
❒ Other: _____	❒ Other: _____

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JOB HAZARD ASSESSMENT

Area: _____ Task Description_____ Daily Task Duration: _____ hours

Prepared by: _____ Title: _____ Date Prepared: _____ Page 2 of 2

Reviewed by: _____ Title: _____ Date Reviewed: _____

Safe Practices and Procedures (attach additional page as necessary)	
❒ Lockout/Tagout (use LO/TO form)	❒ _____
❒ Monitoring: _____	❒ _____
❒ Bonding/grounding: _____	❒ _____
❒ Confined Space Permit	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____
❒ _____	❒ _____

Protective Equipment (list specific type)	
❒ Safety glasses, type: _____	❒ Other: _____
❒ Goggles: _____	❒ Other: _____
❒ Faceshield: _____	❒Other: _____
❒ Glove type:_____	Respirators
❒ Footwear: _____	❒ Dust Mask: ❒ N ❒ O ❒ P
❒ Protective Clothing type: _____	❒ 95 ❒ 99 ❒ 100
❒ Hardhat:: _____	❒ Cartridge Respirator: ❒ Full-face ❒ Half-face
❒ Earplugs: _____ NRR: ____dBA	Cartridge type: _____
❒ Earmuffs: _____ NRR: ____dBA	❒ Airline respirator:_____
❒ Harness/lanyard:	❒ SCBA: _____

Training	
❒ Basic Employee Safety Orientation	❒ Heat Stress
❒ Supervisor's Responsibilities	❒ Hot Work
❒ Asbestos Awareness	❒ Laboratory Safety
❒ Bloodborne Pathogens	❒ Ladder Safety
❒ Chemical Safety	❒ Lead Awareness
❒ Compressed Gasses	❒ Lockout/Tagout
❒ Confined Spaces	❒ Machine Shop Safety
❒ Electrical Safety	❒ Office Safety
❒ Emergency Response Team	❒ Personal Protective Equipment
❒ Ergonomics	❒ Power Tools
❒ Fall Protection	❒ Radiation
❒ First Aid/CPR	❒ Welding/Cutting
❒ Forklift Operation	❒ Other: _____
❒ Hearing Conservation	❒ Other: _____

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LOCKOUT/TAGOUT PROCEDURE

Location: _____ Equipment Type/ID: _____

Lockout performed by: _____ Date: _____

Direct energy types & sources: _____

Stored energy types & sources: _____

Lockout/blockout devices to use: _____

Notes/special hazards or issues: _____

_____

_____

Emergency contact: _____

Shutdown SOP

- ❑ Identify direct and stored energy sources (see above)
- ❑ Notify affected employees (which equipment, when, why)
- ❑ Shut down equipment by normal procedures
- ❑ Isolate equipment from energy - turn off power at source
- ❑ Lockout/tagout energy source(s)
- ❑ Release or protect from stored energy
  - ❑ Electrical ground
  - ❑ Open hydraulic/pneumatic valves
  - ❑ Pipeline blanks
  - ❑ Bleed/flush systems, test downstream valves
  - ❑ Release spring tension
  - ❑ Dissipate heat & cold
  - ❑ Blockout
  - ❑ Shutdown adjacent machines if vibration is an issue
- ❑ Verify lockout effectiveness:
  - ❑ Test lock
  - ❑ Check with voltmeter if electrical
  - ❑ Clear employees from area
  - ❑ Turn equipment controls on
  - ❑ Turn equipment controls off

Startup SOP

- ❑ Make sure equipment is intact, guarding is in place
- ❑ Make sure employees and tools are at safe location
- ❑ Make sure equipment controls and valves are OFF
- ❑ Remove locks & tags
- ❑ Re-start equipment
- ❑ Check equipment operation
- ❑ Return locks and tags

Innovative Technical Solutions, Inc.
A Gilbane Company

SITE SAFETY AUDIT

Project Name: _____ Inspection Date: _____

Project Location: _____ Client: _____

Inspector: _____ Title: _____

Instructions: Check off every item as "Yes", "No", or "Not Applicable". All "No" items must have an explanation of corrective actions undertaken to correct the problem.

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
Documentation					
Site Health & Safety Plan (completed, approved, accessible to employees, and signed by employees)					
Emergency Response/Contingency Plan					
Accident/Injury/Incident Reports					
MSDS's for all chemicals brought on site					
Exposure Monitoring Records					
Training Records - Use Employee Records Log form					
Tailgate Meeting Records					
Corporate Injury & Illness Prevention Program					
Vehicle Inspection Reports					
Carcinogen Use Notification, as appropriate					
Other					
Permits					
Excavation (notice to CAL/OSHA as appropriate)					
Demolition					
Air Quality					
Tank Removal					
Other					
Postings					
OSHA 200 Log - posted and up-to-date					
Map/directions to hospital (posted in every vehicle?)					

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SITE SAFETY AUDIT

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
Emergency Phone Numbers (posted by every phone?)					
Are emergency numbers verified?					
OSHA Job Safety & Health Poster					
Corporate Substance Abuse Policy					
Corporate Sexual Harassment Policy					
Equal Employment Opportunity Notice					
Access to MSDS's					
Access to Medical and Exposure Records					
Exposure monitoring results, as appropriate					
Access to OSHA Standards and Regulations					
Notice of Workers' Compensation Carrier and Benefits Availability					
Notice to Employees of Time Off to Vote					
Proposition 65 Warnings					
Radiological Sources Notification, as appropriate					
Employee Polygraph Protection Act					
Dept. of Fair Employment and Housing Anti-Discrimination Policy					
Americans with Disabilities Act Notification					
Pay Day Notice					
Minimum Wage and Hours					
Unemployment and Disability Insurance Notice					
Noise Hazard Warnings, where appropriate					
"Authorized Personnel Only" signs at perimeter					
Speed limit signs					
Other					
Vehicles/Heavy Equipment					
Backup Alarms are operational on all construction vehicles/equipment					
Mirrors are present and in good condition on all vehicles					

Innovative Technical Solutions, Inc.
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SITE SAFETY AUDIT

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
Fire extinguishers of at least 10 lb. ABC are on all equipment					
Seat belts are on equipment and are used by operator					
Rollover Protection is present on all heavy equipment					
Windshields are in good condition					
General vehicle/equipment condition is good (tires, frame, etc.)					
Equipment is parked with buckets/forks in the down position					
Cranes are moved with the boom down and rigging secured					
Cranes have load chart and angle indicator visible to operator					
Drill rigs are moved with the boom down					
Vehicles maintain proper speeds on site					
Vehicle/equipment operators are alert, check blind spots regularly, and pay deliberate attention to ground personnel					
All chains, slings, and hoists are in good condition and are inspected before use					
Ground personnel pay deliberate attention to heavy equipment and stay within sight of operators					
Fire Safety					
Flammable liquids are stored properly in the appropriate containers					
Welding and torch cutting are performed with a fire extinguisher within easy reach, and only when all combustible materials have been removed from the area					
Hot work performed in potentially flammable areas is performed only with a completed Hot Work Permit and with the proper monitoring					
Oily rags are placed in covered metal containers and are disposed of daily					
Fire extinguishers are accessible and not blocked by vehicles, tools, or equipment					
Fire extinguishers are maintained properly					

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
and inspected, and inspection tags are present					
Fire extinguisher hydrostatic tests are performed at the required intervals (12 years for halon and dry chemical, 5 years for AFFF foam)					
Containers of flammable liquids are bonded/grounded during transfer of their contents					
Other					
Electrical Safety					
All circuit breakers are labelled with the circuits they control					
Electrical outlets, junction boxes and circuit breaker panels are properly covered with no exposed wiring					
All 120-volt outlets which are not part of the permanent wiring of a building are protected by a Ground Fault Circuit Interrupter					
All extension cords are protected from vehicle and foot traffic					
Extension cords are in good condition, with no splices, taping, or missing third prongs					
Portable power tools have 3-prong plugs or are double-insulated					
Lockout/tagout procedures are utilized whenever work is performed on electrical/mechanical equipment					
Other					
Excavations and Trenches					
The competent person is identified for the safety aspects of all excavations/ trenches					
Excavations/trenches and shoring systems are inspected at least every shift by the competent person, and additionally whenever site conditions may change					
All excavations/trenches have been evaluated for confined space conditions					
Confined space entry procedures are utilized for all trenches/excavations posing confined space hazards to entering employees, and a checklist/permit system					

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
is utilized					
Soil conditions have been evaluated by the competent person, and the excavations/trenches are adequately sloped, benched, or shored based on this information					
Shoring systems have been approved by a Registered Professional Engineer					
Shoring design specifications are available on site					
Soil stockpiles are placed no closer than two feet from the edge of all excavations/trenches, and workers are protected from material falling in					
Excavations/trenches are protected from potential inrush of water from rainfall, water or sewer line breakage, or nearby fire hydrants					
Excavations/trenches are kept dry during work operations.					
Pumps used for dewatering are in good working order					
Underground utilities have been located, and exposed utilities are protected					
Underground Service Alert and all entities potentially affected by the excavation have been notified					
Barricades or other devices are used to prevent inadvertent entry into trenches/excavations					
Excavations/trenches are protected from surface imcumbrances such as vehicles, buildings, and soil stockpiles					
Ladders are located in excavation so that employees have access to them within 25 feet at all times					
Other					
Site Control/Housekeeping					
Work Zones (Contamination, Decon, and Support Areas) are clearly marked on site					
Vehicle routes are well-marked					
Emergency exits in trailers are clearly marked and are not blocked					

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SITE SAFETY AUDIT

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
Overhead hazards such as low ceilings and sharp corners are clearly marked					
Debris and materials piles are maintained so as to prevent tripping hazards					
Floor openings and sumps are barricaded, fenced, or covered with a structurally-sound cover					
Decon areas and trailers are maintained in a clean fashion, and clean areas are separated from contaminated areas					
Used Personal Protective Equipment is stored in closed containers and properly labeled for disposal					
Decon water in boot washes is changed regularly					
Confined Space Entry permits/checklists are utilized on site for all such operations					
Benches are provided in decon areas for employees removing their boots					
A separate break area is provided for employees					
Areas where Personal Protective Equipment or respirators are required are clearly identified					
Adequate lighting is provided indoors and for outdoor work after dark					
Other					
Emergency Equipment					
All emergency equipment (eyewashes, First Aid kits, fire extinguishers, SCBAs) are readily accessible to the employees, and not blocked by equipment, tools, etc.					
All emergency equipment is inspected at least monthly, and documented					
First Aid kits are full and clean					
Eyewashes and safety showers are working properly. Eye wash fluid is full, and pressurized eyewashes are fully charged					
Eyewashes/showers have only stainless steel or plastic fittings, and protective cups are in place					
Other					

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SITE SAFETY AUDIT

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
Personal Protective Equipment (PPE)					
Employees are wearing correct PPE and respirators as defined in the H & S Plan					
Areas where specific PPE is required on site are clearly identified					
Site personnel follow the appropriate decon sequence					
Employees' safety equipment, such as harnesses, work boots, safety glasses, hardhats, etc. are in good condition					
Other					
Respiratory Protective Equipment					
Respirators are worn properly					
Respirators are in good physical condition					
Respirators are cleaned daily					
Respirators are stored properly in a protected, clean, dry area on site, and not left hanging out in the open					
Airlines are stored clean and neatly coiled in a clean, dry area					
SCBAs and 5-minute egress cylinders are full and are in good physical shape and working order					
SCBAs are inspected monthly and before each use, and inspection tags are present					
Out-of-service SCBAs and airline respirators are clearly marked and separated from working units					
SCBA and 5-minute egress cylinder hydrostatic test dates are current					
Other					
Hazardous Material/Waste Handling					
Incompatible materials are stored in separate areas					
Hazardous materials and wastes, including flammable substances, are stored in the appropriate containers, are properly labelled, and are protected from weather and ignition sources					
Containers of flammable liquids are					

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
grounded/bonded during transfer of their contents					
All compressed gas and SCBA cylinders are marked with their contents, and are segregated based on compatibility and as "empty" or "full"					
Compressed gas cylinders are kept upright and are tied or chained to rigid supports, or are on stable welding carts					
Cylinder caps are secured in place when compressed gas cylinders are moved or stored					
Compressed gas cylinders are moved with dollies whenever possible					
Flammable liquid storage tanks have berms capable of containing the entire contents of the tank					
Flammable materials storage areas have a fire extinguisher available within 25 feet					
Other					
Ladders/Scaffolds/Elevated Work Surfaces					
Stairs with more than four steps have handrails					
The lowest stair step is no more than 12 inches high					
Stair steps are all the same vertical distance apart					
Ladders and stairs are clean and unobstructed					
Landing platforms, scaffolds, and tarping racks higher than four feet have rigid guardrails at least 42 inches high with midrails halfway between the top rail and platform					
Fixed ladders have landing platforms every 20 feet along the ladders, and ladder cages for fall protection					
Only wooden ladders are used near electrical lines					
Wooden ladders are not painted					
Distance between ladder rungs is 12 inches or less, and rungs are evenly spaced					

SITE SAFETY AUDIT

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
Ladders have no damage, defects, or missing parts, including support feet					
Ladders are marked with their maximum safe load ratings					
Ladders extend three feet above the top surface being climbed, and are secured at top and stable at bottom					
Tarping racks and scaffolds are on level, stable surfaces with dry footings					
Tarping racks and scaffolds, including access ladders, are free of ice, snow, and mud buildup					
Tarping racks and scaffolds have no damage, defects, or missing parts					
Floor boards on tarping racks fit tightly with no open spaces between boards					
Floor boards extend 6-18 inches beyond the ends of the tarping rack, and are tied or bolted at both ends					
Employees working on platforms higher than 7½ feet are wearing properly secured lifelines and safety harnesses					
Other					
Confined Spaces					
All enclosed areas are evaluated for confined space conditions before entry					
Confined spaces into which no one will enter are properly marked and protected from entry					
Confined space entries are performed only with the proper procedures and utilizing and confined space entry permit/checklist					
Other					
Air Monitoring					
Air monitoring instruments are maintained properly, and batteries are charged according to the manufacturers' specifications					
All air monitoring instruments are calibrated daily before use					

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SITE SAFETY AUDIT

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Corr.
Calibration records show the date, type of instrument, serial number, calibration gas used, and the instrument reading compared to the calibration gas concentration.					
Air monitoring readings and calibration records are kept in a bound notebook with all pages numbered and no missing pages					
Air monitoring readings are taken in the appropriate location (i.e., breathing zone of workers, source locations, downwind, perimeter, etc.					
Other					

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SITE SAFETY INSPECTION

Project Name: _____ Date: _____

Project Number: _____ Inspector: _____

Instructions: Check off every item as "Yes", "No", or "Not Applicable". All "No" items must have an explanation of corrective actions undertaken to correct the problem.

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Correction
Documentation, Signs					
Documentation such as Safety Plan, MSDSs, air monitoring logs, training records, and inspections are up to date					
Postings such as emergency numbers, hospital map, permits, OSHA poster, and speed limit signs are maintained					
Housekeeping/Work Areas					
Work areas are kept clean and orderly, and exits and walkways are not blocked					
Materials are stored in proper and stable configurations					
Hazards are not created by sharp surfaces, open pits, wet surfaces, or tripping hazards					
A clean break area is provided to employees					
Adequate lighting is provided indoors and for outdoor work after dark					
Employees are working carefully and without horseplay					
Emergency equipment such as eyewashes, first aid kits, and fire extinguishers are full, inspected and accessible					
Ladders & Scaffolds					
Ladders have no damage, defects, or missing parts, including support feet					
Ladders extend three feet above the top surface being climbed, and are secured at top and stable at bottom					
Only wooden or fiberglass ladders are used near electrical lines					
Scaffolds are on level, stable surfaces, floorboards are tight fitting, have no damage or missing parts,					
Employees working on platforms higher than 6 feet are wearing properly secured lifelines and safety harnesses					

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SITE SAFETY INSPECTION

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Correction
Personal Protective Equipment					
Employees are utilizing proper personal protective equipment and respirators based on hazards, and equipment is in good condition					
Chemical Storage/Fire Safety					
Chemicals, gases, and oily rags are stored properly in the appropriate labeled containers, and only with compatible materials					
Stored compressed gas cylinders are secured and upright, with caps on					
Chemicals are used with adequate ventilation					
Bonding/grounding is used during flammable liquid transfers					
Compressed gas cylinders are moved with caps on, with dollies whenever possible					
Flammable liquid storage areas have containment, and fire extinguishers within 25 feet					
Hot work (welding, cutting) is performed with permit, fire watch, extinguisher					
Air monitoring equipment is maintained and calibrated daily, and monitoring is performed and documented properly					
Vehicles/Heavy Equipment					
Vehicles and heavy equipment are in good condition, including tires, mirrors, windshields, and backup alarms					
Operators and ground personnel are cautious and maintain line of sight					
Seat belts are used by operators					
Equipment is parked with buckets/forks in the down position					
Drill rigs and cranes are moved with the boom down and rigging secured					
All chains, slings, and hoists are in good condition and are inspected before use					
Gas or diesel machinery is only used with proper ventilation					

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SITE SAFETY INSPECTION

Inspection Item	Yes	No	N/A	Corrective Actions	Date of Correction
Electrical Safety					
Electrical equipment is in good condition, grounded, protected from damage, and protected by a Ground Fault Circuit Interrupter					
Lockout/tagout procedures are utilized whenever work is performed on electrical/mechanical equipment					
Excavations, Trenches, Confined Spaces					
The Competent Person has inspected all trenches and excavations at least every shift					
Excavations and trenches are adequately sloped, benched or shored based on soil conditions					
Shoring systems have been approved by a Registered Professional Engineer, and shoring design specifications are on site					
Soil stockpiles are placed no closer than two feet from the edge of excavations					
Excavations/trenches are protected from water by berms, drainage and/or pumps					
Underground utilities have been located, and exposed utilities are protected					
Underground Service Alert and all entities potentially affected by the excavation have been notified					
Excavations and trenches are protected by fencing, barricades, etc.					
Surface encumbrances such as buildings, roads, etc. have been protected					
Ladders are located in excavation so that employees have access to them within 25 feet at all times					
All excavations and trenches have been evaluated for confined space conditions, and a checklist/permit is utilized for all entries					

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SITE SAFETY REQUIREMENTS

Project: _____ Project No.: _____

Superintendent: _____ Start Date : _____

- ❑ Project postings
  - o OSHA postings (Federal, and state as applicable)
  - o Labor law postings, including payday notice, Walsh-Healy Act, etc.
  - o Route to hospital & emergency contacts
  - o Client-required postings:_____
  - o Safe work practices
  - o OSHA 300 form
  - o Other: _____
- ❑ Safety signs
  - o Speed limit
  - o No trespassing/restricted area
  - o PPE required: hardhats, safety glasses, boots, vests
  - o Specific hazard warnings
  - o Other: _____
- ❑ Permits
  - o Excavation
  - o Air quality
  - o Noise
  - o Other: _____
- ❑ Health and safety plan and recordkeeping forms
- ❑ Medical monitoring and training documentation for all employees
- ❑ Chemical inventory, MSDSs for all chemical products, including gasoline & diesel
- ❑ Toilet
- ❑ Handwash
- ❑ Potable water
- ❑ Radios, means of charging: _____
- ❑ First aid kits: Qty: _____ Locations: _____
- ❑ Fire extinguishers (serviced): Qty: ____ Locations: _____
- ❑ Eyewashes: Qty: ____ Locations: _____
- ❑ Spill kits for diesel, gasoline, other: _____
- ❑ Protective equipment:
  - o Safety glasses
  - o Hardhats
  - o Reflective vests
  - o Earplugs
  - o Gloves
  - o Chemical protective clothing, type: _____
  - o Respirators: Type: _____ Cartridge type: _____
  - o Other: _____
- ❑ Monitoring equipment
  - o Confined space (oxygen, combustibles, CO, H2S)
  - o Organic vapor (PID or FID)
  - o Dust
  - o Other: _____
- ❑ Calibration gases: Type: _____
- ❑ Other: _____

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TAILGATE SAFETY MEETING

Date: _____ Time: _____ Page: _____ of _____
Customer: _____ Project: _____ Contract #: _____ Proj. #: _____
Work Description: _____

TODAY'S WORK

_____
_____
_____
_____

SAFETY TOPIC(S) PRESENTED (attach outline/notes as necessary)

Specific Topic(s): _____
_____

Air monitoring results: _____
Incidents/Accidents: _____

SAFETY ISSUES/CONCERNS RAISED BY SITE PERSONNEL

_____
_____
_____

SAFETY ACTIONS TO BE TAKEN TODAY

Action Item	Assigned To

ATTENDEES

Name (print)	Signature	Company	Name (print)	Signature	Company

MEETING CONDUCTED BY

Health & Safety Officer: _____ _____
Name (printed) Signature

Site Superintendent: _____ _____
Name (printed) Signature

ENCLOSURE 3

Project Schedule – Parcel F RAD DGI Phase 2b

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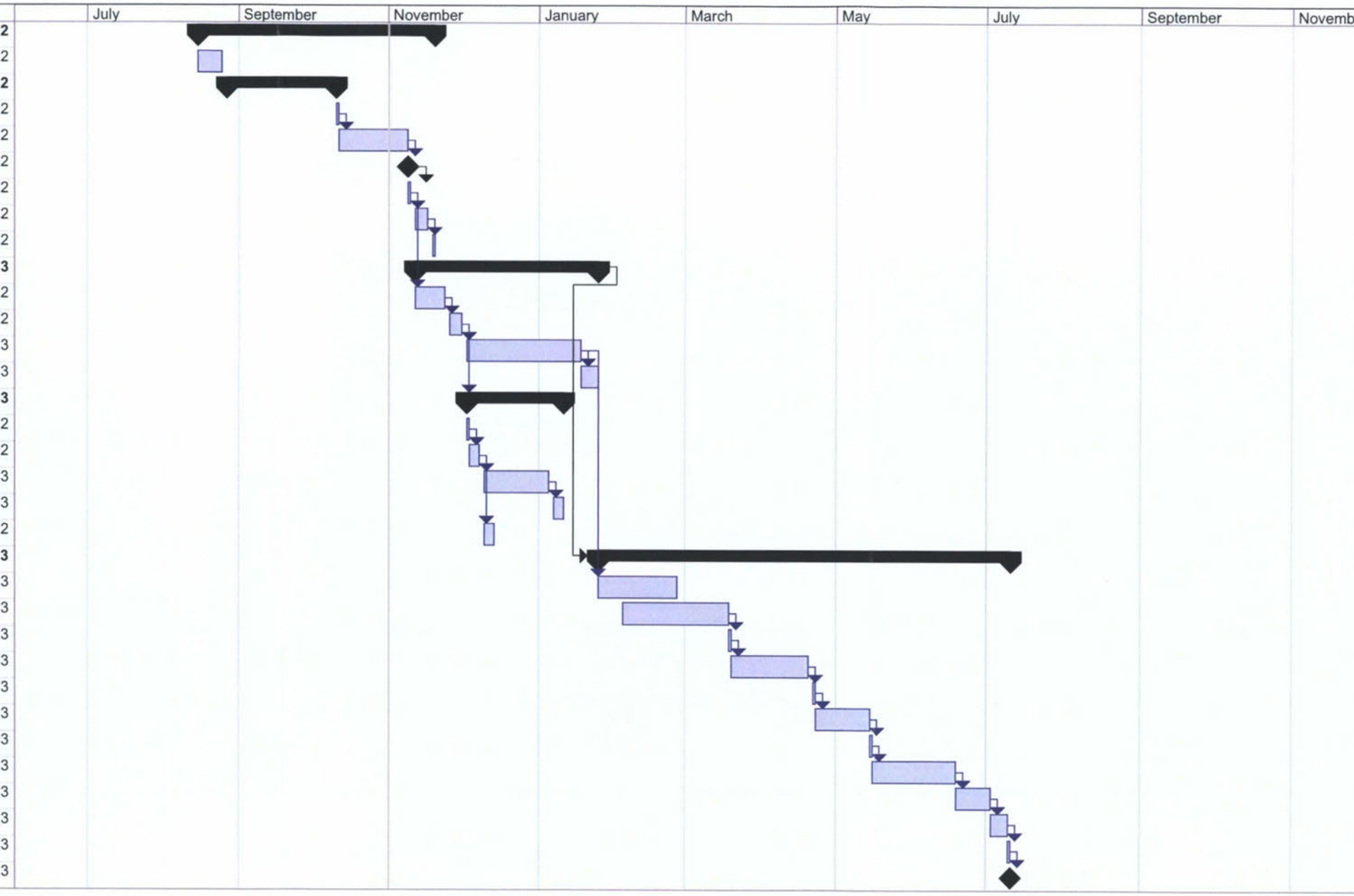
Parcel F
Radiological Data Gap Investigation Phase 2b and Technical Memorandum
Hunters Point Naval Shipyard
Master Schedule

ID	Task Name	Duration	Start	Finish
1	**Work Plan Addendum**	**68 days**	**Wed 8/15/12**	**Mon 11/19/12**
2	Recieve Documents needed for Planning Doc Prep	8 days	Wed 8/15/12	Fri 8/24/12
3	**Planning Documents, Internal Draft**	**32 days**	**Mon 8/27/12**	**Wed 10/10/12**
10	**Internal Draft Planning Documents Delivered**	1 day	Thu 10/11/12	Thu 10/11/12
11	Navy Review Period	20 days	Fri 10/12/12	Thu 11/8/12
12	Navy Comments Due	0 days	Thu 11/8/12	Thu 11/8/12
13	Resolve Comments	1 day	Fri 11/9/12	Fri 11/9/12
14	Incorporate Comments & Submit Final	5 days	Mon 11/12/12	Fri 11/16/12
15	**Final Planning Documents Delivered**	1 day	Mon 11/19/12	Mon 11/19/12
16	**Rad DGI Phase 2B**	**49 days**	**Mon 11/12/12**	**Thu 1/24/13**
17	Procurement	9 days	Mon 11/12/12	Fri 11/23/12
18	2.4.1 Mobilization	5 days	Mon 11/26/12	Fri 11/30/12
19	2.4.2 Sediment Cores - Radionuclides	30 days	Mon 12/3/12	Thu 1/17/13
20	2.4.2 Option Additional Step-out Borings	5 days	Fri 1/18/13	Thu 1/24/13
21	**2.4.3 Clam Sample Collection**	**25 days**	**Mon 12/3/12**	**Thu 1/10/13**
22	Clam Acclimation	1 day	Mon 12/3/12	Mon 12/3/12
23	Clam Cage Deployment	4 days	Tue 12/4/12	Fri 12/7/12
24	Clam Residency	16 days	Mon 12/10/12	Fri 1/4/13
25	Clam Cage Recovery	4 days	Mon 1/7/13	Thu 1/10/13
26	2.4.4 Sedflume and Age Date Cores	4 days	Mon 12/10/12	Thu 12/13/12
27	**Tech Memo Phase 2B**	**116 days**	**Fri 1/25/13**	**Wed 7/10/13**
28	Laboratory Analysis and Validation	21 days	Fri 1/25/13	Mon 2/25/13
29	Prepare Tech Memo #2b, Internal Draft	30 days	Mon 2/4/13	Mon 3/18/13
30	**Internal Draft Tech Memo #2b Delivered**	1 day	Tue 3/19/13	Tue 3/19/13
31	Navy & RASO Review Period	23 days	Wed 3/20/13	Fri 4/19/13
32	Navy & RASO Comments Due	1 day	Mon 4/22/13	Mon 4/22/13
33	Incorporate Comments and Prepare Draft	16 days	Tue 4/23/13	Tue 5/14/13
34	Draft Tech Memo #2b Delivered	1 day	Wed 5/15/13	Wed 5/15/13
35	BCT Review Period	23 days	Thu 5/16/13	Tue 6/18/13
36	Incorporate BCT Comments	10 days	Wed 6/19/13	Tue 7/2/13
37	Prepare Final Tech Memo #2b	4 days	Wed 7/3/13	Tue 7/9/13
38	Final Rad DGI Tech Memo #2b Delivered	1 day	Wed 7/10/13	Wed 7/10/13
39	**PROJECT COMPLETE**	0 days	Wed 7/10/13	Wed 7/10/13



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Tina Low
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Dear BCT Members:

Enclosed please find the Final Amendment to Final Work Plan for Radiological Data Gap Investigation, Parcel F, Hunters Point Naval Shipyard, San Francisco, California, December 10, 2012.

Should you have any concerns with this matter, please contact Mr. Simon Loli at (619) 532-0782, or myself at (619) 532-0913.

Sincerely,

KEITH FORMAN
BRAC Environmental Coordinator
By direction of the Director

Enclosure: Final Amendment to Final Work Plan for Radiological Data Gap Investigation, Parcel F, Hunters Point Naval Shipyard, San Francisco, California. December 10, 2012.

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ITSI Gilbane

Letter of Transmittal

SUBJECT: **Final Amendment to Final Work Plan for Radiological Data Gap Investigation at Parcel F, Hunters Point Naval Shipyard, San Francisco, California; Contract No. N62473-11-D-2227, CTO-0002; DCN ITSI-2227-0002-0002.**

To:	Simon Loli – Navy RPM	**From:**	Ken Leonard
Company:	Base Realignment and Closure Program Management Office West 1455 Frazee Road, Suite 900 San Diego, CA 92108 Ph: 619-532-0930 Fx: 619-532-0995	**Date:**	12/10/12
		Project #:	07225.0002
		Doc No:	**ITSI-2227-0002-0001**
		Direct Line:	925-946-3263

☐ **For Review & Comment** ☐ **Approved As Submitted** ☐ **Resubmit _____ Copies for Approval**

☐ **For Approval** ☐ **Approved As Noted** ☒ **Submit _2_ Copies for Distribution**

☐ **For Information** ☐ **Return for Corrections** ☐ **Return _____ Corrected Prints**

☐ **Other:**

No.	Copies	Date	Title
1	2 (2 hard copies & CD)	December 2012	**Final Amendment to Final Work Plan for Radiological Data Gap Investigation at Parcel F, Hunters Point Naval Shipyard, San Francisco, California**

Comments:

Please do not hesitate to contact me with any questions by telephone or email (kleonard@itsi.com). Thank you.

ITSI Gilbane

Letter of Transmittal

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Mr. Robert Carr, U.S. EPA, Region IX, 75 Hawthorne St., San Francisco, CA 94105
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