November 13, 2015

Ms. Pamela Molitor
Work Assignment Manager
U.S. Environmental Protection Agency (EPA)
77 W. Jackson Blvd. (SR-6J)
Chicago, IL 60604

Subject: **Final Site Management Plan (SMP), Data Management Plan (DMP), and Health and Safety Plan (HASP) for the Remedial Investigation/Feasibility Study (RI/FS) at Bautsch-Gray Mine Site**
Jo Daviess County, Illinois
Remedial Action Contract (RAC) 2 No. EP-S5-06-02
Work Assignment No. 186-RICO-B5TS

Dear Ms. Molitor:

SulTRAC is submitting the electronic copy of the Final Site Management Plan (SMP), Final Data Management Plan (DMP), and Final Health and Safety Plan (HASP) for the above-referenced project. The U.S. Environmental Protection Agency (EPA) approved Revision 1 of the SMP, DMP, and HASP with no comments on November 4, 2015, and requested the titles of the aforementioned documents be changed to "Final". Therefore, SulTRAC is submitting the final SMP, DMP, and HASP with new titles and dates to reflect the formal approval of these documents.

If you have any questions regarding this submittal, please call me at (312) 201-7479.

Sincerely,

Robert Kondreck
SulTRAC Project Manager

Enclosure

cc: Charlene Falco, Illinois EPA Project Manager
Daniel Olsson, EPA Project Officer (letter only)
Mindy Gould, SulTRAC Program Manager (letter only)
File

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FINAL SITE MANAGEMENT PLAN (SMP), FINAL DATA MANAGEMENT PLAN (DMP), AND FINAL HEALTH AND SAFETY PLAN (HASP)
BAUTSCH-GRAY MINE SITE
JO DAVIESS COUNTY, ILLINOIS

SulTRAC has prepared the Final Site Management Plan (SMP), Final Data Management Plan (DMP), and Final Health and Safety Plan (HASP) for the Remedial Investigation/Feasibility Study (RI/FS) at the Bautsch-Gray Mine site in Jo Daviess County, Illinois, under the U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) 2 for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 186-RICO-B5TS. Revision 1 of the aforementioned plans were approved as final by EPA in a letter dated November 4, 2015. Changes from Revision 1 to Final include changing the report titles from "Revision 1" to "Final" and changing the dates.

As requested in EPA's statement of work (SOW) for the site, SulTRAC has prepared the SMP, DMP, and HASP for the Bautsch-Gray Mine Site. The SMP describes how access, security, contingency procedures, management responsibilities, and waste disposal will be handled. The DMP outlines procedures for storing, handling, accessing, and securing data obtained during the RI. The HASP is a site-specific plan that specifies employee training, protective equipment, medical surveillance requirements, standard operating procedures, and a contingency plan in accordance with 29 *Code of Federal Regulations* (CFR) 1910.120 1(1) and (1)(2). These plans are among the site-specific plans to be prepared under the WA in accordance with Task 1 of the EPA SOW. Revisions were completed to the above reference draft DMP, SMP, and HASP based on EPA and Illinois EPA comments or as a consequence of comments to other draft site-specific plans.

SITE MANAGEMENT PLAN

BAUTSCH-GRAY MINE SITE
JO DAVIESS COUNTY, ILLINOIS

FINAL

NOVEMBER 13, 2015

Prepared for
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604

Prepared by
SulTRAC
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REMEDIAL ACTION CONTRACT 2
FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND
NON-TIME-CRITICAL REMOVAL ACTIVITIES
IN REGION 5

SITE MANAGEMENT PLAN
FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) ACTIVITIES
BAUTSCH-GRAY MINE
JO DAVIESS COUNTY, ILLINOIS

FINAL

Prepared for
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604

Date Submitted:	November 13, 2015
EPA Region:	5
Work Assignment No.:	186-RICO-B5TS
Contract No.:	EP-S5-06-02
Prepared by:	SulTRAC
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CONTENTS

1.0 INTRODUCTION

Under Remedial Action Contract (RAC) II Contract No. EP-S5-06-02, Work Assignment (WA) No. 186-RICO-B5TS, the U.S. Environmental Protection Agency (EPA) tasked SulTRAC to perform a remedial investigation/feasibility study (RI/FS) at the Bautsch-Gray Mine site in Jo Daviess County, Illinois (EPA 2013). As part of the RI/FS, SulTRAC will acquire site data to characterize the nature and extent of contamination; evaluate human health and ecological risks that may be posed by site contamination; and identify potential site remedies necessary to eliminate, reduce, or control risks to human health and the environment. The investigation will subsequently generate sufficient data to develop a site remediation approach that eliminates, reduces, or controls risks to human health and the environment posed by the site, and supports a record of decision (ROD).

This site management plan (SMP)—one of the site-specific plans SulTRAC has been contracted to prepare under the WA—describes the responsibilities of managing the RI/FS at the site. Activities to be managed include access, security, contingency procedures, management responsibilities, storage and disposal of investigation-derived waste (IDW), and other procedures to be followed in the field. The RI/FS is scheduled to begin in spring or summer 2014, and will proceed in two phases. The SMP may be amended once Phase I is complete and before Phase II activities commence if site activities change significantly.

This plan describes site investigation activities in Section 2.0; specifies site access, site security, and contingency procedures in Sections 3.0, 4.0, and 5.0, respectively; outlines management responsibilities in Section 6.0; explains identification and management of IDW in Section 7.0; and discusses waste management requirements in Section 8.0. All references cited in the plan are listed in Section 9.0.

2.0 SITE INVESTIGATION ACTIVITIES

SulTRAC will perform various field activities or combinations of activities for data acquisition to support the RI/FS. Given the objectives of the RI/FS for the site, SulTRAC will divide the investigation into four major field activities: (1) soil decision unit and background sampling, (2) Smallpox Creek and wetland sampling, (3) groundwater investigations, and (4) ecological investigations. A detailed description of each task and the associated sampling procedures appear in the field sampling and analysis plan (FSP) portion of the sampling and analysis plan (SAP) (SulTRAC 2015a); these are summarized in the following sub-sections.

The Bautsch-Gray Mine site includes three principal sources: (1) an estimated 40 acres of mine tailings approximately 4 miles south of Galena, Illinois, on Blackjack Road; (2) a settling pond west of the mine tailings pile; and (3) contaminated soil along the overland flow route from the settling pond to Smallpox Creek. Surrounding the Bautsch-Gray Mine site are several residential properties, wetland, Smallpox Creek, vacant vegetated land, and agricultural fields. This section summarizes field activities to occur during both phases of the RI/FS. The SMP may be amended for Phase II if the types of field activities change significantly.

2.1 DECISION UNIT (DU) AND BACKGROUND SAMPLING

The basic sampling approach for soil decision unit (DU) sampling during Phase I and Phase II of the Bautsch-Gray RI utilizes key concepts from EPA's Triad methodology. Key concepts related to the field sampling portion of the RI include dynamic work strategies and real-time measurement technologies. Dynamic work strategies are mostly incorporated into the soil DU sampling by allowing for change and flexibility during the investigation. For example, the soil sampling approach, called adaptive cluster sampling, identifies areas of known contamination and then surrounds those areas with sampling points. Sampling continues until no additional contamination is found. Real-time field equipment (XRF) will be used as the primary investigation tool to evaluate metals contamination in soil. Laboratory samples will also be collected to confirm XRF samples. Further explanation of the sampling approach appears below.

The proposed sampling approach has been designed based on need to collect samples over a fairly large area. The general sampling approach is to collect discrete grab samples at a higher sampling density closer to the mine tailings pile and overland flow area at a lower sampling density farther from these two areas. The discrete grab samples are collected instead of composite samples to assess for human health and ecological risk. This approach is proposed to ensure adequate coverage while minimizing unnecessary collection of samples.

Background sampling will occur near the Bautsch-Gray mine in areas outside of the DU sampling area and in areas around Jo Daviess County. Background sampling will serve two purposes, (1) to aid in determining when to cease DU sampling, and (2) to create site-specific background concentrations. Background sampling will occur prior initiation DU sampling outside of the 100-foot by 100--foot DUs.

The adaptive soil sampling design initiates with DUs (or grids) overlying the areas of known contamination. These areas of contamination were identified by Illinois EPA and U.S. EPA during

previous investigations which were documented in the HRS package. The Bautsch-Gray site is partitioned according to these DUs to facilitate determination of the extent of metals contamination in surrounding areas. DU size depends on the DU's proximity to a known contamination source area—the closer the DU is to the source area, the smaller the DU size. All of the smaller DU's surrounding the source areas will be completed as part of the investigation. Discrete grab samples will be collected within each DU and assessed via the XRF unit. The DU XRF data will be compared to background lead XRF data. If the XRF lead concentration for the DU is above background threshold value, the adjacent DU will be assessed with the XRF unit. If the XRF lead concentration is at or below background concentrations, sampling will cease. After two consecutive DUs are sampled that contain lead below 300 ppm and background concentrations are not reached, DU sampling will cease. As mentioned previously all small DUs immediately surrounding the source areas will be completed. The larger DUs immediately surrounding the smaller DUs will only be sampled if the adjacent smaller DU indicates metals concentrations above background. Sampling and XRF analyses will continue radially around smaller DUs until the metals contamination is fully delineated.

All DUs within or surrounding known contamination will be sampled. Following Phase I field activities, the laboratory results will be used with XRF results at the same locations to create a calibration curve which can be used to adjust XRF data to make XRF screening data comparable with laboratory analytical data. Based on the calibrated XRF data, additional DUs may be added in Phase II if the calibrated XRF results within the DU are above the calibrated background XRF results or if two consecutive DUs are below 300 ppm of lead. The value of 300 ppm is more conservative than the residential cleanup criterion (400 ppm) which was applied during the removal action to determine whether soil should be left in place or removed.

2.2 SMALLPOX CREEK AND WETLAND SAMPLING

The basic sampling approach for Smallpox Creek and wetland sampling during Phase I and Phase II Bautsch-Gray RI will be to sample sediment from transects throughout the distance of the creek and within DUs in the wetland. Based on previous sediment laboratory results from Smallpox Creek, elevated metals concentrations do not appear to depend on proximity to the main source area. Therefore, unlike soil DU sampling, all proposed Smallpox Creek transects will be sampled as part of the RI (with exceptions outlined in Section 5.2.1 of the FSP). All DUs within the wetland will be sampled; however, the soil DUs adjacent to the wetland boundaries will be sampled only if elevated metals are detected in wetland sediment (or if the source investigation migrates toward the wetlands) in Phase II.

The proposed Smallpox Creek sampling design incorporates a higher sampling density closer to the overland flow route and a lower density within other areas such as areas used for background sampling and tributaries not thought to be contributing to contamination. This approach is proposed to help ensure adequate coverage over a fairly large area while minimizing unnecessary collection of samples.

2.3 GROUNDWATER INVESTIGATION

The basic groundwater sampling approach proposed for Phase I and Phase II of the RI is to determine groundwater metals concentrations upgradient and downgradient of the Bautsch-Gray site by vertical aquifer sampling (VAS). The Phase I groundwater investigation will consist of profiling metals concentrations within the unconsolidated material to assess potential impacts to shallow groundwater. Based on geological maps of Jo Daviess County, overburden ranges from less than 25 feet thick (east of Blackjack Road) up to 50 feet thick (in areas west of Blackjack Road). Based on hydraulic maps of the same area, groundwater is expected to be between 5 and 25 feet below ground surface (bgs) west of the tailings pile. Therefore, based on this research, groundwater may exist within the unconsolidated material above the bedrock. To utilize resources appropriately, the unconsolidated saturated material will be sampled and analyzed during Phase I prior to initiating more extensive bedrock aquifer sampling during Phase II, if deemed necessary. Sampling the unconsolidated aquifer will involve direct-push technology or sonic technology to log unconsolidated material and to vertically profile groundwater concentrations; piezometers will be installed at the unconsolidated material-bedrock interface to measure local groundwater flow. VAS in Phase I will be concurrent with sampling of the residential well to obtain a "snap-shot" of groundwater conditions.

If analytical results indicate contaminated shallow groundwater in the unconsolidated materials, further groundwater investigation in bedrock may be conducted to 100 feet bgs during Phase II. The bedrock investigation would consist of logging bedrock for possible fractures followed by biased sample collection at those locations of possible fractures. Acquisition of additional groundwater and borehole data that may occur at open boreholes could include caliper logging, temperature logging, and flow metering to increase understanding of bedrock aquifer conditions and aid in biased sample selection. Groundwater samples collected during the bedrock VAS investigation will be submitted with a request for expedited turnaround in an attempt to determine the need for and placement of permanent monitoring wells. Monitoring wells would be sampled in conjunction with the residential well to obtain a "snap-shot" of groundwater conditions. Following monitoring well installation, a round of measurements of

static water levels at piezometers, staff gauges, and permanent monitoring wells will occur to determine groundwater flow direction.

Additional groundwater investigations during Phase I of the RI include an assessment of the groundwater-surface water interface at Smallpox Creek. The sampling approach for investigating the groundwater-surface water interface at Smallpox Creek includes installing piezometers and staff gauges in and around Smallpox Creek to determine if Smallpox Creek is a gaining or losing stream.

If the results of the Phase I Smallpox Creek investigation do not indicate whether the creek is a gaining or losing stream, then additional creek analysis may be conducted during Phase II. An alternative method for determining the relationship between groundwater and surface water may include placing pressure transducers in the piezometers and monitoring water levels over a longer period of time.

.2.4 ECOLOGICAL INVESTIGATION

An ecological investigation will occur to identify types and quantities of wildlife and natural habitat in and around the Bautsch-Gray site. The investigation will consist of a wetland assessment and field observations of wildlife. The data obtained will be used to assess ecological risk posed by the site. In addition a desktop review of threatened/endangered species of concern will be conducted using state and federal sources. No field samples will be collected during the ecological investigation.

3.0 SITE ACCESS

Earthen features such as ditches and berms prohibit access to most of the Bautsch-Gray Mine site from public roads. Dense forested areas also prohibit access to the site from most of the neighboring properties. However, two entryways into the tailings pile area are present, both off of Blackjack Road. The entryways into the tailings pile are secured with a chain between two bumper posts. The only means of direct access via the settling pond and overland flow route are through private driveways and vegetated areas. During most of the investigation, vehicles will be staged at a vehicle-accessible location, and personnel will walk to each location proposed for field work. VAS sampling will require large-vehicle access, and actual locations for staging the vehicles may be altered based on access to locations of field work. Access to Smallpox Creek will be available where roads cross the Creek. Vehicles will be staged in safe nearby locations, and personnel will walk to locations proposed for field work.

Field work as described in Section 2.0 will occur mostly within the three principal source areas—already accessible via access agreements for previous investigations. However, access to properties surrounding the principal source areas and entry points into Smallpox Creek will require agreements prior to the start of field work—access to specific, privately owned locations within the study area are contingent on voluntary access agreements to be obtained by EPA. SulTRAC will notify the EPA Work Assignment Manager (WAM) of field access requirements, and the WAM will then notify the property owners of any site-related activities. The WAM is expected to provide an initial notification of the field investigation work at the site that covers the entire duration of investigation activities. The residents are expected to sign voluntary access agreements stipulating that EPA and its personnel can conduct on-site work after giving the residents reasonable notice prior to initiating the work. Access agreements will also allow for Illinois EPA to perform oversight.

Actual locations of some sampling activities may change from proposed locations during the field reconnaissance depending on location access issues (that is, swampy areas), presence of aboveground and underground utilities, and need to obtain permission from private residents.

The general sequence for work at a specific location will be as follows:

1. SulTRAC will notify EPA of the addresses or locations where work will occur. EPA will prepare a letter requesting access to the location(s). The property owners/managers will be contacted, and access will be requested.
2. The location(s) will be field marked, and the local utilities protection service (Illinois one-call center) and/or the local township will be contacted to mark utilities within the work areas. Work locations may be adjusted if necessary.
3. Each property owner/manager will be informed of the dates and duration of the work.
4. Work sites will be photographed before any intrusive work begins and after completion to document property conditions.
5. Each property owner/manager will be notified when work is complete.

4.0 SITE SECURITY

Most of the study area is on vacant property, near residential properties, or within agricultural areas. SulTRAC will not be able to completely control site access and security because of the remoteness of the area. However, because of this remoteness, site security is not anticipated to be an issue. Residential well sampling will occur within a more visible area but generally within a very short timeframe. Because activity at each residential sampling location will be temporary, the exclusion zone area will not be a physical boundary. Because soil screening and sediment sampling will occur within remote areas and

within a short period of time, no security issues are anticipated. Within areas where VAS sampling occurs, SulTRAC will establish a 20-foot perimeter around the work area as an "exclusion zone," into which no unauthorized personnel will be allowed. If an exclusion zone perimeter is deemed necessary, caution tape will mark the extent of the exclusion zone.

Due to the remoteness of the area, no security threats are anticipated. Therefore, expectation is to leave the drilling rig in place at a given location overnight or stage it near the site trailer, northwest of the mine tailings pile. However, drill rigs or other large equipment may be staged at the hotel if overnight security is required.

A site trailer or box truck will be positioned northwest of the mine tailings pile, and be powered by either a generator or electrical power. Equipment such as the XRF and Global Positioning System (GPS) unit will be brought back to the hotel or secured at the site trailer for charging overnight. Other equipment such as small toaster ovens will stay secured within the box truck or site trailer overnight. The box truck or site trailer will be secured by either a padlock or built-in locking mechanism.

Because residential sampling is anticipated to occur within areas adjacent to or on public property, local residents or local news media may be interested in the scope and purpose of the field activities. SulTRAC field personnel will direct all public or media inquiries to the EPA WAM. Field personnel will also notify the SulTRAC project manager of any public or media inquiries.

5.0 CONTINGENCY PROCEDURES

Contingency procedures refer to procedures in response to an accident or emergency at the site during RI/FS activities. The health and safety plan submitted as part of the site-specific work plans prepared for this WA contains information regarding actions to be taken during an accident or emergency (SulTRAC 2015b). SulTRAC will designate one field team member as the site safety coordinator (SSC). The SSC will be responsible for ensuring that the field team complies with the health and safety plan and associated contingency procedures. The health and safety plan includes emergency contacts and phone numbers, and will be accessible to field personnel on site throughout the investigation.

6.0 MANAGEMENT RESPONSIBILITIES

Management responsibilities are described in the Quality Assurance Project Plan QAPP submitted as part of the SAP (SulTRAC 2015a). In general, the field team leader will coordinate activities with the SulTRAC project manager, who will in turn communicate directly with the EPA WAM.

7.0 IDENTIFICATION AND MANAGEMENT OF INVESTIGATION-DERIVED WASTE

IDW is waste generated from investigative activities. IDW includes solid and hazardous waste, sample media (including soil/rock and groundwater), and debris that contains "listed" hazardous waste or exhibits a characteristic of a hazardous waste. IDW also includes media and debris that is not hazardous but is contaminated with hazardous constituents. IDW will be managed in accordance with the *"Guide to Management of Investigation-Derived Wastes,"* (OSWER Directive 9345.3-03F, January 1992), which provides IDW disposal options dependent upon the type of waste produced, the relative threat to human health and environment and other site-specific conditions.

IDW generated during field sampling activities at the site will include drill cuttings, purge water from well development and groundwater sampling, and wastewater from decontamination and equipment rinsate procedures. Placement of soil and sediment in the tailings pile is anticipated. Possibly, disposal and/or management of some amounts of soil and/or sediment can occur on site, depending on the threat posed by the waste. In accordance with the IDW guidance, SulTRAC may determine that groundwater removed through monitoring well development or sampling may also require containerization in 55-gallon drums for off-site disposal. Wastewater accumulated through decontamination procedures will be disposed of in the same manner as groundwater. IDW will be temporarily staged at the tailings pile area until each phase of work is complete. Disposal of IDW will occur following completion of each phase of the investigation, prior to demobilization.

8.0 WASTE MANAGEMENT REQUIREMENTS

Disposal of all IDW will accord with federal, state, and local regulations, following receipt of results of IDW water analyses. In accordance with the IDW guidance, the SulTRAC site manager will determine whether the IDW can be returned to the source or disposed of on site. Waste management requirements for waste soil, water, and other miscellaneous materials that cannot be disposed of or managed on site are described in the following sections.

8.1 SOIL/SEDIMENT

Soil collected for XRF screening during the grid sampling investigation will be disposed of on the tailings pile after completion of XRF analysis and any laboratory sampling. Soil collected during the VAS and other subsurface investigation will be disposed of on the tailings pile also. Sediment samples collected during the wetland and Smallpox Creek sampling will be removed from the original location, dried in accordance with the FSP, and disposed of in the tailings pile. The amount of soil and sediment

accumulated during XRF screening is expected to be minimal, and based on historical data, to contain metals concentrations below those in the mine tailings pile. The spent soil and sediment will be disposed of along with the tailings as part of the site remedy.

8.2 WASTE GROUNDWATER AND OTHER WASTE WATER

Groundwater and wastewater will be temporarily managed in 5-gallon buckets, 55-gallon drums, or portable tanks. The containers will then be transported to a centralized, secure storage area at either the tailings pile or at an area deemed appropriate by EPA. The water will be transferred to separate 55-gallon drums or polyethylene tanks at the designated area. Water that appears to have high potential to contain significant contamination based on source location or other observations will be drummed and stored separately to minimize the amount of material potentially requiring management as a hazardous waste. Drums or tanks will be clearly marked to indicate the date of collection, waste contents, and other generator information. Before off-site disposal, the drums will be labeled with appropriate U.S. Department of Transportation (DOT) identification and classification information.

8.3 MISCELLANEOUS

Additional IDW generated from soil, sediment, and groundwater sampling includes disposable personal protective equipment (PPE). Disposable PPE will be managed according to the level of contamination encountered during field activities. In general, PPE will be managed as nonhazardous solid waste, particularly if little contact occurs with the sampling media and low levels of contaminants are involved. Typically, PPE will be double bagged and disposed of with other municipal trash.

6.0 REFERENCES

SulTRAC. 2015a. Sampling and Analysis Plan for Remedial Investigation/Feasibility Study (RI/FS) Activities, Bautsch-Gray Mine Site, Jo Daviess County, Illinois. Prepared for EPA under Contract No. EP-S5-06-02. February 13.

SulTRAC. 2015b. Health and Safety Plan, Bautsch-Gray Mine Site, Jo Daviess County, Illinois. Prepared for EPA under Contract No. EP-S5-06-02. February 13.

U.S. Environmental Protection Agency (EPA). 1992. "Guide to Management of Investigation-Derived Wastes." OSWER Directive 9345.3-03F. January.

EPA. 2013. RAC II Region 5 Statement of Work for Remedial Investigation/Feasibility Study (RI/FS) Bautsch-Gray Mine, Jo Daviess County, Illinois. Issued by EPA Region 5. Contract EP-S5-06-02 Work Assignment 186-RICO-B5TS. May 23.

DATA MANAGEMENT PLAN

BAUTSCH-GRAY MINE SITE
JO DAVIESS COUNTY, ILLINOIS

FINAL

NOVEMBER 13, 2015

Prepared for
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
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DATA MANAGEMENT PLAN
FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) ACTIVITIES
BAUTSCH-GRAY MINE SITE
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FINAL

Prepared for
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Region 5
77 West Jackson Boulevard
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Date Submitted:	November 13, 2015
EPA Region:	5
Work Assignment No.:	186-RICO-B5TS
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Prepared by:	SulTRAC
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CONTENTS

Section Page

1.0 INTRODUCTION

Under Remedial Action Contract (RAC) II Contract No. EP-S5-06-02, Work Assignment (WA) No. 186-RICO-B5TS, the U.S. Environmental Protection Agency (EPA) tasked SulTRAC to perform a remedial investigation/feasibility study (RI/FS) at the Bautsch-Gray Mine site in Jo Daviess County, Illinois (EPA 2013). As part of the RI/FS, SulTRAC will acquire site data to characterize the nature and extent of contamination; evaluate human health and ecological risks that may be posed by site contamination; and identify potential site remedies necessary to eliminate, reduce, or control risks to human health and the environment. The investigation will subsequently generate sufficient data to develop a site remediation approach that eliminates, reduces, or controls risks to human health and the environment posed by the site, and supports a record of decision (ROD).

SulTRAC has prepared this data management plan (DMP) to describe how data will be managed during the RI/FS. The DMP is one of the site-specific plans SulTRAC has been contracted to prepare under the WA. The RI/FS is scheduled to begin in spring 2014, and will proceed in two phases. This plan summarizes the field tasks to be performed as part of the RI/FS in Section 2.0, and describes the data management structure and strategies in Sections 3.0 and 4.0, respectively. References cited in this plan are listed after the text.

2.0 FIELD TASKS

SulTRAC will perform various field activities or combinations of activities for data acquisition to support the RI/FS. Given the objectives of the RI/FS for the site, SulTRAC will divide the investigation into four major field activities: (1) soil decision unit and background sampling, (2) Smallpox Creek and wetland sampling, (3) groundwater investigations, and (4) ecological investigations. A detailed description of each task and the associated sampling procedures appear in the field sampling and analysis plan (FSP) portion of the sampling and analysis plan (SAP) (SulTRAC 2013); these are summarized in the following sub-sections.

The Bautsch-Gray Mine site includes three principal sources: (1) an estimated 40 acres of mine tailings approximately 4 miles south of Galena, Illinois, on Blackjack Road; (2) a settling pond west of the mine tailings pile; and (3) contaminated soil along the overland flow route from the settling pond to Smallpox Creek. Surrounding the Bautsch-Gray Mine site are several residential properties, wetland, Smallpox Creek, vacant vegetated land, and agricultural fields. This section summarizes field activities to occur during both phases of the RI/FS. The SMP may be amended for Phase II if the types of field activities change significantly.

2.1 DECISION UNIT (DU) AND BACKGROUND SAMPLING

The basic sampling approach for soil decision unit (DU) sampling during Phase I and Phase II of the Bautsch-Gray RI utilizes key concepts from EPA's Triad methodology. Key concepts related to the field sampling portion of the RI include dynamic work strategies and real-time measurement technologies. Dynamic work strategies are mostly incorporated into the soil DU sampling by allowing for change and flexibility during the investigation. For example, the soil sampling approach, called adaptive cluster sampling, identifies areas of known contamination and then surrounds those areas with sampling points. Sampling continues until no additional contamination is found. Real-time field equipment (XRF) will be used as the primary investigation tool to evaluate metals contamination in soil. Laboratory samples will also be collected to confirm XRF samples. Further explanation of the sampling approach appears below.

The proposed sampling approach has been designed based on need to collect samples over a fairly large area. The general sampling approach is to collect discrete grab samples at a higher sampling density closer to the mine tailings pile and overland flow area at a lower sampling density farther from these two areas. The discrete grab samples are collected instead of composite samples to assess for human health and ecological risk. This approach is proposed to ensure adequate coverage while minimizing unnecessary collection of samples.

Background sampling will occur near the Bautsch-Gray mine in areas outside of the DU sampling area and in areas around Jo Daviess County. Background sampling will serve two purposes, (1) to aid in determining when to cease DU sampling, and (2) to create site-specific background concentrations. Background sampling will occur prior initiation DU sampling outside of the 100-foot by 100--foot DUs.

The adaptive soil sampling design initiates with DUs (or grids) overlying the areas of known contamination. These areas of contamination were identified by Illinois EPA and U.S. EPA during previous investigations which were documented in the HRS package. The Bautsch-Gray site is partitioned according to these DUs to facilitate determination of the extent of metals contamination in surrounding areas. DU size depends on the DU's proximity to a known contamination source area—the closer the DU is to the source area, the smaller the DU size. All of the smaller DU's surrounding the source areas will be completed as part of the investigation. Discrete grab samples will be collected within each DU and assessed via the XRF unit. The DU XRF data will be compared to background lead XRF data. If the XRF lead concentration for the DU is above background threshold value, the adjacent DU will be assessed with the XRF unit. If the XRF lead concentration is at or below background

concentrations, sampling will cease. After two consecutive DUs are sampled that contain lead below 300 ppm and background concentrations are not reached, DU sampling will cease. As mentioned previously all small DUs immediately surrounding the source areas will be completed. The larger DUs immediately surrounding the smaller DUs will only be sampled if the adjacent smaller DU indicates metals concentrations above background. Sampling and XRF analyses will continue radially around smaller DUs until the metals contamination is fully delineated.

All DUs within or surrounding known contamination will be sampled. Following Phase I field activities, the laboratory results will be used with XRF results at the same locations to create a calibration curve which can be used to adjust XRF data to make XRF screening data comparable with laboratory analytical data. Based on the calibrated XRF data, additional DUs may be added in Phase II if the calibrated XRF results within the DU are above the calibrated background XRF results or if two consecutive DUs are below 300 ppm of lead. The value of 300 ppm is more conservative than the residential cleanup criterion (400 ppm) which was applied during the removal action to determine whether soil should be left in place or removed.

2.2 SMALLPOX CREEK AND WETLAND SAMPLING

The basic sampling approach for Smallpox Creek and wetland sampling during Phase I and Phase II Bautsch-Gray RI will be to sample sediment from transects throughout the distance of the creek and within DUs in the wetland. Based on previous sediment laboratory results from Smallpox Creek, elevated metals concentrations do not appear to depend on proximity to the main source area. Therefore, unlike soil DU sampling, all proposed Smallpox Creek transects will be sampled as part of the RI (with exceptions outlined in Section 5.2.1 of the FSP). All DUs within the wetland will be sampled; however, the soil DUs adjacent to the wetland boundaries will be sampled only if elevated metals are detected in wetland sediment (or if the source investigation migrates toward the wetlands) in Phase II.

The proposed Smallpox Creek sampling design incorporates a higher sampling density closer to the overland flow route and a lower density within other areas such as areas used for background sampling and tributaries not thought to be contributing to contamination. This approach is proposed to help ensure adequate coverage over a fairly large area while minimizing unnecessary collection of samples.

2.3 GROUNDWATER INVESTIGATION

The basic groundwater sampling approach proposed for Phase I and Phase II of the RI is to determine groundwater metals concentrations upgradient and downgradient of the Bautsch-Gray site by vertical aquifer sampling (VAS). The Phase I groundwater investigation will consist of profiling metals concentrations within the unconsolidated material to assess potential impacts to shallow groundwater. Based on geological maps of Jo Daviess County, overburden ranges from less than 25 feet thick (east of Blackjack Road) up to 50 feet thick (in areas west of Blackjack Road). Based on hydraulic maps of the same area, groundwater is expected to be between 5 and 25 feet below ground surface (bgs) west of the tailings pile. Therefore, based on this research, groundwater may exist within the unconsolidated material above the bedrock. To utilize resources appropriately, the unconsolidated saturated material will be sampled and analyzed during Phase I prior to initiating more extensive bedrock aquifer sampling during Phase II, if deemed necessary. Sampling the unconsolidated aquifer will involve direct-push technology or sonic technology to log unconsolidated material and to vertically profile groundwater concentrations; piezometers will be installed at the unconsolidated material-bedrock interface to measure local groundwater flow. VAS in Phase I will be concurrent with sampling of the residential well to obtain a "snap-shot" of groundwater conditions.

If analytical results indicate contaminated shallow groundwater in the unconsolidated materials, further groundwater investigation in bedrock may be conducted to 100 feet bgs during Phase II. The bedrock investigation would consist of logging bedrock for possible fractures followed by biased sample collection at those locations of possible fractures. Acquisition of additional groundwater and borehole data that may occur at open boreholes could include caliper logging, temperature logging, and flow metering to increase understanding of bedrock aquifer conditions and aid in biased sample selection. Groundwater samples collected during the bedrock VAS investigation will be submitted with a request for expedited turnaround in an attempt to determine the need for and placement of permanent monitoring wells. Monitoring wells would be sampled in conjunction with the residential well to obtain a "snap-shot" of groundwater conditions. Following monitoring well installation, a round of measurements of static water levels at piezometers, staff gauges, and permanent monitoring wells will occur to determine groundwater flow direction.

Additional groundwater investigations during Phase I of the RI include an assessment of the groundwater-surface water interface at Smallpox Creek. The sampling approach for investigating the groundwater-

surface water interface at Smallpox Creek includes installing piezometers and staff gauges in and around Smallpox Creek to determine if Smallpox Creek is a gaining or losing stream.

If the results of the Phase I Smallpox Creek investigation do not indicate whether the creek is a gaining or losing stream, then additional creek analysis may be conducted during Phase II. An alternative method for determining the relationship between groundwater and surface water may include placing pressure transducers in the piezometers and monitoring water levels over a longer period of time.

2.4 ECOLOGICAL INVESTIGATION

An ecological investigation will occur to identify types and quantities of wildlife and natural habitat in and around the Bautsch-Gray site. The investigation will consist of a wetland assessment and field observations of wildlife. The data obtained will be used to assess ecological risk posed by the site. In addition a desktop review of threatened/endangered species of concern will be conducted using state and federal sources. No field samples will be collected during the ecological investigation.

3.0 DATA MANAGEMENT STRATEGY

Data management involves orderly collection, identification, storage, retrieval, and assessment of information generated by field activities proposed within the FSP for the site. The overall data goals for the site activities can be met only if the data obtained in the field and at the analytical laboratory can be demonstrated and documented to meet data quality goals.

SulTRAC data management strategies require that the data coordinator and the SulTRAC project manager store all data acquired from RI/FS activities electronically. Data obtained during activities specified within the FSP are of the following seven types: (1) field data, (2) XRF data, (3) global positioning system (GPS) and survey data, (4) SulTRAC digitally recorded data, (5) subcontractor borehole data, (6) laboratory data, and (7) data validation. Data from all the activities will be converted to electronic files and archived by SulTRAC's analytical coordinator. This section describes the strategy for managing each of the seven types of data to be acquired during activities specified within the FSP.

3.1 FIELD DATA

The field team will collect the samples as specified in the FSP portion of the SAP (SulTRAC 2013). Examples of field data to be recorded include (but are not limited to) sampling location, sampling depth, sample matrix, and sampling method.

After samples are collected, sample documentation (sample labels and chain-of-custody records) will be completed as described in Section 8.0 of the FSP. Scribe software will be used to generate labels for each sample sent to the Contract Laboratory Program (CLP) laboratories. Each sample will also be assigned an identifying number by CLP Scribe software. Scribe was developed to expedite sample documentation, track samples from the field to the laboratory, and reduce the most common documentation issues associated with sampling. A quality control (QC) review will be conducted on sample documentation. The primary sample documentation steps for field sampling activities are as follows:

1. The field team will collect the samples and document sample information on a chain-of-custody form in accordance with the FSP. The field team will record appropriate information in a field logbook.
2. The field team leader will conduct a QC review of sample documentation.
3. Errors in sample documentation will be corrected.
4. If the sample documentation is acceptable, samples will be packaged and shipped to the off-site laboratory.

3.2 XRF DATA

The SulTRAC field team will obtain XRF data at each soil and sediment sampling location during the RI/FS. XRF data will include the unique sample number correlated to a sampling location, the date and time of the sample, and results of the XRF screening. SulTRAC will use the software provided with the equipment to download and record data in a computer within a project folder.

Downloaded XRF data will be converted to Microsoft Excel or a statistical analysis program such as EPA's ProUCL along with laboratory data. SulTRAC or the EPA FIELDS team will use statistical analysis to compare XRF data to laboratory analytical data (once laboratory analytical data are received) and develop a correlation factor. Data generated during statistical analysis will be saved digitally in a computer within a project folder. Prior to statistical analysis, the laboratory data will be processed as described in Sections 3.6 and 3.7.

3.3 GPS AND SURVEY DATA

The SulTRAC field team or subcontractor will obtain the following GPS and survey data during the RI/FS:

- Utility locations (if applicable)
- XRF sediment screening/sampling locations

- XRF DU boundaries
- VAS sampling locations
- Monitoring well locations
- Stream gauge and piezometer locations
- Other pertinent site-specific features.

SulTRAC currently uses Environmental Systems Research Institute's (ESRI) software for a majority of projects that incorporate geographic information systems (GIS). SulTRAC will manage the GIS data acquired during the sampling event within an ESRI ArcGIS 9 geodatabase built and designed for the project. GPS technology will also be used for accurate navigation to and capture of sampling locations and activities.

Using a site-specific geodatabase will ease delivery in GIS format of sampling features for EPA use and examination. A geodatabase contains certain tables, columns, and relationships among tables in a single file that allows use of the database by ESRI applications. Geodatabases have many advantages over traditional shapefiles. Spatial data reside within a single file, which eliminates need to store data in multiple shapefiles, thus eliminating many potential data management issues. A geodatabase also allows more modeling, analysis, and cartographic functionality.

Trimble GeoXT handheld GPS units with an accuracy of less than 1 meter will be used in the field for data acquisition. These units have preloaded Trimble's GPS Correct Software to ensure differential correction of data captured, as well as Terrasync software, which will use base map features such as aerial photography, utilities, and parcel boundaries acquired before field activities begin. SulTRAC will load the aforementioned GIS layers onto the GPS units for reference by the field team prior to commencing field activities.

Most GPS units, including the Trimble GeoXT, offer several settings that also serve as quality checks during data acquisition. For example, a minimum number of visible satellites (typically four) can be specified, thereby signaling a warning to the field team if a feature is to be captured when fewer than the minimum four satellites are available. In addition, GPS units can calculate a position dilution of precision (PDOP) value, with lower values leading to more accurate locations of features. Typically, a PDOP value of 6 or less is desirable for appropriately accurate data acquisition. These types of settings will be adjusted accordingly on the GPS units before field work begins to ensure the highest quality data capture. Using GIS and Trimble GPS technology with the project geodatabase and applicable ESRI software will

ensure sound collection of sampling location data and provide quality data to be processed after completion of field work.

Professional surveying services may be engaged during Phase II if permanent monitoring wells are installed. A subcontractor will professionally survey the monitoring wells to a common reference datum at the site. Data acquired by the subcontractor will adhere to standards set by the survey license. Data received by SulTRAC will be processed in the same manner as GPS data. Professional surveying services are not likely to be required until Phase II of the investigation.

3.4 SULTRAC DIGITALLY RECORDED DATA

SulTRAC may record water quality readings during VAS, water levels using pressure transducers during Smallpox Creek investigation, and temperature using electronic temperature gauges during Smallpox Creek investigation. SulTRAC may record water quality readings, water levels, and temperature via a personal digital assistant (PDA) device directly connected to the meter. The water quality data will be recorded on the PDA with designation of an associated unique sample number for each location correlated to a sampling location. SulTRAC will use the software provided with the meter to transfer the data into the computer within the project folder. The raw data may then be uploaded into a template for easier analysis, and subsequently will be restored to the project folder.

3.5 SUBCONTRACTED BOREHOLE DATA

Borehole data such as any geophysical testing will be stored and processed by the subcontractor or government agency responsible for creating the data. SulTRAC will receive the final edited data that will be stored digitally within the project folder.

3.6 LABORATORY DATA

Laboratory data will include results regarding bioavailability and grain size, as well as results from chemical analyses of all samples, including QC results. The primary sample documentation steps for the laboratory are as follows:

1. A laboratory custodian will receive and log the samples on the laboratory's custody forms.
2. Problems and corrective actions will be reported to the SulTRAC data coordinator or project manager.
3. Laboratory analysts will analyze the samples.

4. Laboratory analysts and the laboratory supervisor will conduct QC reviews of their work.

5. If data QC results are unacceptable, corrective action will occur to remedy the problem, and the samples will be reanalyzed if necessary.

In accordance with EPA policy, SulTRAC will use analytical services provided by the government to the extent possible. Therefore, all environmental samples collected during Phase I and Phase II of the investigation will be submitted to a CLP laboratory (excluding measurement of grain size, and acid-volatile sulfide/simultaneously extracted metals [AVS/SEM] and bioavailability analyses). The CLP laboratory will prepare a data package that includes a summary of sample analytical results (including QC results), the chain-of-custody record, raw data, and a summary report. Data package deliverables will be consistent with the CLP scope of work.

Because government analytical services are available neither for measurement of grain size nor for AVS/SEM and bioavailability analyses, SulTRAC will procure a private laboratory to perform these tasks. The standard ASTM International (ASTM) methods will be used, and data packages will be prepared in accordance with the requirements specified in the Quality Assurance Project Plan (QAPP) section of the SAP (SulTRAC 2013). The subcontracted laboratory will use standard data reporting techniques and provide Level 3 data packages. Electronic and hard copies of subcontracted laboratory data will be archived by the SulTRAC analytical coordinator. Field data (notebooks and sampling sheets) will be maintained at SulTRAC's Chicago office. SulTRAC will also provide 10-year data storage.

3.7 DATA VALIDATION

On preformatted analytical result forms, a chemist will routinely screen analytical data for accuracy as the data are received from the laboratory. CLP-generated analytical data from this investigation will undergo data evaluation via computer-aided data review and evaluation (CADRE) processes only. The analytical coordinator and project manager will review the case narrative to ensure that project-required criteria have been achieved. Any CADRE-identified data quality issues will be communicated to the EPA Work Assignment Manager in the data validation report prepared for each sampling event.

SulTRAC will review analytical data generated by the subcontracted laboratory. The analytical coordinator and project manager will review the case narrative to ensure that project-required criteria have been achieved. A data summary report will be prepared identifying any data quality issues, and data qualifiers will be applied to the data, as necessary.

GPS/GIS data obtained from the field will undergo a series of processing steps, including quality review by field team and GPS/GIS personnel, differential correction, and geodatabase import. Once the field data are obtained, GPS/GIS personnel will perform a quality check and differential correction to ensure that all features captured are within the appropriate projection of the project by overlaying these features with GPS reference data previously described. Additional attribute information may be populated for each feature (such as, sample identification number) if not previously entered by field teams. Once the data have been differentially corrected and imported into the geodatabase, the geodatabase is ready for reporting and analysis.

XRF data obtained from the field will undergo an analysis similar to the one described above. Correction of the XRF data will be based on a comparison of the XRF data to data from the laboratory samples. By use of this correction factor, alteration of the XRF data may occur. Once the data have been corrected, the XRF data will be ready for reporting and analysis.

4.0 DATA MANAGEMENT STRUCTURE

Field data sheets and field logbooks will be entered and/or scanned and stored electronically by SulTRAC's data coordinator or project manager. All raw chemical data results forwarded by the laboratory will be stored electronically by SulTRAC's data coordinator and forwarded to the project manager for inclusion into the overall site electronic database. As a backup, data will also be maintained in hard copy format at the SulTRAC office in Chicago, Illinois. Scribe software will be used to carry out chain-of-custody procedures for CLP samples.

5.0 REFERENCES

SulTRAC. 2015. Sampling and Analysis Plan for Remedial Investigation/Feasibility Study (RI/FS) Activities, Bautsch-Gray Mine Site, Jo Daviess County, Illinois. Prepared for the U.S. Environmental Protection Agency (EPA) under Contract No. EP-S5-06-02. November 13.

U.S. Environmental Protection Agency (EPA). 2013. RAC II Region 5 Statement of Work for Remedial Investigation/Feasibility Study (RI/FS) Bautsch-Gray Mine, Jo Daviess County, Illinois. Issued by EPA Region 5. Contract EP-S5-06-02 Work Assignment 186-RICO-B5TS. May 23.

HEALTH AND SAFETY PLAN

BAUTSCH-GRAY MINE SITE
JO DAVIESS COUNTY, ILLINOIS

FINAL

NOVEMBER 13, 2015

Prepared for
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604

Prepared by
SulTRAC
1 South Wacker Drive, 37th Floor
Chicago, IL 60606

Site Name: Bautsch-Gray Mine	**Site Contact:** N/A	**Telephone:** N/A
Location: Jo Daviess County, Illinois	**Client Contact:** Pamela Molitor	**Telephone:** (312) 353-0967
EPA ID No. ILN000510407	**Prepared By:** Robert Kondreck	**Date Prepared:** December 20, 2013
Project No. 103G1852186	**Dates of Activities:** February 2014 through 2015 (HASP is not valid for periods longer than 12 months)	**Emergency Response** ☐ Yes ☒ No

Objectives:

Conduct an remedial investigation (RI) to determine the extent of the metals contamination to nearby properties by conducting:

1) Site Reconnisance
2) XRF Soil Screening and Sampling
3) XRF Sediment Screening and Sediment/Surface Water Sampling
4) Verticle Aquifer Sampling (VAS)
5) Monitoring well installation, sampling, and residential well sampling

Site Type: *Check as many as applicable.*

☐ Active	☐ Landfill	☐ Inner-City
☒ Inactive	☐ Railroad	☒ Rural
☐ Secured	☐ Residential	☐ Remote
☒ Unsecured	☐ Industrial	☐ Other (*specify*)

Project Scope of Work and Site Background

The Bautsch-Gray Mine was an operational lead and zinc mine. Since it closed in 1975, tailings from the mine property have continued to erode and move toward residential properties, wetlands and fisheries. In 2000 and 2001, Illinois EPA assessed the site and confirmed that waste piles at the mine property contained elevated levels of lead, arsenic and other heavy metals. Additional investigations showed that nearby creeks and drainage ditches had been affected by contaminants that moved from a large mine tailings pile on the mine property. In addition, one residential drinking water well was found to have been contaminated by the mine tailings.

During a storm in August 2009, heavy rain carried tailings from the main waste pile on the mine property across Blackjack Road onto residential property. According to the Jo Daviess County Highway Department, this has been a problem in previous raining seasons. On August 24, 2009, Illinois EPA took samples on and around the site and the residential property and found high levels of lead in soil samples from both places. That prompted the state's request for federal assistance. The EPA initiated a time-critical removal action to install and maintain a water treatment system on the residence with elevated lead levels in their well. Removal actions were also taken to regrade the tailings pile and address residential soils. The Bautsch-Gray Mine Site was added to the Superfund program National Priorities List in September 2012.

The scope of work for the RI, includes; 1) General site reconnisance; 2) XRF soil screening and laboratory sampling based on a grid system surrounding the tailings pile and other known contaminated areas; 3) XRF sediment screening and laboratory sampling, surface water sampling, and sediment depth measurements at transects across Smallpox Creek and wetland areas; 4) VAS at locations upgradient of the tailings pile, surrounding the tailings pile, and near Smallpox Creek; and 5) Monitoring well installation, groundwater sampling, and residential well sampling. The scope of work will be performed in two phases and will vary in effort for each task based on initial sampling findings. For example, during XRF grid sampling if several grids are found at or below background, grids further from the source areas may be eliminated. Therefore, the duration of field activities may vary.

Health and Safety Approver Comments or Additional Instructions: Avoid dust-generating activities. Use dust monitors with action level of 3,000 µg/m^3 and initiate dust control (i.e. water spray) or evacuate upwing if action level is exceeded. Boot covers are required. Use plastic sheeting to kneel on while sampling soils. Knee pads may also be used as needed. Maintain an appropriate supply of water for eyewash and drench, as well as D-Lead soap or wipes for hand and face wash. Apply appropriate chemical hygiene, including frequent hand washing. No eating, drinking, smoking/tobacco use, or application of cosmetics in potentially-contaminated areas. Heavy equipment will required surficial decontamination prior to departure from site.

Health and Safety Plan Approver Signature: Chris Draper **Date:** APPROVED By chris.draper at 2:28 pm, Apr 10, 2014

Note: A minimum of two persons with appropriate training and medical surveillance must be on site for any fieldwork subject to Level 2 HASP requirements.
Note: A detailed site sketch or figure may be included on Page 10 of 12.

Initial Isolation and Protective Action Distances (for emergency response operations only): NA

Initial Isolation Distance: NA

Exclusions zone will established around each drilling location based on site conditions and or noise levels at drilling operations (i.e. a circular exclusion zone based on noise levels ≥85 dbA from the drill rig or a minimum of 20 feet around the rig, whichever is greater). Exclusion zones will be delineated using cones, barrier tape or similar visual indicators.

IDW shall be drummed and remain onsite pending characterization for subsequent disposal.

Wind Speed and Direction (Approach from upwind)	Temperature (°F)	Relative Humidity (%)	Probability of Precipitation (%)	Weather Forecast (such as partly cloudy, snow, etc.)
Capture weather information daily on Tailgate Safety Briefing form or in site logbook				

On-Site Supplies: ☒ First Aid Kit ☐ Fire Extinguisher ☐ Air Horn ☐ Oral Thermometer ☒ Noise Dosimeter

Known or Anticipated Site Hazards or Concerns: (Hazards covered by existing Safe Work Practices are listed on the next page)

☐ Work on active roadway	☒ Overhead utilities	☐ Energized electrical systems
☐ Onsite laboratory	☒ Buried Utilities	☒ Portable hand tool use
☐ Explosion or fire hazard	☐ Surface or underground storage tanks	☐ Portable electrical tool use
☐ Oxygen deficiency	☒ General slips, trips, falls	☐ Machine guarding
☐ Unknown or poorly characterized chemical hazards	☒ Uneven, muddy, rugged terrain	☐ Portable fire extinguisher use
☒ Inorganic chemicals	☐ Lift (man lift, cherry picker) use	☐ Driving commercial vehicles
☐ Organic chemicals	☐ Industrial truck (forklift) use	☐ Driving personal vehicles
☐ Chemical warfare materiel	☐ Wood or metal ladder use	☐ Scientific diving operations
☐ Compressed Gas Cylinders	☐ Dangerous goods shipped by air	☐ Injury and Illness Prevention Program (California only)
☐ Asbestos	☐ Elevated work (over 6' high)	☐ Ergonomics (California only)
☒ Respirable particulates	☒ Heavy equipment use or operation	☐ Work in strip or shaft mines
☐ Respirable silica	☐ Construction work	☐ Client-specific safety requirements (attach to HASP)
☐ Blasting and explosives	☐ Excavation or trenching	☐ ATV use
☐ Non-ionizing radiation (lasers, radiofrequencies, UV)	☐ Benching, shoring, bracing	☐ Methamphetamine lab
☐ Ionizing radiation (alpha, beta, gamma, etc.)	☐ Scaffold use	☒ Working over or near water
☐ Heat stress	☒ High noise	☐ Mold
☒ Cold stress	☐ Grinding operations	☐ *Other (insert)*

Explosion or Fire Potential: ☐ High ☐ Medium ☒ Low ☐ Unknown

Chemical Products Tetra Tech EM Inc. Will Use or Store On Site: (Attach a Material Safety Data Sheet [MSDS] for each item.)

- ☒ Alconox or Liquinox
- ☐ Hydrochloric acid (HCl)
- ☒ Nitric acid (HNO_3)
- ☒ Sodium hydroxide (NaOH)
- ☐ Calibration gas (Methane)
- ☐ Calibration gas (Isobutylene)
- ☐ Calibration gas (Pentane)
- ☐ Calibration gas (4-gas mixture)
- ☐ Hydrogen gas
- ☐ Household bleach (NaOCl)
- ☐ Sulfuric acid (H_2SO_4)
- ☐ Hexane
- ☐ Isopropyl alcohol
- ☐ HazCat Kit
- ☒ D-Lead Soap
- ☒ Potable water (eyewash/drench)

WARNING: Eyewash solution shall be readily available on ALL projects where corrosives (acids or bases) are used, including sample preservatives

Applicable Safety Programs and Safe Work Practices (SWP). Attach to HASP:

- ☐ DCN 4-03 Demolition and Decontamination
- ☐ DCN 4-05 Trenching and Excavation Safety
- ☐ DCN 4-08 Asbestos Protection Program
- ☐ DCN 4-09 Haulage and Earth Moving
- ☒ DCN 4-10 Lead Protection Program
- ☐ SWP DCN 5-01 General Safe Work Practices
- ☒ SWP DCN 5-02 General Safe Work Practices HAZWOPER
- ☐ SWP DCN 5-03 Safe Work Practices for Office Employees
- ☒ SWP DCN 5-04 Safe Drilling Practices
- ☐ SWP DCN 5-05 Safe Direct Push (GeoProbe) Practices
- ☒ SWP DCN 5-06 Working Over or Near Water
- ☒ SWP DCN 5-07 Use of Heavy Equipment
- ☐ SWP DCN 5-08 Special Site Hazards (Firearms, Remote Sites, Mines, aircraft, etc.)
- ☐ SWP DCN 5-09 Safe Electrical Work Practices
- ☐ SWP DCN 5-10 Fall Protection Practices
- ☐ SWP DCN 5-11 Portable Ladder Safety
- ☐ SWP DCN 5-12 Drum and Container Handling Practices
- ☐ SWP DCN 5-13 Flammable Hazards and Ignition Sources
- ☐ SWP DCN 5-14 Spill and Discharge Control Practices
- ☐ SWP DCN 5-15 Heat Stress
- ☒ SWP DCN 5-16 Cold Stress
- ☒ SWP DCN 5-17 Biohazards
- ☐ SWP DCN 5-18 Underground Storage Tank Removal Practices
- ☒ SWP DCN 5-19 Safe Lifting Procedures
- ☐ SWP DCN 5-22 Hydrographic Data Collection
- ☐ SWP DCN 5-23 Permit-Required Confined Space Entry Practices
- ☐ SWP DCN 5-24 Non-Permit-Required Confined Space Entry Practices
- ☐ SWP DCN 5-26 Prevention of Sun Exposure
- ☐ SWP DCN 5-27 Respirator Cleaning Practices
- ☐ SWP DCN 5-28 Safe Use Practices for Use of Respirators
- ☒ SWP DCN 5-35 Underground Utilities, including 5-35F, Ground Disturbance Permit
- ☒ SWP DCN 5-36 Drill Rigs

Tasks Performed At Job Site that are NOT Covered by SWPs

NOTE: Many AHA's can be found on the Health & Safety intranet site at: http://home.ttemi.com/C18/Activity%20Hazard%20Analysis%20Document/default.aspx

Attach Activity Hazard Analysis (AHA) for each non-covered task

- ☒ Soil Screening and Sampling with XRF at Lead Sites
- ☒ Sediment Screening and Sampling with XRF at Lead Sites
- ☒ Observation Near Drill Rigs and Heavy Equipment
- ☒ Surface Water Sampling
- ☒ Groundwater Sampling

Tetra Tech Employee Training and Medical Requirements:

Basic Training and Medical

- ☒ Initial 40 Hour Training
- ☒ 8-Hour Supervisor Training (one-time)
- ☒ Current 8-Hour Refresher Training
- ☒ Current Medical Clearance (including respirator use)
- ☒ Current First Aid Training
- ☒ Current CPR Training
- ☐ Current Respirator Fit-Test

Other Specific Training and Medical Surveillance Requirements

- ☐ Confined Space Training
- ☐ Level A Training
- ☐ Radiation Training
- ☐ OSHA 10-hour Construction Safety Training
- ☐ OSHA 30-hour Construction Safety Training
- ☐ Asbestos Awareness Training
- ☐ Asbestos B-Reader X-Ray
- ☒ Blood Lead Level and ZPP Pre, during and Post-Project
- ☐ Urinary Arsenic Level Pre and Post-Project
- ☐ Other _____
- ☐ Other _____

Materials Present or Suspected at Site	Highest Observed Concentration (specify units and sample medium)[1,2]	Exposure Limit (specify ppm or mg/m^3)[3,4]	IDLH Level (specify ppm or mg/m^3)	Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other)	Symptoms and Effects of Acute Exposure	Photoionization Potential (eV)
Arsenic	68 mg/kg (Waste) 91.2 mg/kg (Soil) 33.9 mg/kg (Soil)	PEL = 0.010 mg/m^3 TWA REL = 0.002 mg/m^3 TWA TLV = 0.01 mg/m^3 TWA [Skin] Hazard ☒	5 mg/m^3 (Ca)	Toxic	Ulceration of nasal septum, dermatitis gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin	N/A
Cadmium	39 mg/kg (Waste)	PEL = 0.005 mg/m^3 TWA REL = Ca TLV = 0.01 mg/m^3 TWA; 0.002 mg/m^3 respirable fraction [Skin] Hazard ☒	9 mg/m^3 (Ca)	Toxic	Pulmonary adema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, anosmia, emphysema, proteinuria, mild anemia	N/A
Copper	217 mg/kg (Waste) 210 mg/kg (Soil) 311.5 mg/kg (Sediment)	PEL = 1 mg/m^3 TWA REL = 1 mg/m^3 TWA TLV = 1 mg/m^3 TWA [Skin] Hazard ☒	100 mg/m^3	Toxic	Irritation of eyes, nose, pharynx, nasal septum perforation, metallic taste, dermatitis (in animals: lung, liver, kidney damage, anemia)	N/A
Lead	10,764 mg/kg (Waste) 2,292 mg/Kg (Soil) 1,437.5 mg/Kg (Sediment) 27 ppb (Groundwater)	PEL = 0.05 mg/m^3 TWA REL = 0.05 mg/m^3 TWA TLV = 0.05 mg/m^3 TWA [Skin] Hazard ☒	100 mg/m^3	Toxic	Lassitude, insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, wrist and ankle paralysis, encephalophathy, kidney disease, irritation of eyes, hypotension	N/A
Magnesium	73,333 mg/kg (Waste)	PEL = 0.05 mg/m^3 TWA REL = 0.05 mg/m^3 TWA TLV = 0.05 mg/m^3 TWA [Skin] Hazard ☒	500 mg/m^3	Toxic	Manganism, asthenia, insomnia, mental confusion, metal fume fever, dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flue-like fever low-back pain, vomiting, malaise (vague feeling of discomfort), lassitude (weakness, exhaustion), kidney damage	N/A
Zinc (as Zinc Oxide)	12,667 mg/kg (Waste) 12,700 mg/kg (Soil) 7,420 mg/kg (Sediment)	PEL = 15 mg/m^3 TWA dust; 5 mg/m3 TWA respirable dust REL = 5 mg/m^3 TWA TLV = 10 mg/m^3 TWA [Skin] Hazard ☒	500 mg/m^3	Toxic	Metal fume fever, chills, muscle ache, nausea, fever, dry throat, cough, lassitude, metallic taste, headache, blurred vision, low back pain, vomiting, malaise, chest tightness, dysnea, rales, decreased pulmonary function	N/A

Specify Information Sources:

1 Environmental Protection Agency (EPA). 2012. Bautsch-Gray Mine HRS Documentation Record. March.
2 Illinois EPA. 2002. CERCLA Expanded Site Inspection, Volume 1. March 31.
3 American Conference of Governmental Industrial Hygienists (ACGIH). "Threshold Limit Values and Biological Exposure Indices for 2012."
4 NIOSH Pocket Guide to Hazardous Chemicals, September 2005

Note: In the Exposure Limit column, include Ceiling (C) and Short-Term Exposure Limits (STEL) if they are available. Also, use the following short forms and abbreviations to complete the table above.

A = Air
CARC = Carcinogenic
eV = Electron volt
U = Unknown

IDLH = Immediately dangerous to life or health
mg/m^3 = Milligram per cubic meter
N/A = Not applicable
NE = None established

PEL = Permissible exposure limit
ppm = Part per million
REL = Recommended exposure limit
S = Soil

TLV = Threshold limit value

Note: If no contingency level of protection is selected, all employees covered under this plan must evacuate the immediate site area if air contaminant levels require upgrading PPE. Level A field work requires a Level 3 HASP. This information is available on the chemical hazards page of this HASP.

Field Activities Covered Under this HASP:

Task Description	Level of Protection[1]		Date of Activities
	Primary	Contingency	
1 Site Reconnaissance	☐ A ☐ B ☐ C ☒ D	Level C is not authorized	2/2014 to 2/2015
2 XRF Soil Screening and Sampling	☐ A ☐ B ☐ C ☒ D	Level C is not authorized	2/2014 to 2/2015
3 XRF Sediment Screening and Sediment/Surface Water Sampling	☐ A ☐ B ☐ C ☒ D	Level C is not authorized	2/2014 to 2/2015
4 Verticle Aquifer Sampling (VAS)	☐ A ☐ B ☐ C ☒ D	Level C is not authorized	2/2014 to 2/2015
5 Monitoring Well Installation, Development, Sampling and Residential Well Sampling	☐ A ☐ B ☐ C ☒ D	Level C is not authorized	2/2014 to 2/2015

Site Personnel and Responsibilities (include subcontractors):

Employee Name and Office Code / Location	Task(s)	Responsibilities
Robert Kondreck (Tt CH)	1-5	• Project Manager: Manages the overall project, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with client as necessary. Additionally, For projects lasting longer than one consecutive week on-site, the PM is responsible for conducting one field audit using Form AF-1.
Chris Burns (Tt CH)	1-5	• Field Team Leader: Directs field activities, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with the Project Manager and the client as necessary
Cheryl Kondreck (Sullivan CH)	1-5	• Site Safety Coordinator (SSC): Ensures that appropriate personal protective equipment (PPE) is available, enforces proper use of PPE by on-site personnel and subcontractors; suspends investigative work if personnel are or may be exposed to an immediate health hazard; implements and enforces the HASP; identifies and controls site hazards when possible; communicates site hazards to all personnel; and reports any deviations observed from anticipated conditions described in the health and safety plan to the health and safety representative.
Matt Villicana (Tt CH)	1-5	• Alternate Site Safety Coordinator (if any)
Tracey Koach (Sullivan CH), James Robinson (Sullivan CH), Bethany Hand (Tt CH), Adam Peterca (Tt CH), Lance Summers (Tt CH)	1-5	• Field Personnel: Completes tasks as directed by the project manager, field team leader, and SSC, and follows the HASP and all SWPs and guidelines established in the Tetra Tech, Inc., Health and Safety Manual.
TBD	4,5	• Tetra Tech-hired subcontractor personnel on site (a subcontract SSC MUST be identified by name): Completes tasks as outlined in the project scope of work in accordance with the contract. Participates in all Tetra Tech on-site safety meetings and follows all procedures and guidelines established in this HASP, as well as the company health and safety plan and program.

Note:
1. See next page for details on levels of protection

NOTE: Contingency level of protection section should be completed only if the upgraded level of protection is immediately available at the job site. If no contingency level of protection is denoted, all employees covered under this HASP must evacuate the immediate site area if air contaminant levels would require an upgrade of PPE.

Protective Equipment: (Indicate type or material as necessary for each task.)

Task	Primary Level of Protection (A,B,C,D)	PPE Component Description (Primary)	Contingency Level of Protection (A, B, C, D)	PPE Component Description (Contingency)
1	D	Respirator type: None Cartridge type (if applicable): Not Applicable CPC material: Cotton or Tyvek Coveralls (optional) Glove material(s): None, Surgical Nitrile, or Work Gloves Boot material: Leather Steel-toe/Steel shank with required boot covers Other: safety glasses, high-visibility vest, insect repellant, sun screen, Type 2 or better PFD when within 15' of water >3' deep or swiftly moving.	N/A	Level C is NOT Authorized
2	D	Respirator type: None Cartridge type (if applicable): Not Applicable CPC material: Cotton or Tyvek Coveralls (optional) Glove material(s): None, Surgical Nitrile, or Work Gloves Boot material: Leather Steel-toe/Steel shank with required boot covers Other: safety glasses, high-visibility vest, insect repellant, sun screen, Type 2 or better PFD when within 15' of water >3' deep or swiftly moving.	N/A	Level C is NOT Authorized
3	D	Respirator type: None Cartridge type (if applicable): Not Applicable CPC material: Cotton or Tyvek Coveralls (optional) Glove material(s): None, Surgical Nitrile, or Work Gloves Boot material: Leather Steel-toe/Steel shank with required boot covers Other: safety glasses, high-visibility vest, insect repellant, sun screen, Type 2 or better PFD when within 15' of water >3' deep or swiftly moving.	N/A	Level C is NOT Authorized
4	D	Respirator type: None Cartridge type (if applicable): Not Applicable CPC material: Cotton or Tyvek Coveralls (optional) Glove material(s): None, Surgical Nitrile, or Work Gloves Boot material: Leather Steel-toe/Steel shank with required boot covers Other: Hardhat,(when working around drill rig) safety glasses, high-visibility vest, insect repellant, sun screen, hearing protection during heavy equipment and/or drill operation	N/A	Level C is NOT Authorized
5	D	Respirator type: None Cartridge type (if applicable): Not Applicable CPC material: Cotton or Tyvek Coveralls (optional) Glove material(s): None, Surgical Nitrile, or Work Gloves Boot material: Leather Steel-toe/Steel shank with required boot covers Other: Hardhat (when working around drill rig), safety glasses, high-visibility vest, insect repellant, sun screen	N/A	Level C is NOT Authorized

Respirator Notes:
Respirator cartridges may only be used for a maximum time of 8 hours or one work shift, whichever is less, and must be discarded at that time. For job sites with organic vapors, respirator cartridges may be used as described in this note as long as the concentration is less than 200 parts per million (ppm), the boiling point is greater than 70 °Celsius, and the relative humidity is less than 85 percent. If any of these levels are exceeded, a site-specific respirator cartridge change-out schedule must be developed and included in the HASP using Tetra Tech Form RP-2 (Respiratory Hazard Assessment Form)

Notes:
All levels of protection must include eye, head, and foot protection.
CPC = Chemical protective clothing
Thermoluminescent Dosimeter (TLD) Badges must be worn during all field activities on sites with radiation hazards. TLDs must be worn under CPC.

Monitoring Equipment: All monitoring equipment on site must be calibrated before and after each use and results recorded in the site logbook				
Instrument (Check all required)	**Task**	**Instrument Reading**	**Action Guideline**	**Comments**
☐ Combustible gas indicator model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	0 to 10% LEL	Monitor; evacuate if confined space	
		10 to 25% LEL	Potential explosion hazard; notify SSC	
		>25% LEL	Explosion hazard; interrupt task; evacuate site; notify SSC	
☐ Oxygen meter model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	>23.5% Oxygen	Potential fire hazard; evacuate site	
		23.5 to 19.5% Oxygen	Oxygen level normal	
		<19.5% Oxygen	Oxygen deficiency; interrupt task; evacuate site; notify SSC	
☐ Radiation survey meter model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Normal background	Proceed	Annual exposure not to exceed 1,250 mrem per quarter Background reading must be taken in an area known to be free of radiation sources.
		Two to three times background	Notify SSC	
		>Three times background	Radiological hazard; interrupt task; evacuate site; notify RSO	
☐ Photoionization detector model: ☐ 11.7 eV ☐ 10.6 eV ☐ 10.2 eV ☐ 9.8 eV ☐ Other (specify): _____	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Any response above background to 5 ppm above background	Level B is recommended Level C[a] may be acceptable	These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved.
		> 5 to 500 ppm above background	Level B	
		> 500 ppm above background	Level A	
☐ Flame ionization detector model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Any response above background to 5 ppm above background	Level B is recommended Level C[a] may be acceptable	These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved.
		>5 to 500 ppm above background	Level B	
		>500 above background	Level A	
☐ Detector tube models:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Specify: < 1/2 the PEL > 1/2 the PEL	Specify:	The action level for upgrading the level of protection is one-half of the contaminant's PEL. If the PEL is reached, evacuate the site and notify a safety specialist
☒ Other (specify): DataRAM 4 (or similar)	☐ 1 ☐ 2 ☐ 3 ☒ 4 ☒ 5	Specify: 3,000 mg/m3 on instument	Specify: Move upwind and implement dust control measures	Dust control will be provided by the drilling subsontractor in the form of a water truck and /or mister system. Monitors will be set both upwind and downwind of operations *(see dust level calculations at the end of this document).*

Notes:
eV= electron volt LEL=Lower explosive limit mrem=Millirem PEL=Permissible exposure limit ppm=Part per million

a. Level B is required when chemical hazards are present, but are uncharacterized. Level C may be acceptable for certain tasks in some situations. If you are uncertain, consult your RSO.

Project-Specific Industrial Hygiene Requirements

OSHA-Regulated Chemicals*:

Check any present on the job site in any medium (air, water, soil)

- ☐ No chemicals below are located on the job site
- ☐ Friable Asbestos
- ☐ Silica, crystalline
- ☐ alpha-Napthylamine
- ☐ Methyl chloromethyl ether
- ☐ 3,3'-Dichlorobenzidine (and its salts)
- ☐ bis-Chloromethyl ether
- ☐ beta-Napthylamine
- ☐ Benzidine
- ☐ 4-Aminodiphenyl
- ☐ Ethyleneimine
- ☐ beta-Propiolactone
- ☐ 2-Acetylaminoflourene
- ☐ 4-Dimethylaminoazobenzene
- ☐ N-nitrosomethylamine
- ☐ Vinyl chloride
- ☐ Inorganic arsenic
- ☒ Lead
- ☐ Chromium (VI)
- ☐ Cadmium
- ☐ Benzene
- ☐ Coke oven emissions
- ☐ 1,2-Dibromo-3-chloropropane
- ☐ Acrylonitrile
- ☐ Ethylene oxide
- ☐ Formaldehyde
- ☐ Methylenedianiline
- ☐ 1,3-Butadiene
- ☐ Methylene chloride

* NOTE: Many states, including California and New Jersey, have chemical-specific worker protection requirements and standards for many chemicals and known or suspected carcinogens.

Emergency Contacts:

	Telephone No.
WorkCare and Incident Intervention	888.449.7787, or 800.455.6155
Tetra Tech EMI 24-hour Anonymous Hazard Reporting Line	866.383.8070
U.S. Coast Guard National Response Center	800.424.8802
InfoTrac	800.535.5053
Poison Control	800.222.1222
Fire department	911
Police department	911

Personnel Call-Down List:

Job Title or Position:	Name	Cell Phone:
Safety Manager	Chris Draper	615.969.1334
Project Manager:	Rob Kondreck	773.563.3502
Field Team Leader:	Rob Kondreck	773.563.3502
Site Safety Coordinator (SSC):	Chris Burns	570.417.1280
Subcontractor SSC:	TBD	

Medical and Site Emergencies:

Signal a site or medical emergency with three blasts of a loud horn (car horn, fog horn, or similar device). Site personnel should evacuate to the area of safe refuge designated on the site map.

Hospital Name: Mercy Medical Center
Address: 250 Mercy Drive
Dubuque, IA 52001

General Phone: (563) 589-8000
Emergency Phone: 911
Ambulance Phone: 911

Hospital called to verify emergency services are offered? YES ☒ NO ☐

Step-by-step Route to Hospital: (see Page 11 of 12 for route map)

See Figure

Note: This page must be posted on site.

Decontamination Procedures

The site safety coordinator overseas implementation of project decontamination procedures and is responsible for ensuring they are effective.

Personnel Decontamination

Level D Decon - ☐ Wet ☒ Dry

With face and hand wash using D-Lead (or similar) soap

Level C Decon - ☐ Wet ☐ Dry

Level B Decon – Briefly outline the level B decontamination methods to be used on a separate page attached to this HASP.

Level A Decon – A Level 3 HASP is required. Notify your regional health and safety representative and health and safety director.

Equipment Decontamination

All tools, equipment, and machinery from the Exclusion Zone (hot) or Contamination Reduction Zone (warm) are decontaminated in the CRZ before they are removed to the Support Zone (cold). Sampling Decontamination Procedures: Field decontamination will be conducted in accordance with the procedures provided in the EPA Region 4 SESD FBQSTP Field Equipment Cleaning and Decontamination (SESDPROC-205-R2), December 2011. The SESD FBQSTPs are available at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html .

Respirator Decontamination

Respirators are decontaminated in compliance with SWP 5-27 and should be included with this HASP.

Waste Handling for Decontamination

Procedures for decontamination waste disposal meet all applicable local, state, and federal regulations.

Decontamination Equipment

- ☐ Washtubs
- ☐ Buckets
- ☒ Scrub brushes [boot wash and/or equipment decon]
- ☐ Pressurized sprayer
- ☒ Detergent [Alconox for equipment]
- ☒ Soap [D-Lead]]
- ☐ Household bleach solution
  Concentration/Dilution: _____
- ☐ Deionized water
- ☐ Disposable sanitizer wipes
- ☐ Facemask sanitizer powder
- ☐ Wire brush
- ☐ Spray bottle
- ☐ Tubs / pools
- ☒ Banner/barrier tape/cones
- ☒ Plastic sheeting [drill decon]
- ☐ Tarps and poles
- ☒ Trash bags
- ☐ Trash cans
- ☐ Duct tape
- ☒ Paper towels
- ☐ Folding chairs
- ☐ Other

Emergency Response Planning

During the pre-work briefing and daily tailgate safety meetings, all on-site employees will be trained in the provisions of emergency response planning, site communication systems, and site evacuation routes.

In the event of an emergency that necessitates evacuation of a work task area or the site, the following procedures will take place.

- The Tetra Tech SSC will contact all nearby personnel using the on-site communications to advise the personnel of the emergency.
- The personnel will proceed along site roads to a safe distance upwind from the hazard source.
- The personnel will remain in that area until the SSC or an authorized individual provides further instructions.

In the event of a severe spill or a leak, site personnel will follow the procedures listed below.

- Evacuate the affected area and relocate personnel to an upwind location.
- Inform the Tetra Tech SSC, a Tetra Tech office, and a site representative immediately.
- Locate the source of the spill or leak, and stop the flow if it is safe to do so.
- Begin containment and recovery of spilled or leaked materials.
- Notify appropriate local, state, and federal agencies.

In the event of severe weather, site personnel will follow the procedures listed below.

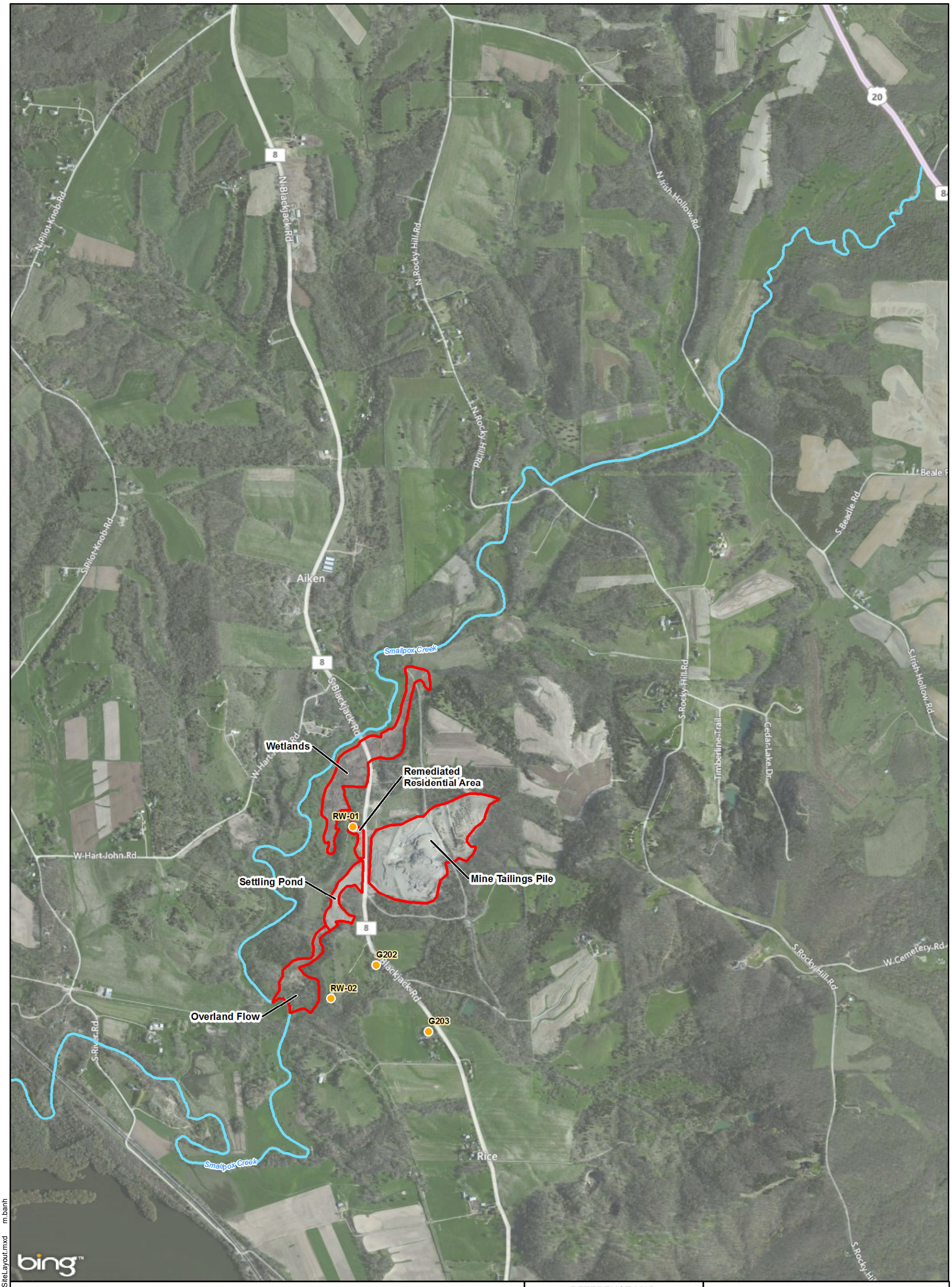
- Site work shall not be conducted during severe weather, including high winds and lightning.
- In the event of severe weather, stop work, lower any equipment (drill rigs) and evacuate the affected area.
- Severe weather may cause heat or cold stress. Refer to SWPs 5-15 and 5-16 for information on both.

All work-related incidents must be reported. According to TtEMI's reporting procedures, for non-emergency incidents you should:

- Notify WorkCare and Incident Intervention at 888.449.7787, or 800.455.6155
- Notify your Project Manager or Safety Manager via phone immediately.
- Complete a "Tetra Tech Incident Report" (Form IR) within 24 hours and send it to your RSO. If an injury or illness has occurred, the Form IR-A and the WorkCare HIPAA form must be completed at the same time the Form IR is completed.

Site Map (May be drawn after crews arrive onsite or inserted using aerial photographs, site figures, etc.):

See Attached Map



LEGEND

- Residential Well
- Area Boundary
- River

N

0 1,000 2,000 Feet

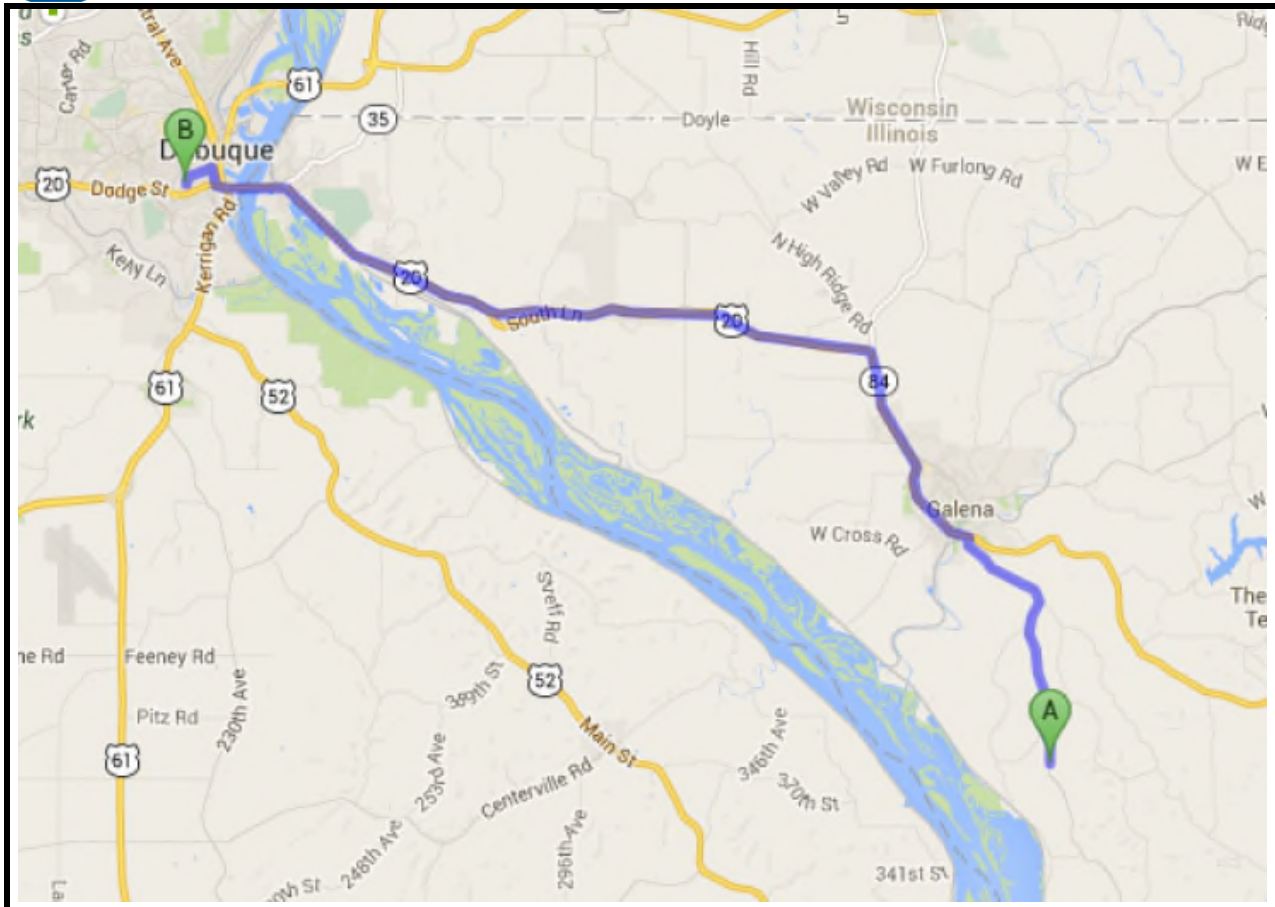
REFERENCE MAP

BAUTSCH-GRAY MINE SITE
GALENA, ILLINOIS

FIGURE 2
SITE LAYOUT MAP

SulTRAC

9/5/2013 G:\G\1852\186 Bautsch-Gray Mine\MXD\Fig2-SiteLayout.mxd m.banh



	1. Head **north** on **County Rd 8/W Blackjack Rd** toward **W Hart John Rd** About 7 mins	go 4.3 mi total 4.3 mi
↱	2. Turn right onto **4th St**	go 0.1 mi total 4.4 mi
20	3. Take the 1st **left** onto **Hwy 20 W/US-20 W/Decatur St/Spring St** Continue to follow Hwy 20 W/US-20 W Entering Iowa About 18 mins	go 15.1 mi total 19.5 mi
↱	4. Turn right onto **Locust St** About 55 secs	go 0.3 mi total 19.9 mi
↰	5. Turn **left** onto **W 3rd St** About 1 min	go 0.4 mi total 20.3 mi
↰	6. Turn **left** onto **James St**	go 358 ft total 20.4 mi
↱	7. Turn right onto **Langworthy St**	go 23 ft total 20.4 mi
↰	8. Turn **left**	go 292 ft total 20.4 mi
B	**Mercy Medical Center** 250 Mercy Dr, Dubuque, IA 52001, United States	

Note: A dry-run should be conducted to establish a physical location associated with the map included in the HASP. Verbal verification from the hospital emergency room should also be obtained to ensure that the hospital will accept chemically contaminated patients.

APPROVAL AND SIGN-OFF FORM

Project No.: 103G1852186

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the Site Safety Coordinator (SSC) as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual. I understand the training and medical requirements for conducting field work and have met these requirements.

Tetra Tech has prepared this plan solely for the purpose of the health and safety protection of Tetra Tech employees. Subcontractors, visitors, and others at the site, while required to read and follow the provisions outlined in this plan at a minimum, should refer to their safety program for specific information related to their health and safety protection.

Name	Company / Agency / Organization	Signature	Date

I have read, understood, and agree with the information set forth in this Health and Safety Plan and comply with and will enforce this HASP, as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual.

Name	Project-Specific Position	Signature	Date
	Project Manager		
	Field Team Leader		
	Site Safety Coordinator		
	Subcontractor SSC		

Tetra Tech has prepared this plan solely for the purpose of the health and safety protection of Tetra Tech employees. Subcontractors, visitors, and others at the site, while required to read, acknowledge and follow the provisions outlined in this plan at a minimum, should refer to their safety program for specific information related to health and safety.

Note: Use Additional sheets as necessary to ensure that all personnel sign and affirm this document.

TETRA TECH
Safety Excellence

VOLUNTARY PROTECTION PROGRAM

VPP
Voluntary Protection Programs
An OSHA Cooperative Program

Management Leadership

Lead by example. Good managers recognize the benefits of a strong safety program and ensure that their personnel and subcontractors have the right tools, equipment, and attitude to work safely.

Some areas where effective management leadership for safety can be demonstrated include:

- Provide visible safety leadership - start meetings with a safety topic, integrate safety into planning, scheduling, and budgeting processes, take personal action to resolve safety issues.
- Become involved in incident reporting, investigation, corrective action - share lessons learned.
- Include subcontractors in your safety program and oversee their work.

Employee Involvement

Get involved! Take personal action and work directly with your supervisor daily to identify, control, or eliminate potential safety hazards.

Other ways to become involved in the safety program and improve work conditions include:

- Initiate hazard reports to identify hazards, suggest improvements, and recognize safe behaviors
- Participate in safety meetings and worksite safety inspections (daily, weekly, monthly, and quarterly)
- Participate in incident reports, investigations, corrective actions, and Lessons Learned

Worksite Analysis

The process of identifying and evaluating potential hazards is a critical element in achieving zero incidents and creating low risk and hazard-free work areas.

Worksite analysis methods used to identify and evaluate potential hazards include:

- Safety inspections (daily, weekly, monthly, and quarterly)
- Develop or review safe work procedures, AHA's, and the HASP
- Monitoring for air quality, heat stress, noise, ergonomics and other job hazards

Hazard Prevention and Control

Eliminating hazards from your job, preventing new hazards, and controlling known hazards are fundamental parts of the projects safety program.

Important points include:

- Control hazards by:
  - Installing and maintaining ***Engineering Controls***
  - Following ***Administrative/Work Practice Controls*** (HASP, AHAs, and safe work practices)
  - Specifying and wearing ***Personal Protective Equipment*** where needed
- Perform integrated safety reviews for new or modified work tasks
- Consult with qualified medical and safety professionals as needed

Safety and Health Training

Effective safety training is an important element in incident prevention. Remember, if you are unfamiliar with the work or feel that you don't have the necessary training, speak up and notify your team leader or project manager.

Safety training methods that may be used at the project include:

- New employee orientation, including HASP and task-specific training
- Project meetings, daily briefings, and/or task briefings
- Lessons learned and monthly safety communications

Emergency Contacts

WorkCare - For issues requiring an Occupational Health Physician; assistance is available 24 hours per day, 7 days per week.

InfoTrac - For issues related to incidents involving the transportation of hazardous chemicals; this hotline provides accident assistance 24 hours per day, 7 days per week

U.S. Coast Guard National Response Center - For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Poison Control Center – For known or suspected poisoning.

Limitations:

The Level-Two HASP is not appropriate in some cases:

- Projects involving unexploded ordnance (UXO), radiation sources as the primary hazard, or known chemical/biological weapons site must employ the Level 3 HASP
- Projects of duration longer than 90 days may need a Level 3 HASP (consult your RSO)

Decontamination:

Decontamination Solutions for Chemical and Biological Warfare Agents[a]: PPE and equipment can be decontaminated using 0.5 percent bleach (1 gallon laundry bleach to 9 gallons water) for biological agents (15 minutes of contact time for anthrax spores; 3 minutes for others) followed by water rinse for chemical and biological agents. In the absence of bleach, dry powders such as soap detergents, earth, and flour can be used. The powders should be applied and then wiped off using wet tissue paper. Finally, water and water/soap solutions can be used to physically remove or dilute chemical and biological agents. Do not use bleach solution on bare skin; use soap and water instead. Protect decontamination workers from exposure to bleach.

Decontamination for Radiological and Other Chemicals: Primary decontamination should use Alconox and water unless otherwise specified in chemical specific information resources. The effectiveness of radiation decontamination should be checked using a radiation survey instrument. Decontamination procedures should be repeated until the radiation meter reads less than 100 counts per minute over a 100-square-centimeter area when the probe is held 1 centimeter from the surface and moving slower than 2.5 centimeters per second.

Decontamination Corridor: The decontamination setup can be adjusted to meet the needs of the situation. The decontamination procedures can be altered to meet the needs of the specific situation when compound- and site-specific information is available.

Decontamination Waste: All disposable equipment, clothing, and decontamination solutions will be double-bagged or containerized in an acceptable manner and disposed of with investigation-derived waste.

Decontamination Personnel: Decontamination personnel should dress in the same level of PPE or one level below the entry team PPE level.

All investigation-derived waste should be left on site with the permission of the property owner and the EPA on-scene coordinator. In some instances, another contractor will dispose of decontamination waste and investigation-derived waste. DO NOT place waste in regular trash. DO NOT dispose of waste until proper procedures are established.

Notes:

[a] Source: Jane's Information Group. 2002. *Jane's Chem-Bio Handbook*. Page 39.

Miscellaneous Field Sheets

Dust Exposure Calculation Worksheet

ATSDR – Lead Factsheet

Daily Tailgate Safety Meeting Form

Health and Safety Plan Amendment

Field Audit Checklist

Example Activity Hazard Analysis (AHA) Blank Form

DUST EXPOSURE CALCULATION WORKSHEET					
DustLevel			Safety Factor for this site = 4		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)	Problem from Single Compound [5mg/m3)/ELmix]
Aluminum	5	1.E-9	1.25E+15	2.00E-10	0.000
Antimony	0.5	1.E-9	1.25E+14	2.00E-09	0.000
Arsenic	0.01	91	27.41	9.12E+03	0.182
Barium	0.5	1.E-9	1.25E+14	2.00E-09	0.000
Beryllium	0.002	1.E-9	5.E+11	5.00E-07	0.000
Cadmium	0.005	1.E-9	1.25E+12	2.00E-07	0.000
Chlordane	0.5	1.E-9	1.25E+14	2.00E-09	0.000
Chrome (hex)	0.005	1.E-9	1.25E+12	2.00E-07	0.000
Chromium	0.5	1.E-9	1.25E+14	2.00E-09	0.000
Cobalt	0.02	1.E-9	5.E+12	5.00E-08	0.000
Copper	1	210	1,190.48	2.10E+02	0.004
Cyanides	5	1.E-9	1.25E+15	2.00E-10	0.000
DDT	1	1.E-9	2.5E+14	1.00E-09	0.000
Dieldrin	0.25	1.E-9	6.25E+13	4.00E-09	0.000
Dioxins (hex)	0.001	1.E-9	2.5E+11	1.00E-06	0.000
Dioxins (tetra)	1.00E-08	1.E-9	2.5E+6	1.00E-01	0.000
Endosulfan	0.1	1.E-9	2.5E+13	1.00E-08	0.000
Fluorides	2.5	1.E-9	6.25E+14	4.00E-10	0.000
Iron (dusts)	5	1.E-9	1.25E+15	2.00E-10	0.000
Lead	0.05	2,292	5.45	4.58E+04	0.917
Manganese	0.2	1.E-9	5.E+13	5.00E-09	0.000
Mercury	0.025	1.E-9	6.25E+12	4.00E-08	0.000
Nickel	1	1.E-9	2.5E+14	1.00E-09	0.000
PCBs	0.5	1.E-9	1.25E+14	2.00E-09	0.000
Phthalates	5	1.E-9	1.25E+15	2.00E-10	0.000
PNAs	0.2	1.E-9	5.E+13	5.00E-09	0.000
Selenium	0.2	1.E-9	5.E+13	5.00E-09	0.000
Silver	0.01	1.E-9	2.5E+12	1.00E-07	0.000
Vanadium	0.05	1.E-9	1.25E+13	2.00E-08	0.000
Zinc	5	12,700	98.43	2.54E+03	0.051
		0.00	Sum	5.77E+04	
		Dust Exposure Level at Mixture PEL =	4.332		1.154

0

EQUATIONS USED IN THIS CALCULATION

Dust action level = (For one dust)

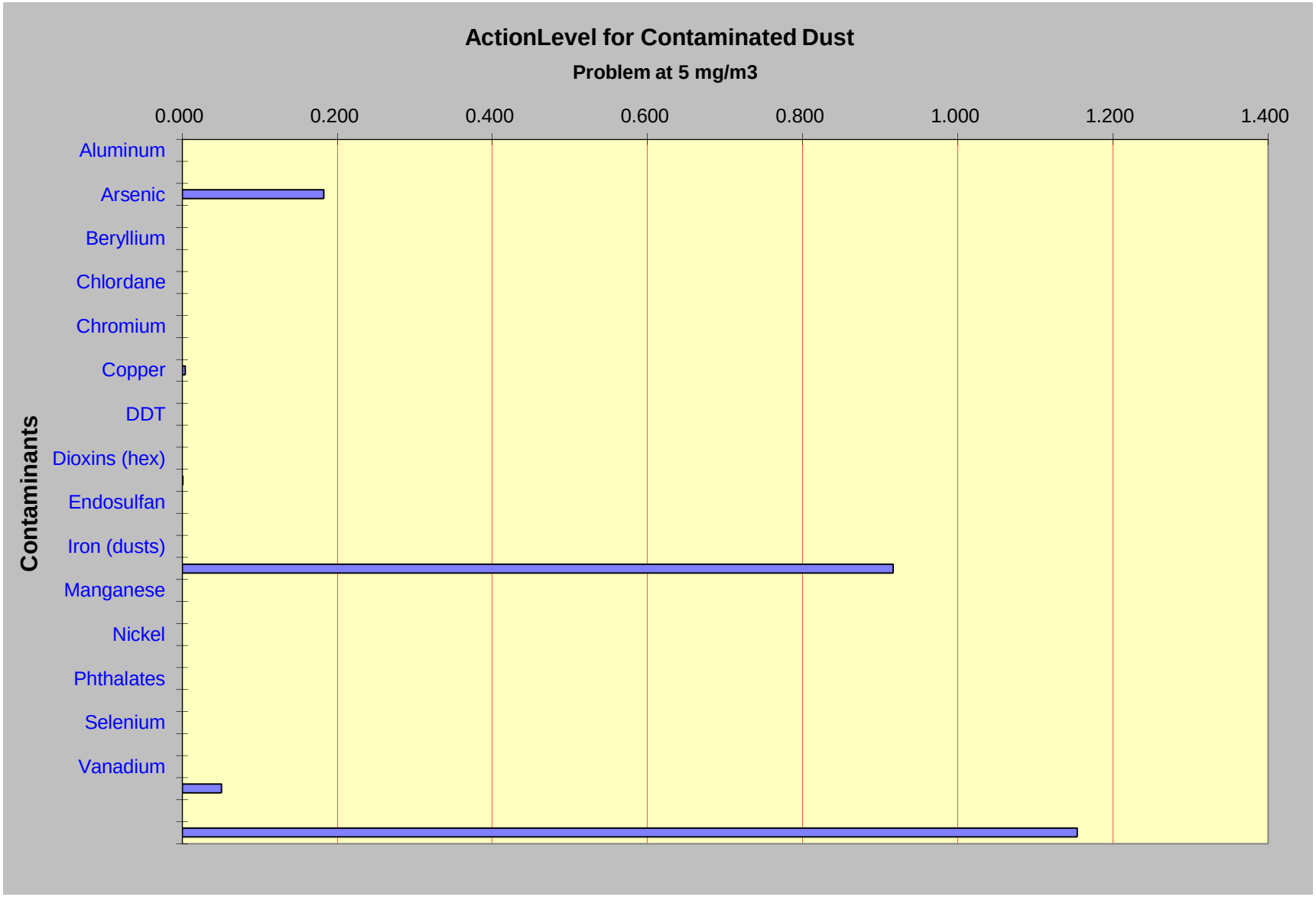
$$\frac{(1E+6)(\text{Exposure Limit mg/m3})}{(\text{Concentration mg/kg})(\text{Safety Factor})}$$

Dust action level = (For mixed dusts)

$$\frac{(1E+6) / (\text{Safety Factor})}{\text{Sum of [(Concentration mg/kg) / (Exposure Limit)]}}$$

Spreadsheet: Dustlevl.xls

Author: Chris Marlowe
908 / 225 - 7000


ActionLevel for Contaminated Dust
Problem at 5 mg/m3
0.000
0.200
0.400
0.600
0.800
1.000
1.200
1.400
Contaminants
Aluminum
Arsenic
Beryllium
Chlordane
Chromium
Copper
DDT
Dioxins (hex)
Endosulfan
Iron (dusts)
Manganese
Nickel
Phthalates
Selenium
Vanadium

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

❑ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.

❑ When lead is released to the air, it may travel long distances before settling to the ground.

❑ Once lead falls onto soil, it usually sticks to soil particles.

❑ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

❑ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.

❑ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.

❑ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.

❑ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❏ Avoid exposure to sources of lead.

❏ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❏ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❏ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❏ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 μg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

TETRA TECH, INC.

DAILY TAILGATE SAFETY MEETING FORM

Date: _____ Time: _____ Project No.: _____

Client:_____ Site Location: _____

Site Activities Planned for Today: _____

Weather Conditions: _____

Safety Topics Discussed	
Protective clothing and equipment:	
Chemical and physical hazards:	
Emergency procedures:	
Equipment hazards:	
Other:	
Attendees	
Printed Name	**Signature**

Meeting Conducted by:

_____ _____

Name Signature

TETRA TECH EM INC.

HEALTH AND SAFETY PLAN AMENDMENT

Site Name: _____

Amendment Date: _____

Purpose or Reason for Amendment: _____

_____

_____

Required Additional Safe Work Practices or Activity Hazard Analyses: _____

_____

Required Changes in PPE: _____

_____

_____

Action Level Changes: _____

_____

_____

_____

_____

AMENDMENT APPROVAL

RSO or Designee	_____ Name	_____ Signature	_____ Date
Site Safety Coordinator	_____ Name	_____ Signature	_____ Date

Date presented during daily site safety meeting: _____

TETRA TECH, INC.

FIELD AUDIT CHECKLIST

Project Name: _____ Project No.: _____

Field Location: _____ Completed by: _____

Project Manager: _____ Site Safety Coordinator: _____

General Items		In Compliance?		
Health and Safety Plan Requirements		Yes	No	NA
1	Approved health and safety plan (HASP) on site or available			
2	Names of on-site personnel recorded in field logbook or daily log			
3	HASP compliance agreement form signed by all on-site personnel			
4	Material Safety Data Sheets on site or available			
5	Designated site safety coordinator physically present on jobsite			
6	Daily tailgate safety meetings conducted and documented on Form HST-2			
7	Documentation available proving compliance with HASP requirements for medical examinations, fit testing, and training (including subcontractors)			
8	HASP onsite matches scope of work being conducted			
9	Emergency evacuation plan in place and hospital located			
10	Exclusion, decontamination, and support zones delineated and enforced			
11	HASP attachments present onsite (VPP sheet, audit checklist, AHA, etc.)			
12	Illness and injury prevention program reports completed (California only)			
Emergency Planning				
13	Emergency telephone numbers posted			
14	Emergency route to hospital posted			
15	Local emergency providers notified of site activities			
16	Adequate safety equipment inventory available			
17	First aid provider and supplies available			
18	Eyewash solution available when corrosive chemicals are present			
Air Monitoring				
19	Monitoring equipment specified in HASP available and in working order			
20	Monitoring equipment calibrated and calibration records available			
21	Personnel know how to operate monitoring equipment and equipment manuals available on site			
22	Environmental and personnel monitoring performed as specified in HASP			

Safety Items		In Compliance?		
Personal Protection		Yes	No	NA
23	Splash suit, if required			
24	Chemical protective clothing, if required			
25	Safety glasses or goggles (always required)			
26	Gloves, if required			
27	Overboots, if required			
28	Hard hat (always required)			
29	High visibility vest, if required			
30	Hearing protection, if required			
31	Full-face respirator, if required			
Instrumentation				
32	Combustible gas meter and calibration notes			
33	Oxygen meter and calibration notes			
34	Organic vapor analyzer and calibration notes			
Supplies				
35	Decontamination equipment and supplies			
35	Fire extinguishers			
37	Spill cleanup supplies			
Corrective Action Taken During Audit:				

Note: NA = Not applicable

_____ _____

Auditor's Signature Site Safety Coordinator's Signature

_____

Date

Tetra Tech, Inc.	ACTIVITY HAZARD ANALYSIS (AHA) Tetra Tech EM Inc. **(Insert Task Name Here)**

Task Description

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Insert a brief narrative description of each task to be completed.

Below, go step by step through the whole process. For each step, identify the potential hazards and describe the "actions" taken to control the hazard (i.e. PPE, lock-out tagout, training, keeping unauthorized parties out of the area, etc.), Example below.

Hazards		Actions
Task Steps	**Potential Hazards**	**Critical Safety Procedures and Controls**
Insert additional rows as needed		
Equipment to be Used	**Inspection Requirements**	**Training Requirements**

Assessed By _____ Name _____ Signature _____ Date

Approved By _____ Name _____ Signature _____ Date

Activity Hazard Analysis

Soil Screening and Sampling with XRF at Lead Sites

Sediment Screening and Sampling with XRF at Lead Sites

Observation Near Drill Rigs and Heavy Equipment

Surface Water Sampling

Groundwater Sampling

Tetra Tech, Inc.

ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech, Inc.

Soil Screening and Sampling With XRF at Lead Sites

Task Description

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Health and Safety Department for Tetra Tech, Inc. The AHA contains potential hazards posed during each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Hazards		Actions
Task Steps	**Potential Hazards**	**Critical Safety Procedures and Controls[1]**
Review sampling area and prepare sampling materials	SLIPS, TRIPS, FALLS	• Don necessary Level D PPE, including hardhat, safety-toe, non-skid boots, safety glasses, and nitrile (or similar) gloves • Visually inspect the area for slippery spots or debris and correct if found • Use leather work gloves to move debris or other obstacles
	BACK STRAIN/SPRAIN	• Follow SWP 5-19, Safe Lifting Procedures when moving debris or other obstacles and unloading sampling equipment
	LACERATION	• Have a first aid kit on-site available for small cuts
	BIOLOGICAL HAZARDS	• Follow SWP 5-17, Biohazards, when inspecting the sampling area specifically for stinging insects, poisonous animals, or irritant vegetation
Soil sample collection	LEAD EXPOSURE	• Don necessary Level D PPE, including hardhat, safety-toe, non-skid boots, safety glasses, and nitrile (or similar) gloves • Wear dust mask or take preventative measures to reduce dust.
	SLIPS, TRIPS, FALLS	• Visually inspect the area for slippery spots or debris and correct if found
	BACK STRAIN/SPRAIN	• Follow SWP 5-19, Safe Lifting Procedures for repeated bending and standing
	LACERATION	• Have a first aid kit on-site available for small cuts
XRF soil screening and sample preparation	LEAD EXPOSURE	• Don necessary Level D PPE, including safety glasses and nitrile (or similar) gloves • Wear dust mask or take preventative measures to reduce dust.
	XRF USE	• Be aware of XRF radioactive source direction while XRF is in use. Wear TLD badge. • Review operators manual and precautions for equipment to be used • Inspect equipment to be used in accordance with manufacturer's recommendations • Never attempt to adjust or perform maintenance beyond operator level
	LACERATION	• Have a first aid kit on-site available for small cuts

Store sample containers in coolers and load onto vehicles	SLIP/TRIP/FALL BACK STRAIN/SPRAIN	• Ensure all debris has been removed from the path of travel • Use proper lifting techniques, including obtaining help with heavy coolers
Equipment to be Used • Level D PPE (steel-toed boots, safety glasses, nitrile gloves) • XRF • First Aid Kit	**Inspection Requirements** Inspect all equipment prior to use	**Training Requirements** • Safe Lifting Procedures • PPE • Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update) • Medical Surveillance • CPR/First Aid (one employee on-site must have current CPR/First Aid training) • XRF Use Training • [CA projects require Ergonomics, Heat Stress and Injury and Illness Prevention Plan training]

Notes:

1. The following Safe Work Practices apply to all operations: SWP 5-01, General safe Work Practices and/or 5-02, General Safe Work Practices HAZWOPER.

Assessed By: _____ **Signature:** _____ **Date:** _____

Approved By: _____ **Signature:** _____ **Date:** _____

ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech, Inc.

Sediment Screening and Sampling With XRF at Lead Sites

Task Description

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Health and Safety Department for Tetra Tech, Inc. The AHA contains potential hazards posed during each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Hazards		Actions
Task Steps	**Potential Hazards**	**Critical Safety Procedures and Controls[1]**
Review sampling area and prepare sampling materials	SLIPS, TRIPS, FALLS	• Don necessary Level D PPE, including non-skid boots, safety glasses, and nitrile (or similar) gloves, • Visually inspect the area for slippery spots or debris and correct if found • Follow SWP 5-06, working over or near water • Use leather work gloves to move debris or other obstacles
	BACK STRAIN/SPRAIN	• Follow SWP 5-19, Safe Lifting Procedures when moving debris or other obstacles and unloading sampling equipment
	LACERATION	• Have a first aid kit on-site available for small cuts
	BIOLOGICAL HAZARDS	• Follow SWP 5-17, Biohazards, when inspecting the sampling area specifically for stinging insects, poisonous animals, or irritant vegetation
Submerge trowel at sampling location	BACK STRAIN/SPRAIN EMPLOYEE EXPOSURE	• Wear safety glasses and nitrile gloves • Wear steel-toed, non-skid boots in accordance with Tetra Tech, Inc. policy • Use proper lifting techniques (lift with legs not back)
Extract sediment by removing submerged trowel	BACK STRAIN/SPRAIN EMPLOYEE EXPOSURE	• Wear safety glasses and nitrile gloves • Wear steel-toed, non-skid boots in accordance with Tetra Tech, Inc. policy • Use proper lifting techniques (lift with legs not back)
Fill sample bottles or plastic baggies with sample material, load coolers and IDW (if appropriate) into vehicle	LACERATION	• Handle all glass containers carefully • Have a first aid kit on-site available for small cuts • Dispose of all broken shards immediately
XRF soil screening and sample preparation	LEAD EXPOSURE	• Don necessary Level D PPE, including safety glasses and nitrile (or similar) gloves • Wear dust mask or take preventative measures to reduce dust.
	XRF USE	• Be aware of XRF radioactive source direction while XRF is in use. Wear TLD badge. • Review operators manual and precautions for equipment to be used • Inspect equipment to be used in accordance with manufacturer's recommendations • Never attempt to adjust or perform maintenance beyond operator level
	LACERATION	• Have a first aid kit on-site available for small cuts
Store sample containers in coolers and load onto vehicles	SLIP/TRIP/FALL	• Ensure all debris has been removed from the path of travel

	BACK STRAIN/SPRAIN	• Use proper lifting techniques, including obtaining help with heavy coolers
Equipment to be Used • Level D PPE (steel-toed boots, safety glasses, nitrile gloves) • XRF • First Aid Kit • Disposable scoop • Disposable trowel	**Inspection Requirements** Inspect all equipment prior to use	**Training Requirements** • Safe Lifting Procedures • PPE • Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update) • Medical Surveillance • CPR/First Aid (one employee on-site must have current CPR/First Aid training) • XRF Use Training • [CA projects require Ergonomics, Heat Stress and Injury and Illness Prevention Plan training]

Notes:

1. The following Safe Work Practices apply to all operations: SWP 5-01, General safe Work Practices and/or 5-02, General Safe Work Practices HAZWOPER.

Assessed By: _____ **Signature:** _____ **Date:** _____

Approved By: _____ **Signature:** _____ **Date:** _____

Tetra Tech, Inc.	ACTIVITY HAZARD ANALYSIS (AHA) Tetra Tech, Inc.

Observation Near Drill Rigs and Heavy Equipment

Task Description

This Activity Hazard Analysis (AHA) applies to collection of grab groundwater samples. It has been developed and approved by the Health and Safety Department. The AHA identifies potential hazards posed during each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.

Hazards		Actions
Task Steps Observe Near Drill Rigs and Heavy Equipment	**Potential Hazards** SLIP/TRIP/FALL BACK STRAIN/SPRAIN NOISE HAZARD EMPLOYEE EXPOSURE STRUCK BY INCIDENTS	**Critical Safety Procedures and Controls** • Visually inspect the area for slippery spots or debris and correct if found • Wear steel-toed, non-skid boots in accordance with Tetra Tech, Inc. policy • Use proper lifting techniques (lift with legs not back) • Wear hearing protection at all times near operating equipment • No loose-fitting clothing; wear hardhat, safety glasses, high-visibility (Class II) vest/shirt and nitrile gloves; upgrade to Level C IAW HASP requirements • Ensure communication with the operator prior to approaching equipment; ensure the operator is aware of your position at all times; stay out of the swing radius or operational area
Equipment to be Used • Specified PPE (including hardhat) • Air monitoring equipment in agreement with site HASP • First aid kit & eye wash	**Inspection Requirements** • PPE prior to use • Inspect and calibrate any monitoring equipment • Subcontractor MUST inspect drill prior to operation	**Training Requirements** • As specified in site HASP

Tetra Tech, Inc.	ACTIVITY HAZARD ANALYSIS (AHA) Tetra Tech, Inc. # Surface Water Sampling

Task Description

This Activity Hazard Analysis (AHA) applies to collection of surface water samples. It has been developed and approved by the Director of Health and Safety for Tetra Tech, Inc. The AHA contains potential hazards posed during each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.

Hazards		Actions
Task Steps	**Potential Hazards**	**Critical Safety Procedures and Controls**
Set up equipment at sampling location	SLIP/TRIP/FALL WORKING OVER OR NEAR WATER (>3' DEEP OR SWIFTLY MOVING) BACK STRAIN/SPRAIN	• Visually inspect the area for slippery spots or debris and correct if found • Wear steel-toed, non-skid boots in accordance with Tetra Tech, Inc. policy Wear Type 2 or greater PFD and follow SWP 5-06, Working Over or Near Water • Use proper lifting techniques (lift with legs not back)
Extract Surface Water by submerging bottleware	EMPLOYEE EXPOSURE	• Wear safety glasses and nitrile gloves
Fill sample bottles with sample material, load coolers and IDW (if appropriate) into vehicle	LACERATION	• Handle all glass containers carefully • Have a first aid kit on-site available for small cuts • Dispose of all broken shards immediately
Store sample containers in coolers and load onto vehicles	SLIP/TRIP/FALL BACK STRAIN/SPRAIN	• Ensure all debris has been removed from the path of travel • Use proper lifting techniques, including obtaining help with heavy coolers
Equipment to be Used • Level D PPE (steel-toed boots, safety glasses, nitrile gloves, and Type 2 or better personal floatation device) • Reflective safety vest if in areas of vehicle traffic • First Aid Kit	**Inspection Requirements** • None	**Training Requirements** • Safe Lifting Procedures • PPE • Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update) • CPR/First Aid (one employee on-site must have current CPR/First Aid training)

ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech, Inc.

Groundwater Sampling

Task Description

This Activity Hazard Analysis (AHA) applies to collection of grab groundwater samples. It has been developed and approved by the Director of Health and Safety for Tetra Tech, Inc. The AHA contains potential hazards posed during each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.

Hazards		Actions
Task Steps	**Potential Hazards**	**Critical Safety Procedures and Controls**
Set up equipment at piezometer or well	SLIP/TRIP/FALL BACK STRAIN/SPRAIN	• Visually inspect the area for slippery spots or debris and correct if found • Wear steel-toed, non-skid boots in accordance with Tetra Tech, Inc. policy • Use proper lifting techniques (lift with legs not back)
Measure depth to water	EMPLOYEE EXPOSURE	• Use photoionization detector (PID) or flame ionization detector (FID) as indicated in the site-specific APP/HASP to monitor well head and ambient air • Wear safety glasses and nitrile gloves to protect against splash
Measure and insert tube into well	LACERATION	• Only use retractable safety blade to cut tubing • Cut in a direction away from the face/body
Begin extracting water from well	EMPLOYEE EXPOSURE	• Use PID or FID as indicated in the site-specific APP/HASP to monitor well head and ambient air • Wear safety glasses and nitrile gloves
Fill sample bottles with sample material, load coolers and IDW (if appropriate) into vehicle	LACERATION	• Handle all glass containers carefully • Have a first aid kit on-site available for small cuts • Dispose of all broken shards immediately
Store sample containers in coolers and load onto vehicles	SLIP/TRIP/FALL BACK STRAIN/SPRAIN	• Ensure all debris has been removed from the path of travel • Use proper lifting techniques, including obtaining help with heavy coolers
Equipment to be Used • Level D PPE (steel-toed boots, safety glasses, nitrile gloves) • Hardhat (when working around drill rig) • Reflective safety vest if in areas of vehicle traffic • Retractable safety blade • First Aid Kit • PID or FID	**Inspection Requirements** • None	**Training Requirements** • Safe Lifting Procedures • PPE • Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update) • CPR/First Aid (one employee on-site must have current CPR/First Aid training)

Safe Work Practices

DCN 4-10 Lead Protection Program

SWP DCN 5-02 General Safe Work Practices HAZWOPER

SWP DCN 5-04 Safe Drilling Practices

SWP DCN 5-06 Working Over or Near Water

SWP DCN 5-07 Use of Heavy Equipment

SWP DCN 5-16 Cold Stress

SWP DCN 5-17 Biohazards

SWP DCN 5-19 Safe Lifting Procedures

SWP DCN 5-35 Underground Utilities, including 5-35F, Ground Disturbance Permit

SWP DCN 5-36 Drill Rigs

Tetra Tech, Inc. (Tetra Tech) has established the lead protection program based on requirements outlined in 29 CFR Part 1926.62, Lead. This program applies to all employees who may be occupationally exposed to lead during construction activities. Situations in which the lead standard may apply during Tetra Tech work tasks include the following:

- Removal and encapsulation of materials containing lead
- Releases of lead during an emergency clean up
- Transportation, disposal, storage, or on-site containment of lead or materials containing lead where construction activities are performed
- Maintenance operations associated with the activities above

Tetra Tech will implement engineering and work practice controls, including administrative controls, to reduce or minimize employee exposure to lead whenever feasible. A written compliance plan that describes how Tetra Tech will comply with the lead standard will be included with the project's health and safety plan (HASP) whenever applicable. The compliance plan will detail activities, controls, air monitoring results, and other information relevant to the work that involves exposure to lead.

The sections below describe Tetra Tech's (1) lead protection policy, (2) field procedures to prevent or minimize exposure to lead, (3) medical surveillance procedures, (4) employee information and training, and (5) recordkeeping requirements.

1.0 LEAD PROTECTION POLICY

Tetra Tech, Inc. will ensure that no employee is exposed to lead at concentrations greater than 50 micrograms per cubic meter ($\mu g/m^3$) of air averaged over an 8-hour period. This level is the Occupational Safety and Health Administration's permissible exposure limit (PEL) for lead. Short exposures to lead above the PEL are permitted as long as the average exposure does not

exceed the PEL in an 8-hour workday. Daily exposure to lead can extend beyond a typical 8-hour workday as the result of overtime or other alternations in an employee's work schedule. If an employee is exposed to lead for more than 8 hours, the allowable time weighted average (TWA) concentration for that day will be reduced as calculated using the following formula:

$$\frac{400}{\text{Hours worked in the day}} = \text{Allowable employee exposure (in } \mu\text{g/ m}^3\text{)}$$

For example, for an employee exposed to lead during a 10-hour shift, the allowable exposure is 40 µg/m^3.

$$\frac{400}{10 \text{ hours}} = 40\ \mu\text{g/ m}^3$$

Tetra Tech will not calculate an employee's lead exposure by averaging the exposure level with and without respiratory protection as allowed under Paragraph (c)(3) of the lead standard.

The action level for airborne lead is 30 µg/m^3 as an 8-hour TWA. This value does not consider the use of respirators.

2.0 FIELD PROCEDURES

Field procedures that Tetra Tech will use to prevent or minimize employee exposure to lead include exposure assessment and observation, use of personal protective equipment (PPE), including respiratory protection and protective work clothing, housekeeping procedures, hygiene, and sign posting.

2.1 Exposure Assessment and Observation

If lead is present at a work site in any form, the Tetra Tech site safety coordinator (SSC) will make an initial determination of whether the action level may be exceeded. This initial determination includes instrumental monitoring of the air for lead and must indicate exposure of

a representative number of employees reasonably believed to be exposed to the highest levels. The sampling results may be used to make decisions about appropriate controls and PPE use. If any employee complains of symptoms that may be attributable to lead exposure or if any other information or observations indicate employee exposure to lead, this information must also be considered as part of the initial determination. If an initial determination shows that a reasonable possibility exists that any employee may be exposed to lead above the action level (without regard to the use of respirators), an air monitoring program to determine the exposure level of every employee will be conducted.

When air monitoring for lead is performed, Tetra Tech will allow the employee or a designee to act as an observer of the monitoring. Observers are entitled to an explanation of the measurement procedure and a record of the results obtained. Because results will not normally be available at the time of the monitoring, observers are entitled to an explanation of the measurement procedure and to record the results obtained. Tetra Tech will provide the observer with any PPE required by employees working in the area being monitored. Tetra Tech also requires any observer to wear all such equipment and to comply with all applicable health and safety procedures.

2.2 Respiratory Protection

When engineering and work practice controls are not feasible or sufficient to reduce exposures to or below the lead PEL, Tetra Tech will require employees to use respiratory protective equipment. Tetra Tech has established a Respiratory Protection Program to provide and ensure safe and appropriate use of respirators when exposure to airborne contaminates is not controlled below the PEL by other means. The cost of respirators is paid for by Tetra Tech. Tetra Tech may also be required to provide on-site employees with respirators even if air exposure levels do not exceed the PEL. An employee may request a respirator when, for example, medical advice

suggests that lead absorption should be decreased. Employees who intend to have children in the near future can also request a respirator to minimize adverse reproductive effects. During the preparation of the HASP, Tetra Tech will ensure that respirators are chosen, fitted, worn, cleaned, and maintained properly during use, and replaced when they stop providing adequate protection.

Tetra Tech will select respirators that have been approved by the National Institute for Occupational Safety and Health (NIOSH). The respirator selected will provide a proper amount of protection based on the anticipated concentration of airborne lead at each site. Selection will also be based on information provided in Table 1 of 29 CFR Part 1926.62. A respirator that provides a greater level of protection than required may be chosen by the employee.

Air purifying respirators will use P-100 or equivalent filters. Employees should change the filters whenever breathing becomes difficult. Respirator wearers are permitted to periodically leave the work area to wash their faces and respirator face pieces whenever necessary to prevent skin irritation. Medical surveillance must be conducted prior to respirator usage. Results of the medical surveillance examination may indicate that an alternative means of respiratory protection is needed.

The Tetra Tech Respiratory Protection Program ensures that the respirator face piece fits properly. Tetra Tech employees receive proper training in the use of respirators during an initial 40-hour health and safety training course and through subsequent annual, in-house, 8-hour refresher training courses. Tetra Tech instructs employees in how to wear a respirator, why it is needed, and its limitations.

2.3 Protective Work Clothing and Equipment

If an employee is exposed to lead above the PEL or if exposure can cause skin and eye irritation, Tetra Tech will provide appropriate protective work clothing and equipment for the hazard. Appropriate protective work clothing and equipment may include cotton coveralls or similar full-body work clothing, gloves, hats, shoes or disposable shoe covers, and face shields or vented goggles. All equipment is provided to staff at no cost.

Tetra Tech is responsible for repairing and replacing clothing and equipment when necessary and for cleaning, laundering, and disposing of protective clothing and equipment. Contaminated work clothing or equipment must be removed in changing rooms and must not be worn home. Contaminated clothing to be cleaned, laundered, and disposed of must be placed in a closed, impermeable container in a changing room. At no time may contaminants be removed from protective clothing or equipment by means that may disperse the lead contamination into the air.

2.4 Housekeeping

The Tetra Tech SSC will ensure that all surfaces are maintained so that they are as free as practicable of accumulations of lead. Floors and other surfaces where lead accumulates will be cleaned by vacuuming or other methods that minimize the likelihood of lead becoming airborne. Vacuums will be equipped with high efficiency particulate air (HEPA) filters.

2.5 Personal Hygiene

Changing rooms, showers, and filtered or fresh air lunch areas will be made available to workers exposed to airborne lead above its PEL. Changing rooms, showers, and lunch areas that are free of lead contamination must be provided to workers exposed to lead in excess of the PEL. After showering, no work clothing (including shoes and underwear) or work equipment may be worn home. Clothing used during the shift should be carefully separated from street clothes so that

cross contamination does not occur. Employees may not enter the lunch area while wearing protective clothing or equipment unless dust on the clothing has been removed by HEPA vacuuming, downdraft decontamination booths, or other methods. Finally, workers exposed to lead must wash their hands and face prior to eating, drinking, smoking, or applying cosmetics. In areas where the PEL is exceeded, the Tetra Tech SSC will ensure that food and beverages are not present or consumed, tobacco products are not present or used, and cosmetics are not applied. If Tetra Tech is unable to provide showers, the SSC will ensure that employees wash their hands and face at the end of each work shift.

2.6 Sign Posting

The Tetra Tech SSC will post appropriate warning signs in each work area where employee exposure to lead is above the PEL. The signs will read as follows:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR
EATING

The Tetra Tech SSC will ensure that the signs remain legible.

3.0 MEDICAL SURVEILLANCE

Medical surveillance can determine if personnel have been effectively protected. Effective implementation of the exposure controls defined in this program will protect most workers from the adverse effects of exposure but may not satisfactorily protect individual workers who (1) have high body burdens acquired over the past years, (2) have additional uncontrolled sources of

of nonoccupational exposure, (3) exhibit unusual lead absorption rates, or (4) have specific, nonwork-related medical conditions that could be aggravated by exposure (for example, renal disease and anemia). In addition, control systems may fail or hygiene and respirator programs may be inadequate. Periodic medical surveillance of individual workers will help detect potential failures of protective measures.

All required medical surveillance must be performed by or under the supervision of a licensed physician. Medical surveillance is provided without cost to employees at a reasonable time and place. The medical surveillance program provides biological monitoring of lead and provides special medical examinations based on a case-by-case need.

Tetra Tech shall make an initial medical surveillance examination available to any employee exposed to lead on any day at or above the action level of 30 µg/m^3 (8-hour TWA) for more than 30 days in any consecutive 12-month period. The initial medical surveillance will consist of a full examination and blood sampling for lead and zinc protoporphyrin (ZPP) levels to establish a baseline level to which subsequent data may be compared. The blood lead and ZPP tests are known as biological monitoring. The full examination is discussed in the Tetra Tech, Inc. Health and Safety Manual, Document 3-2, Medical Surveillance.
Tetra Tech shall notify each employee in writing of the results of his or her blood lead level within 5 working days of the receipt of the biological monitoring results.

The biological monitoring will be conducted at least every 2 months for the first 6 months and every 6 months thereafter. If a worker's blood lead level is at or above 40 µg per 100 milliliters (mL), the monitoring frequency must be increased from every 6 months to at least every 2 months and must not be reduced until two consecutive blood lead level tests indicate a lead level

below 40 µg per 100 mL. An employee whose blood lead level exceeds 40 µg per 100 mL will be temporarily removed from the work area with medical removal protection benefits.

Medical examinations will also be conducted annually on employees exposed to lead above the action level and on an employee whose blood lead level exceeded 40 µg per 100 mL at any time during the preceding year. A medical examination or consultation will also be conducted as soon as possible after an employee notifies Tetra Tech that he or she is experiencing signs or symptoms commonly associated with acute lead poisoning or that he or she has difficulty breathing while wearing a respirator or during a respirator fit test. Employees will also be offered a medical examination or medical advice concerning the effects of current and past exposure and their ability to bear healthy offspring.

If a need for multiple physician reviews arises, Tetra Tech will consult 29 CFR Part 1926.62(j)(iii) of the lead standard for proper procedures.

Employees are not permitted to engage in prophylactic chelation unless under the direct supervision of a licensed physician in a clinical setting and the knowledge of Tetra Tech.

Tetra Tech will remove an employee from work who has an exposure to lead at or above the action level and who exhibits a blood lead level at or above 50 µg per 100 mL. This removal will be
conducted in accordance with the requirements of 29 CFR Part 1926 (k), Medical Removal Protection, of the lead standard.

4.0 EMPLOYEE INFORMATION AND TRAINING

Tetra Tech will communicate the hazards of lead in accordance with the Hazard Communication standards for both general and construction industries, 29 CFR 1910. 1200 and 29 CFR 1926.59, respectively. Tetra Tech will train affected employees on the following topics:

- Contents of the lead standard
- Work operations involved
- Purpose of respiratory protection
- Medical surveillance requirements
- Engineering and work practice controls
- Contents of the compliance plan
- Restriction of chelation agents
- Rights to medical records

5.0 RECORDKEEPING

As required by the lead standard, Tetra Tech will establish and maintain an accurate record of the following:

- Exposure assessments
- Medical surveillance records for each individual
- Medical removal records for each individual

Records will be made available for review or copying to affected employees, former employees and their designated representatives, and the Assistant Secretary of OSHA and Director of NIOSH when requested in writing. Records will be properly transferred if Tetra Tech ceases to do business.

To prevent injuries and adverse health effects, the following general safe work practices (SWP) are to be followed when conducting work involving known and unknown site hazards on hazardous waste sites. These SWPs establish a pattern of general precautions and measures for reducing risks associated with hazardous site operations. This list is not inclusive and may be amended as necessary.

- Do not eat, drink, chew gum or tobacco, take medication, or smoke in contaminated or potentially contaminated areas or where the possibility for contact with site contamination exists.
- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. If a source of potable water is not available at the work site that can be used for hands-washing, the use of waterless hand cleaning products will be used, followed by actual hand-washing as soon as practicable upon exiting the site. A thorough shower and wash must be conducted as soon as possible if excessive skin contamination occurs.
- Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, or other such areas. Avoid, whenever possible, kneeling on the ground or leaning or sitting on drums, equipment, or the ground. Do not place monitoring equipment on potentially contaminated surfaces.
- Remove beards or facial hair that interferes with a satisfactory qualitative respirator fit test or routine pre-entry positive and negative pressure checks.
- Be familiar with and knowledgeable of and adhere to all instructions in the site-specific health and safety plan (HASP). At a minimum, a safety meeting will be held at the start of each project to discuss the HASP. Additional meetings will be held, as necessary, to address new or continuing safety and health concerns.
- Be aware of the location of the nearest telephone and all emergency telephone numbers.
- Attend a briefing on the anticipated hazards, equipment requirements, SWPs, emergency procedures, and communication methods before going on site.
- Plan and delineate entrance, exit, and emergency escape routes.
- Rehearse unfamiliar operations prior to implementation.

- Use the "buddy system" whenever respiratory protection equipment is in use. Buddies should establish hand signals or other means of emergency communication in case radios break down or are unavailable.
- Buddies should maintain visual contact with each other and with other on-site team members by remaining in close proximity in order to assist each other in case of emergency.
- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Nonessential vehicles and equipment should remain within the support zone.
- Establish appropriate support, contamination reduction, and exclusion zones.
- Establish appropriate decontamination procedures for leaving the site.
- Immediately report all injuries, illnesses, and unsafe conditions, practices, and equipment to the site safety coordinator (SSC).
- Maintain a portion of the site field logbook as a project safety log. The project safety log will be used to record the names, entry and exit dates, and times on site of all Tetra Tech personnel, subcontractor personnel, and project site visitors; air quality and personal exposure monitoring data; and other information related to safety matters. Form SSC-1, Daily Site Log, may be used to record names of on-site personnel.
- A portable eyewash station should be located in the support zone if chemical splashes to eyes are possible.
- Do not bring matches and lighters in the exclusion zone or contamination reduction zone. Flames and open fires are not permitted on site.
- Observe coworkers for signs of toxic exposure and heat or cold stress.
- Inform coworkers of nonvisual effects of illness if you experience them, such as headaches, dizziness, nausea, or blurred vision.

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This document establishes safe work practices (SWP) to follow during drilling operations. These SWPs are based on suggested safety procedures provided in the National Drilling Association's "Drilling Safety Guide." Procedures to follow before, during, and after drilling are listed below.

Before beginning any drill operation, each employee must conform to the following requirements:

- Wear a hard hat, safety glasses or goggles, steel-toed work boots, a shirt and full-length pants when working with or near the drill rig. Shirts must be tucked in at the belt.
- Do not wear loose or frayed clothing, loose long hair, or loose jewelry while working with rotating equipment.
- Do not eat, drink, or smoke near the drill rig.
- Identify all underground utility and buried structure locations before drilling.
- Ensure that drill masts or other projecting devices will be farther than 25 feet in any direction from overhead power lines.
- Ensure that the drill rig and any other machinery used is inspected daily by competent, qualified individuals. The site safety coordinator (SSC) will ensure compliance with this precaution.
- Drill rig operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors, to their supervisors or the SSC.
- Establish hand-signal communications for use when verbal communication is difficult. One person per work team will be designated to give hand signals to equipment operators.

While the drill rig is operating, employees must:

- Wear appropriate respiratory and personal protective equipment (PPE) when conditions warrant their use.
- Avoid direct contact with known or suspected contaminated surfaces.
- Move tools, materials, cords, hoses, and debris to prevent tripping hazards and contact with moving drill rig parts.

- Adequately secure tools, materials, and equipment subject to displacement or falling.
- Store flammable materials away from ignition sources and in approved containers.
- Maintain adequate clearance of the drill rig and mast from overhead transmission lines. The minimum clearance is 25 feet unless special permission is granted by the utility company. Call the local utility company for proper clearance.
- Only qualified and licensed personnel should operate drill rigs.
- Workers should not assume that the drill rig operator is keeping track of the rig's exact location. Workers should never walk directly behind or beside heavy equipment without the operator's knowledge.
- Workers should maintain visual contact with drill rig operators at all times.
- When an operator must maneuver equipment in tight quarters, the presence of a second person is required to ensure adequate clearance. If much backing is required, two ground guides will be used: one in the direction the equipment is moving, and the other in the operator's normal field of vision to relay signals.
- Auger sections and other equipment are extremely heavy. All lifting precautions should be taken before moving heavy equipment. Appropriate equipment, such as chains, hoists, straps, and other equipment, should be used to safely transport heavy equipment too heavy to safely lift.
- Proper personal lifting techniques will be used. Workers should lift using their legs, not their backs.
- Workers will not use equipment they are not familiar with. This precaution applies to heavy as well as light equipment.
- All personnel not essential to work activities will be kept out of the work area.
- Workers will be aware of their footing at all times.
- Workers will remain alert at all times.

After drilling operations are completed, employees should do the following:

- Shut down machinery before repairing or lubricating parts (except parts that must be in motion for lubrication).
- Shut down mechanical equipment prior to and during fueling operations. When refueling or transferring fuel, containers and equipment must be bonded to prevent the buildup of static electricity.
- Keep drill rigs in the exclusion zone until work has been completed. Such equipment should then be decontaminated within the designated decontamination area.
- Engage parking brakes when equipment is not in use.
- Implement an ongoing maintenance program for all tools and equipment. All tools and moving equipment should be inspected regularly to ensure that parts are secured, are intact, and have no cracks or areas of weakness. The equipment must turn smoothly without wobbling and must operate in accordance with manufacturer specifications. Defective items should be promptly repaired or replaced. Maintenance and repair logs will be kept.
- Store tools in clean, secure areas to prevent damage, loss, or theft.

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The following sections discuss general procedures for working over or near water, underwater work, and cold water procedures.

1.0 SCOPE

This safe work practice (SWP) provides guidelines for all Tetra Tech employees and subcontractors who work over or near bodies of water three (3) or more feet deep or swiftly moving water. This SWP was developed in accordance with the Occupational Safety and Health Administration (OSHA) standard specified in Title 29 of the *Code of Federal Regulations* (CFR), Part 1926.106, "Working Over or Near Water."

2.0 RESPONSIBILITIES

The project manager (PM) is responsible for identifying all health and safety requirements of each project, including all tasks that may involve worker exposure to hazards or working in or near bodies of water. The PM will appoint a site safety coordinator (SSC) to ensure that this SWP is followed in the field. Workers will follow this SWP whenever working near or in any body of water that is over three (3) feet deep or swiftly moving.

3.0 GENERAL PROCEDURES

When working over or near water, the following precautions will be taken:

- All staff and team members must wear a personal flotation device (PFD) when working within 15 feet of a water body. Personnel will be provided with U.S. Coast Guard (USCG)-approved life jackets or work vests. The PFD should be Class III, which will support the head of an unconscious person above water.
- Life jackets and work vests will be inspected before and after each use.
- Ring buoys with at least 90 feet of line shall be provided and readily available for employee rescue operations.
- The distance between ring buoys shall not exceed 200 feet.

- A USCG-approved life-saving skiff will be available.
- Under no circumstances will team members enter water bodies without protective clothing such as rubber boots or waders.
- At least one person will remain on shore as a look-out.

If a team member falls into the water, a ring buoy, branch, paddle, pole, or other floating object should be extended to the person in the water. Resist the impulse to dive in; employees should not attempt a deep water rescue unless they have been trained in water lifesaving skills. When the person in the water grabs the extended item, the worker should be pulled toward the shore or boat. If the person is unconscious, the PFD, clothing, or hair should be hooked to pull the person toward the shore or boat. Once the person has been safely retrieved, necessary emergency medical procedures should be performed by qualified personnel. If none are necessary, the retrieved team member should change into dry clothing as soon as possible after any necessary personal decontamination.

4.0 UNDERWATER WORK

Underwater work should be performed in accordance with the procedures and guidelines of the Diving Safety Program (Document Control No. 2-15).

5.0 COLD WATER PROCEDURES

When the water temperature is below 45 °F, hypothermia is a serious risk. A person can loose feeling in the extremities within 5 minutes. Additional protective equipment such as cold water immersion suits may be required. All field staff members should be familiar with cold water survival techniques or should receive training from an American Red Cross-certified swimming instructor in cold water survival techniques when site conditions warrant such knowledge. Cold water safe work practices must be addressed in site specific safety documents.

After a person has been rescued from cold water, he or she should change into dry clothes as soon as possible. If the person who has fallen into the water displays hypothermia symptoms, he or she should be treated immediately and taken to a medical facility. Under no circumstances should the hypothermia victim be given hot liquids because this could

accelerate shock. Drinks no warmer than normal body temperature are acceptable. If symptoms are severe and evacuation to a medical facility cannot be quickly conducted, any wet clothing should be removed, the victim should be placed in blankets or sleeping bags in a sheltered location, and the rescuer should climb into the blankets or sleeping bag with victim to provide additional warmth. The victim should also be treated continuously for shock, elevating feet and monitoring the victim's pulse and breathing rate.

If a team member falls into cold water, he or she should not remove any clothing while in the water because clothing provides additional insulation. Although clothing creates an added drag while swimming, the insulation outweighs the disadvantage of the additional drag. Each team member should carry a wool hat to place on his or her head in case he or she falls into the water. A wool hat, even when wet, provides good insulation for the head, where a large amount of body heat is lost.

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1.0 PURPOSE

The purpose of this procedure is to identify minimum requirements, and to provide guidance to Tetra Tech Inc. (Tetra Tech) project personnel concerning the management of construction tools and equipment on construction projects.

2.0 SCOPE

This procedure applies to all Tetra Tech projects that include a construction, O&M, and/or UXO component, including remediation construction.

3.0 MINIMUM REQUIREMENTS

3.1 Definitions

3.1.1 Construction Equipment

For the purposes of this procedure, construction equipment shall mean heavy equipment, such as excavators, scrapers, off-road trucks, dozers, road graders, compactors, dredges, and cranes; light equipment, such as skid-steers, forklifts, generators, and light plants; and operating systems such as screens, crushers, conveyors, pugmills, mobile treatment plants, and pumps. Any discussion of construction equipment shall be understood not to include cars, pickup trucks, flatbed trucks, etc. registered for use on public roadways, which shall be called vehicles hereinafter. Also for the purposes of this procedure, construction equipment shall be synonymous with Contractor's Equipment, a term also commonly used in the construction industry to designate the types of equipment described above.

3.1.2 Terms

The terms "should, may, and might" as used in statements in this procedure are intended to denote a discretionary consideration; the terms "shall & must" are intended to impose a mandatory requirement. The terms "is, are, & will" as used in statements in this procedure are intended to denote discretionary or mandatory requirements that are addressed in other department/disciplines' procedures. However, nothing contained herein should be interpreted as to prohibit development and approval of project-specific procedures or plans that take exception to mandatory direction presented in this procedure provided that the appropriate level of approval, (Executive Vice President of Construction, Business Line Executive Vice President, or the Vice President ESQ Services as appropriate) is obtained for deviations from such requirements.

3.1.3 Tools of the Trade

Specific hand tools and or equipment (e.g., manlifts, trucks, trenchers, and pumps) normally provided by or to workers for the performance of their particular work activity.

3.2 Roles & Responsibilities

3.2.1 Equipment Supervisor

Depending on the project's equipment needs, an individual may be designated as the Equipment Supervisor. Responsibilities of the Equipment Supervisor include:

- Determination of the equipment needs for the project;
- Providing input to the Work Plan concerning equipment;
- Identification of Contract and legal/regulatory requirements for mobilization of equipment on client facilities;
- Submit required certifications, inspection reports, and test reports for equipment;
- Arranging for the mobilization/demobilization of equipment in support of the project's schedule, providing required notices, such as mobilization details and dates, and obtaining Contractual or legally required approvals for mobilization;
- Receipt inspection of equipment arriving at the site, including coordination of any client or third party inspection;
- Coordination with equipment yard personnel or vendors regarding equipment maintenance;
- Ensuring implementation of safe work practices for equipment utilization; and
- Assuring that the return of demobilized equipment is performed in accordance with the terms of the rental/lease/PO agreement and documented correctly, or, for Tetra Tech owned equipment, that the equipment transfer form is completed and coordinated with the Equipment Manager; and
- All other responsibilities as assigned by the Project Manager or Site Supervisor

3.3 Safe Operation Requirements for Tools

3.3.1 Manual T-Post Drivers

There shall be no use of manual fence post drivers, such as those typically used to drive T-posts, without prior approval from the Site Safety Coordinator or the Vice President of Construction. Any approval of the use of such a tool shall require the implementation of an Activity Hazard Analysis (AHA) to identify and control the hazards presented by the tool. The AHA shall address appropriate PPE and position for the task in order to avoid injury to the worker.

3.3.2 Tools

The Site Supervisor shall determine the nature and quantity of tools required for the construction effort and shall ensure that adequate tools are provided in support of the schedule.

Tools may be assigned to workers or crews for the duration of their activities and shall be stored in gang boxes or other secured storage areas when not in use.

The Site Supervisor may designate certain tools to be issued from a tool control area on a daily basis. These tools should be signed out at the beginning of the work, returned to the tool control area at the end of the work, and signed back in.

3.3.3 Worker Provided Personal Tools

Workers may be required to provide personal tools of the trade for their particular work. Master mechanics, for example, may be required to provide tools required for repairs and maintenance of construction equipment and vehicles. Requirements for workers to provide their own tools shall be established based on the project requirements and shall be discussed at the Pre-Job Conference to be held in accordance with the requirements of the Labor Relations Guidelines LR-8, Pre-Job Conferences.

Any worker required or offering to provide personal tools shall be required to present a list of personal tools being provided upon reporting to the project site. The Site Supervisor shall inventory the tools against this list for verification that all listed tools have been provided. The list shall then be maintained for use in performing an inventory of the tools when the worker is to leave the site at the end of the worker's assignment and shall be the basis for any claims for loss or damage.

The Site Supervisor shall ensure that any personal tools brought onto the project site receive a safety inspection. The safety inspection shall include as a minimum, the items addressed in Section 3.3.4 of this procedure.

The Site Supervisor should ensure that secure, lockable facilities are provided for the storage of worker provided personal tools.

The worker shall be responsible for notification of lost or damaged tools immediately on discovery of the loss. The limits of the project's liability (if any) for loss or damage to personal tools provided by the workers should be established at the Pre-Job Conference.

Use of personal tools, other than addressed above, either by manual or by Tetra Tech nonmanual personnel, should not be allowed except as specifically authorized by the Project Manager or Site Supervisor. Project personnel should be notified that Tetra Tech will not be liable for any theft, loss, or damage of unauthorized personal tools on the project site.

3.3.4 Tool Safety Inspection

OSHA 29 CFR Part 1926 Subpart I Tools – Hand and Power provides guidance for tool safety. All tools shall be inspected for the following minimum features by the person using the tool prior to starting the work:

- Proper general condition of tools, electrical cords, and air hoses;
- Presence and serviceability of guards and safety devices;
- Proper electrical grounding or double insulation protection;
- Power tools properly equipped with constant pressure switches;
- Tool retainers installed on pneumatic tools;
- Proper adjustment of the tool; and
- Confirming that the load rating of the tool is sufficient for the work to be performed.

Unsafe tools shall be removed from service and the Site Supervisor advised of the condition for corrective action. An Out of Service tag should be placed on all unsafe or defective tools to prevent their inadvertent use by others. These tools should be physically segregated from the acceptable tools.

3.3.5 Environmental Safety and Quality Policy Implementation

Proper selection of construction equipment can impact employee health, consideration should be given to ergonomic design when selecting construction equipment.

Selection of construction equipment and vehicles may have significant impacts on the environment, either adverse or beneficial. Proper selection of the size and type of equipment and vehicles can reduce the adverse impacts from their operation.

Project procurement practices for construction equipment, parts, supplies, lubricants, and fuel shall be consistent with the principles of pollution prevention. For example, consideration should be given to such factors as rent versus buy options, disposable versus reusable filters, recycled versus virgin oils/fluids, recycling versus disposal of spent fluids and used parts, and fuel efficiency and economy of operation.

Spent fluids, filters, and used parts shall be recycled to the extent practical, or otherwise disposed of in accordance with the environmental compliance elements of the Work Plan or EHS plan.

Proper utilization of construction equipment and vehicles can also reduce adverse impacts on the environment. (For example, it is Tetra Tech's policy to not allow unattended equipment and vehicles to be left with motors running. This is not only a safety consideration; it reduces adverse environmental impacts and is generally cost effective due to reduced fuel consumption.)

3.3.6 Insurance

The Project Manager shall ensure that all construction equipment, including Tetra Tech-owned or rental/lease equipment, is covered by appropriate insurance policies for the intended use of the equipment. Property insurance on construction equipment is normally arranged by Tetra Tech if Tetra Tech bears the risk of loss or if Tetra Tech is required to arrange such insurance. However, all rented/leased construction equipment valued in excess of $100,000, and all cranes regardless of their value shall be reported to the Administration and Compliance Department via the 'Insurance Request for Leased Equipment' (Attachement 5, and available in Tetra Links and from procurement) for specific inclusion under the Tetra Tech property insurance policy. The procurement representative should be contacted to ensure that this

occurs in each case. Notification is not required for equipment valued under $100,000 except when the construction equipment provider requests a certificate of insurance be provided, or the equipment is a crane.

The Project Manager, usually through the designated procurement representative, should ensure that duplicate insurance coverage is not provided through the equipment provider since this will increase the rental rates. In those cases where the provider requires insurance certificates to verify coverage by Tetra Tech, the procurement representative should be contacted to obtain the appropriate documentation.

A Vehicle Insurance Form (available from the Vehicle Insurance Coordinator, Tetra Links or procurement) shall be processed and sent to the Vehicle Insurance Coordinator for all vehicles (leased, rented, or owned) which are registered and operated off jobsites on public highways.

3.3.7 Receipt and Inspection

All construction equipment shall be subject to a receipt inspection by a competent person and any Contract or otherwise required additional person(s) prior to acceptance at the project site. The inspections and tests shall be in accordance with the manufacturer's recommendations. Most vendors provide a form for notation of any existing damage to the equipment to be filled out on receipt. The equipment should be inspected carefully to determine its condition, including any damage, missing or non-functional equipment. The agreement should be used as a basis to determine that everything required (e.g., the equipment, its condition, manuals, spares, documentation of inspections, and certifications) has been provided. All discrepancies should be noted on the form. A pre-inspection of the equipment prior to transport to the Project site should be considered. Particular attention shall be given to the following items:

- All safety equipment and its condition;
- Operator (when provided) certification for the equipment;
- Posted operating and safety instructions;
- All pollution control devices and their condition;
- Safe entry and egress, with steps, ladders, handholds, and platforms provided as required, including safe access to perform routine checks, maintenance, and refueling operations;
- Leaking fluids, such as hydraulic oil, engine oil, transmission fluid, and coolant;

- Deteriorated or cracked hydraulic and coolant hoses which could result in leaks or spills;
- Guard belts, gears, shafts, pulleys, fly wheels and other reciprocating, rotating or moving parts shall be guarded to protect workers from becoming caught on, in or between machinery; and
- Presence of the manufacturer operation and maintenance manual.

Equipment or vehicles with deficient conditions relating to safety or protection of the environment shall not be placed into service until the deficiencies have been corrected and documented.

All construction equipment shall be subject to an operational check prior to acceptance at the project site. The operational check should verify that the equipment has the capability to function as intended or as required through the full range of its intended use.

Receipt of construction equipment shall be documented; with a copy of the receipt inspection report provided to the Equipment Supervisor and to the equipment purchase order file. Documentation should include entries for date and time of receipt, condition of equipment, mileage or engine hours at time of receipt, information on next scheduled maintenance, and a record of operating and maintenance manuals received with the equipment. Photographs or a video record of the equipment on receipt should be taken if conditions are noted that would warrant further documentation.

Construction equipment providers will often include terms and conditions on receipt documentation to be signed when construction equipment is delivered to the project site. **Project personnel requested to sign this receipt documentation shall not sign any delivery forms unless authorized to do so by Legal of the Project Manager. Further, if they are required to sign delivery forms, they shall be instructed to cross out all terms and conditions, on both the front and back of the forms, before signing.** Alternately, the person receiving the construction equipment should enter the following statement in the immediate vicinity of their signature: “In lieu of the terms and conditions set forth on this document, the Original Purchase Order (or appropriate form of agreement) terms and conditions apply to the receipt of this item(s).” These actions are necessary to avoid acceptance of additional or different terms and conditions.

Construction equipment delivered to the project site should be accompanied with operating and maintenance manuals. Cranes and lifting equipment shall include certification of satisfactory completion of annual inspection and have load charts posted in the cab. Additionally, some

construction equipment may be supplied with common replacement parts, such as filters and belts, and any specialized tools required for routine operation or maintenance. (i.e. forks, buckets, lift arms, and tool carries) These items should be carefully inventoried upon receipt, and documented on the receipt inspection report. Responsibility for protection and maintenance of the construction equipment shall be verified, and all measures necessary to protect the construction equipment from damage or loss will be instituted in accordance with the agreement, operating, and maintenance manuals or other instructions as appropriate.

Disposition requirements for construction equipment found to not be in accordance with the rental/lease/sale agreement when received shall be confirmed with the vendor immediately.

A sample Equipment/Vehicle Inspection Report is included as Attachment 1 to this procedure.

3.3.8 Protection from Environmental Extremes

Consideration shall be given to the environmental conditions to which the construction equipment will be exposed to during its time at the project site or during transportation. The manufacturer's instructions shall be reviewed and followed to ensure adequate protection from damage due to environmental conditions.

Adequate protection to the construction equipment's cooling system shall be verified by ensuring that the appropriate coolant/antifreeze mixture, as recommended by the manufacturer, has been used.

Appropriate procedures for operating or storing construction equipment, such as water treatment systems, shall be developed in accordance with the manufacturer's instructions. Measures such as draining and venting the system, providing auxiliary heat sources (e.g., heat tape), dry storage, shaft rotation, fluid levels, shall be taken to protect construction equipment subject to damage from environmental conditions.

Manufacturer's instructions concerning periodic operation of construction equipment shall be followed.

A means of ensuring that appropriate protective measures are instituted and performed as required should be implemented through the establishment of site procedures, logs, and/or checklists.

3.3.9 Equipment Inspections

All construction equipment shall be inspected daily (when in use) for safety and operability, including manufacturer's recommended daily inspections. The inspection form/checklist should note any deficiencies for correction and serve as documentation of the inspection performance. The Equipment Supervisor shall be notified of any deficiency immediately. A Daily Equipment Inspection form, a sample of which is included as Attachment 2 to this procedure, should be filled out at the start of the shift and provided to the Equipment Supervisor. Other supplemental forms which may be used in conjunction with Attachment 2 are the equipment specific "Pre-operation Inspection" and/or "Function Tests" forms, which are normally supplied by the equipment manufacturer. This information is usually found in the equipment's Operation Manual.

Government property control procedures usually require the implementation of a vehicle utilization log for vehicles when used on government projects; other projects should also implement a similar system for logging use of these vehicles. The log should be kept in the vehicle and an entry made for each use, including name of the driver, purpose of the trip, starting mileage, ending mileage, fuel purchased, maintenance performed, and any damage incurred. The log sheets should be transmiTetra Teched as required in the contract documents and the project's documentation plan. Copies of the log sheets will be maintained and filed as discussed in Section 3.3.12 of this procedure.

A separate Daily Equipment Inspection Report should be filled out for each shift if construction equipment is utilized on multiple shifts.

The Equipment Supervisor should use the information on Daily Equipment Inspection forms to schedule any repairs or preventive maintenance required for the equipment. Equipment with missing or defective safety features should not be put in service until repairs have been performed to bring the equipment into compliance with any applicable Tetra Tech H&S Program and/or regulatory requirements.

Implementation of the daily equipment inspections should be the subject of periodic verification inspections performed by the Project Manager, Site Supervisor, and/or the Site Safety Coordinator (SSC). These periodic inspections should include verification that the required maintenance is being performed in a timely manner to ensure that unsafe conditions or impacts to the environment (e.g., spills, releases, and discharges) are not created by delays in correcting deficiencies noted on the Daily Equipment Inspection Forms.

Rigging equipment, wire rope, nylon or KEVLAR slings and chokers shall be inspected by a competent person prior to use each shift; particular attention shall be paid to the rigging condition and presence of load/certification tags.

Cranes (weight handling equipment) shall be subjected to annual and certification inspections per OSHA guidelines. Mobile and crawler cranes shall be inspected on a monthly basis; a sample checklist form is included as Attachment 3 to this procedure.

Construction equipment to be demobilized shall be given a final inspection, similar to the receipt inspection, to identify and document, by means of written description and pictures, the condition of the equipment as it leaves the project site. Where possible, a concurrent inspection by the vendor is preferred. Additionally, some projects, particularly USACE projects, require a certificate of decontamination prior to the equipment leaving the site.

3.3.10 Operator Qualifications

Tetra Tech employees operating vehicles or construction equipment on public rights of way shall be required to have in their possession a valid driver's license appropriate to the location where the item is being operated and containing the appropriate endorsement for the type of vehicle or construction equipment being operated. A Commercial Driver's License (CDL) may be required for operation of some construction equipment on public rights of way, or as a specific requirement of a client's safety program. In addition, individual states may require specific licenses or certifications for operators of certain equipment, such as forklifts, and hoisting equipment. Additionally, the client's safety program may include license or certification requirements for personnel operating equipment on their property. The contract documents should be reviewed carefully to ensure that any such requirements are incorporated into the project's Work Plan or HASP. The Site Supervisor shall verify that the operator possesses the required license(s). Copies of licenses should be maintained in the on-site project employee file.

Any agreements for the rental or lease of vehicles or equipment should be reviewed for any provider's requirements for licensing or certification of operators to ensure that any such requirements are incorporated into the project's Work Plan or HASP.

Operators shall be required to demonstrate their proficiency in operating the construction equipment to be assigned to them prior to being allowed to work. Crane operators shall have qualifications for the type of crane to be operated.

Operator proficiency may be demonstrated through a performance test such as those

developed by the International Union of Operating Engineers, or by equipment manufacturers such as Caterpillar. These performance tests include exercises developed to demonstrate operator proficiency in various aspects of equipment operation, including daily operator inspections, ability to follow directions, ability to understand equipment limitations and operating guidelines, safety, and productivity. Also included are checklists that assist an observer in evaluating all of the various aspects of equipment operation. Attachment 4 is an example of Operator/Driver Observation Checklist.

Where it is not possible or practical to demonstrate operator proficiency through a performance test as described above, there should be a period of observation of the operator during the initial period of performance, whether the operator is a new employee or a current employee who is being assigned to a different type of equipment than previously operated on the project site. This observation may be performed by a knowledgeable member of the management team or a designated craft employee such as a foreman or steward. The above referenced checklists could be used for this observation in lieu of the performance test.

Operators shall be physically fit to perform their duties and may be required to participate in the Tetra Tech Medical Surveillance program.

3.3.11 Refresher Training and Evaluation

Refresher training in relevant topics shall be provided to Crane (as defined by OSHA 1910.180(a) operators, and Powered Industrial Truck (PIT) as defined by OSHA 1910.178(a)(1) operators prior to be allowed to continue operating when:

- The operator has been observed to operate the PIT/Crane in an unsafe manner.
- The operator has been involved in an accident or near-miss incident.
- The operator has received an evaluation that reveals that the operator is not operating the PIT/Crane safely.
- The operator is assigned to operate a different type of PIT/Crane; or
- A condition in the workplace changes in a manner that could affect safe operation of the PIT/Crane.

An evaluation of each PIT/Crane operator's performance shall be conducted at least once every three years.

Refresher training in relevant topics shall be provided to all other construction equipment operators when:

- The operator has been observed to operate the equipment in an unsafe manner.
- The operator has been involved in an accident or near-miss incident.
- The operator has received an evaluation that reveals that the operator is not operating the equipment safely.
- The operator is assigned to drive a different type of equipment; or
- A condition in the workplace changes in a manner that could affect safe operation of the equipment.

The employer shall certify that each operator has been trained and evaluated. The certification shall include the name of the operator, the type of equipment, the date of the training, the date of the evaluation, and the identity of the person(s) performing the training or evaluation.

3.3.12 Repairs

All construction equipment shall be repaired as necessary and maintained in good working order. Repairs to rented/leased construction equipment shall be in accordance with the terms of the rental/lease agreement. Repairs to rented/leased and Tetra Tech's construction equipment shall be documented and a record of the repairs maintained in the project files. Copies of the repair records are to be forwarded to the equipment yard for Tetra Tech-owned equipment.

Construction equipment with deficiencies noted on the Daily Inspection Report should be repaired promptly. The Equipment Supervisor, with input from the Environmental and Safety Supervisor as appropriate, should evaluate if a piece of equipment or a vehicle should be removed from service until the deficiency is corrected.

Construction equipment that develops a fluid leak such as engine oil, hydraulic oil, transmission fluid, or coolant shall be removed from service until the deficient condition has been corrected.

Construction equipment with missing or inoperable exhaust systems, including spark or flame arrestors, mufflers, and catalytic converters, shall be removed from service until the deficient

condition has been corrected.

Tampering with, removal, modification, or otherwise rendering inoperable any pollution control device on construction equipment shall not be allowed except as specifically authorized by the equipment manufacturer or appropriate authority and the Project Manager or Supervisor's concurrence

Only trained, qualified personnel shall be allowed to repair equipment. The project's Work Plan should address repairs to equipment by designating required actions in the event of an equipment failure.

An Authorization for Capital Expenditure or Lease (AFCEL) is to be completed for all major repair work (i.e., $1500.00 and over) performed on Tetra Tech-owned construction equipment in accordance with Accounting/Finance Procedure AF-8, Fixed Assets. (Note that on some construction equipment, the cost of a specific item, a replacement tire for example, may require the processing of an AFCEL due to the item cost.)

Costs for major repairs, as well as repairs for deficiencies, to Tetra Tech-owned construction equipment shall be charged back to the project releasing the equipment if the need for repairs is identified within 30 days of the equipment's release and removal from a project and there are indications that the repairs are needed as the result of lack of maintenance or failure of the releasing project to otherwise keep the equipment in good working order.

No repair shall be undertaken for damage covered by an insurance claim until the damage is reported to the Administration and Compliance Department and the insurer approves the repairs.

3.3.13 Documentation and Record Keeping

A file shall be established and maintained for each operator which contains documentation that the operator has the proper qualifications, licenses/certificates, and training to perform his/her job function. Records may include training identified in the HASP (e.g., OSHA, DOT, Waste Management training), vehicle operator licenses, results of site-administered proficiency testing, and any other special licenses/certificates required by state/local law or the client.

A file shall be established and maintained for each piece of construction equipment, and all records relating to that equipment shall be placed in the file, including the Receipt Inspection Report, annual inspections (for cranes), record of the date the equipment was first placed in

service, Daily Equipment Inspection records, maintenance records, repair records, record of the last date that the equipment was in service, demobilization inspection report, and the decontamination certificate, if applicable. For ease of retrieval, all records pertaining to pieces of equipment should be maintained in separate folders for each piece of equipment.

Additional copies of inspection reports and records may be required to be maintained in other project files, such as the procurement files and/or the Environmental Health and Safety files, based on the project's Documentation Plan.

The Equipment Supervisor should ensure that complete and accurate record of equipment utilization, including a list of idle equipment, is provided to the Quality Control Site Manager on a daily basis..

It may be useful to maintain equipment utilization information on a spreadsheet depending on the size of the project. Information such as equipment mobilization date, date of first use, utilization of equipment by rental period (for example, if rental rate is based on hourly usage and is billed on a monthly cycle, there should be an entry for the number of hours the equipment was used in each billing period), scheduled equipment release date, actual release date, and demobilization date. This information may be useful in verification of vendor invoices, in review of production rates, for preparation of requests for change orders or equitable adjustment, or for backup for use in support of (or defense against) claims.

Copies of all maintenance and repair records for Tetra Tech-owned construction equipment shall be forwarded to the Tetra Tech Equipment Manager at the regional equipment yard on a periodic basis. This period should be monthly, and in no circumstances should it exceed quarterly. An Equipment Service Form is available from the Equipment Manager. This form shall be used to report unscheduled and preventative maintenance on Tetra Tech-owned construction equipment.

The Equipment Manager produces a spreadsheet for Tetra Tech-owned construction equipment that is distributed to the projects on a monthly basis. The Equipment Supervisor shall ensure that reports of mileage or meter readings and routine maintenance for all Tetra Tech-owned construction equipment and vehicles assigned to the project are provided to the Equipment Manager for inclusion on the spreadsheet on a monthly basis. A Meter/Mileage Reading Update Form, available from the Equipment Manager, shall be used to report the required information.

The Equipment Supervisor should review the availability date included on the spreadsheet for Tetra Tech-owned equipment and vehicles assigned to the project and inform the Equipment

Manager of any required revisions to these dates.

The Equipment Supervisor shall complete an Equipment Transfer Report, available from the Equipment Manager, for all Tetra Tech-owned construction equipment and vehicles to be mobilized to, and demobilized from the project. Copies of the Equipment Transfer Reports shall be provided to the Equipment Manager at the regional equipment yard.

There shall be no equipment disposal action (junk or sale) for Tetra Tech-owned construction equipment or vehicles without prior notification and approval from the Tetra Tech President.

4.0 GUIDANCE

4.1 Additional Considerations

4.1.1 Control of Government Property

Activities involving the use of Government property are to be controlled by specific procedures negotiated with the Client in accordance with the contract's terms and conditions; such procedures shall be consulted where appropriate. Such activities may involve the handling or installation of Government property, whether furnished by the Government to Tetra Tech or acquired by Tetra Tech for use in the performance of work and for which the Government has retained title.

Government property may include construction tools and equipment purchased as a project cost, as well as permanent materials or equipment purchased for incorporation into the work. Project-specific procedures for control of Government property are to address issues relevant to the use, storage, inventory control, maintenance, and/or final disposition of the Government property.

4.1.2 Spill Control and Emergency Response Dedicated Tools and Equipment

The project's Emergency Response Plan, or Emergency Action Plan is to identify dedicated personal protective equipment and emergency response tools and equipment to be available for an emergency response to a spill or discharge of hazardous material.

Dedicated emergency response tools and equipment are to be segregated and identified for use in emergency response situations. The use of dedicated emergency response tools or equipment for any other activity is not to be permitted.

4.1.3 Inventory Control

An individual should be designated as the Material Control Supervisor and should be responsible for inventory control of all tools issued from the tool control area. A log should be maintained for all tools issued and should record, as a minimum, the identification by name and employee number of the individual signing out the tool, the date and time the tool was signed out, the intended use of the tool (by area or system), an indication of when the tool is to be returned, and the time and date when the tool is returned.
Inventory control of tools assigned to individuals or crews should be performed on a daily basis as the tools are returned to the gang box or storage area. The crew foreman should be responsible for inventory control of tools assigned to the foreman's crew.

The Site Supervisor should immediately be made aware of any missing tools and should take the appropriate action to investigate and/or replace the missing tools.

4.1.4 Disposition of Tools at Project Completion

The Project Manager should make a determination of the disposition of tools remaining at the end of the project. The project may not be reimbursed by the client for the purchase of tools on certain cost reimbursable and lump sum projects. On other projects, a dollar value for individual tools may establish whether or not the client provides any reimbursement. The terms and conditions of the contract should provide direction as to the required disposition of the tools. Tools for which the project has been reimbursed by the client are to be dispositioned in accordance with the client's preferences and the contract terms and conditions.

Tools purchased for the project as a project cost, and which are not to be turned over to the client, should be dispositioned by the Project Manager. Means of disposition may include, but not be limited to, declaring the tools surplus, sale of the tools, or providing the tools to another project. The Project Manager should consult with the appropriate Business Line Executive Vice Presidents, concerning disposition of project tools.

Tetra Tech owned tools (i.e., not purchased as a project cost) should be dispositioned by the Project Manager based on consultation with the appropriate Business Line Executive Vice Presidents. Means of disposition of Tetra Tech-owned tools may include, but not be limited to, declaring the tools surplus, sale of the tools, return of the tools to an equipment yard, or providing the tools to another project.

4.1.5 Company-Owned Equipment

Tetra Tech utilizes regional equipment yard(s) for the temporary storage and maintenance of Tetra Tech-owned construction equipment and vehicles when not currently assigned to a project. Available Tetra Tech-owned equipment should be considered for support of a project's construction effort based on an analysis of the benefits to the project and/or Tetra Tech. When evaluating Tetra Tech owned equipment the requirements discussed in 4.1.6 below should be considered when making the equipment selection.

4.1.6 Rental/Lease Equipment

Agreements for rental/lease of construction equipment should be coordinated through an authorized procurement representative to ensure that appropriate terms and conditions are included in the agreement. The Scope of Work for the agreement should be developed and reviewed carefully, including review by the Site Supervisor or Equipment Supervisor for inclusion of sufficient detail in order to clearly define the scope of work.

The Equipment Supervisor, or requisitioner if there is no designated Equipment Supervisor, should review the terms and conditions of all rental/lease agreements to determine that the following topics are adequately addressed:

- Receipt and return of the rental or leased equipment and any required accessories;
- Inspection and documentation of receipt and release;
- Provision of documentation required to be submitted, such as Occupational Safety and Health Administration (OSHA) accredited inspection reports, NDE reports, test reports (i.e. load test for cranes), typically annual inspections, and wire rope certification.
- Provision of all safety equipment and accessories, as required, such as fire extinguishers, seat belts, Roll Over Protection Structures (ROPS), Falling Object Protection Structures (FOPS), access steps, handholds, platforms, and anti two-block devices and load moment indicator (cranes);
- Provision of documentation demonstrating operator certification;
- Provision of Certificate of Compliance when required, for instance by NAVFAC P-307 Management of Weight Handling Equipment, Appendix P - Contractor Crane Requirements.

- Provision and requirements of routine and non-routine maintenance and repairs, including payment for labor, parts, filters, lubricants, and fluids;
- Documentation requirements for the above maintenance and repairs;
- Disposal/recycling requirements for used parts, filters, lubricants, and fluids;
- Items such as point of delivery, costs of delivery and return, rental charges during idle time, notification requirements for demobilization, and point of return;
- Appropriate rental rate provisions for straight time and overtime;
- Responsibility for damage to equipment;
- Insurance;
- Indemnification (if included);
- Payment for replacement of parts subject to normal wear and tear, such as tires, tracks, cuTetra Teching edges, and teeth; and
- Documentation requirements required in support of invoices for basic rental rates and overtime rates, as well as labor, parts, filters, lubricants, and fluids.

Rental agreements should be structured to include normal wear and tear on the equipment in the basic rental rate. In all cases, there should be mutual agreement with the equipment vendor as to the condition of the equipment as it is delivered. This should include items such as the life expectancy of the parts subject to wear and tear, their condition on receipt (i.e., percentage of usable life remaining), and the expected condition on return of the equipment. There should be agreement on minor versus major repairs and on what constitutes normal wear and tear. Mutual agreement is essential to mitigate potential claims from vendors for excessive wear and tear.

4.1.7 Mobilization of Equipment

Mobilization of construction equipment may be a long lead time item and may require client or third party involvement or approvals to gain site access, depending on the required equipment. The Site Supervisor or Equipment Supervisor should determine the lead time required, including Contract submitted and advance notice/approval requirements, and plan for the mobilization of equipment to support the project's schedule.

- Planning for mobilization of equipment should include a thorough review of Contract requirements for utilization of each equipment and site access requirements.
- Documentation of certification, and OSHA compliant annual inspection, load testing, safety devices (e.g., anti two-block) installed, wire rope certification, and operator's certification for cranes (weight handling equipment) should be reviewed prior to initiating mobilization of cranes.

4.1.8 Equipment Maintenance

The Equipment Supervisor should be responsible for administration of a construction equipment maintenance program for the project. A spreadsheet of all Tetra Tech-owned equipment, titled the Status of All Project Equipment, is maintained by the Construction Department providing notification of the scheduled maintenance requirements for each piece of equipment. Either this spreadsheet, or a project specific spreadsheet, should be maintained and statused on a periodic basis. Specific maintenance requirements may also be contained in specific contract negotiated property procedures or in other Tetra Tech corporate procedures.

As construction equipment is received on site, it should be added to the spreadsheet for tracking of the required maintenance.

A review of the scheduled maintenance should be performed for all construction equipment to be used in the Exclusion Zone to determine the desirability of performing any upcoming scheduled maintenance prior to placing the equipment in service. It may be difficult and expensive to perform the maintenance under the conditions required in the Exclusion Zone, or to decontaminate the construction equipment in order to perform the maintenance under clean conditions. When the maintenance of equipment in the Exclusion Zone is anticipated, the Site Supervisor should ensure that qualified personnel are available with the appropriate medical clearances and certifications to work in the Exclusion Zone.

4.1.9 Construction Equipment Safe Operation Requirements

Standards for safe operation of equipment are contained in the documents identified herein, inclusive and in particular of the requirements for safe operation of lifting and rigging equipment and weight handling equipment. The Contract typically will specify certain documents/codes to be followed for the project.

- The United States Army Corps of Engineers (USACE) Safety and Health Requirements Manual, EM 385-1-1, Chapters 16, 17, and 18, provide guidance concerning the safe operation of construction equipment.
- Safe operation of earth drilling equipment is addressed in SWP 5-36 Drill Rigs.
- Safe operation of hand and power tools is addressed in OSHA standard 29CFR Part 1926 Subpart I.
- Safe operation of cranes, derricks, hoists, elevators and conveyors is addressed in OSHA standard 29CFR Part 1926 Subpart N.
- Safe operation of motor vehicles, mechanized equipment and marine operations is addressed in 29CFR Part 1926 Subpart O.
- Rollover protective structures and overhead protection is addressed in 29CFR Part 1926 Subpart W.
- The American Society of Mechanical Engineers (ASME) provides guidance in the B30 commiTetra Techee volumes – Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings.
- The United States Department of Energy (DOE) provides guidance for safe lifting operations in Technical Standard DOE-STD-1090 – Hoisting and Rigging.
- The United States Navy publication NAVFAC P-307 – Management of Weight Handling Equipment includes requirements for Contractor Cranes (see appendix P). Navy facilities issue Instructions specific to particular facilities such as 'NAVSHIPYDPUGET INSTRUCTION 11262.4A' which provides requirements for weight handling equipment at all Navy facilities within the Puget Sound.

Construction Equipment safety requirements shall be met before any task can be safely and properly performed, including

- Equipment will be used only in the manner in which it was designed.

- Vehicles and equipment shall be kept in the appropriate gear or drive range when in motion, specifically when ascending or descending a grade. Freewheeling or coasting is prohibited.
- Steps, handrails and grab irons shall be used and equipment shall be faced when mounting or dismounting equipment. When climbing onto or from equipment a 3-point contact shall be maintained. Steps, handrails and grab rails shall be kept maintained, clean and free from slip, trip and fall hazards. Allow extra time in winter or rainy conditions to clean ice, snow and mud from equipment.
- Operators shall wear seat belts before starting and while in operation if the equipment is supplied with seat belts.
- Eye protection is mandatory if the equipment does not have an enclosed cab.
- Passengers shall not ride on equipment unless the equipment is designed to accommodate passengers.
- Before dismounting, the operator shall secure the equipment from movement by lowering all ground-engaging attachments, if so equipped (i.e., setting the parking brake, placing the transmission in park, disabling the hydraulics and activating any other elements of the equipment per the operator's manual).
- Wheeled equipment, without ground-engaging attachments, shall be chocked immediately following dismount with chock blocks that are adequate for the wheel size and equipment weight.
- Blades, buckets and other materials shall be in contact with the ground before the operator dismounts the equipment.
- Equipment should not be left unattended while the engine is running. If conditions exist that make it necessary for equipment to be left running in an unattended state (i.e., cold weather and certain start-ups), do not allow the general public entrance to the area unless the area can be clearly delineated. If the area cannot be clearly delineated to preclude casual entrance by the general public, unattended equipment shall not be left running.

- The work site around equipment shall be clear prior to moving equipment. The operator shall be attentive to people and any vehicles that may have entered the area during the walk-around inspection.
- All operations shall be in accordance with manufacturers Standard Operating Procedures (SOPs).
- All ground disturbance operations shall comply with the DCN 4-5 Trenching and Excavation Practices.
- Proper working distances shall be maintained when operating equipment that is near electrical lines, as defined in DCN 5-9 Safe Electrical Work Practices.
- Employees shall not get on or off a vehicle or piece of equipment while it is moving.

4.1.10. General Traffic Requirements

The traffic rules in this section shall be followed, at a minimum, when heavy equipment and haul trucks are operated on project sites. The PM or SSC shall implement new traffic rules as conditions or project changes dictate.

- All applicable local governing authority driving rules shall be followed when driving heavy equipment and haul trucks on public or project sites.
- Operators shall understand and adhere to the site traffic right-of-way rules and work zone configurations.
- Speed limits, dependent on the risk associated with the site, shall be posted for the location and shall always be observed. Violation of speed limits shall result in disciplinary actions, which shall be posted and discussed with the workforce. Appropriate signage shall adequately communicate haul roads and traffic hazards.
- Vehicles and equipment shall follow at a safe distance as determined by road conditions, the specific vehicle and loading. The site shall define a minimum following distance.

- Passing shall be limited to areas of adequate clearance, visibility and where marked accordingly. Passing may be prohibited completely on some sites or areas.

- Lights should be used to direct equipment at night; work zone lighting shall be sufficient for the work being performed.

- Adequate equipment spotters and ground employees should be deployed in conjunction with the job zone and traffic control plan. Spotters shall be not in the path of equipment travel while equipment is backing into a dump or loading area. Spotters shall wear bright, reflective clothing and be competent in directing and signaling equipment. Spotters and operators shall have a clear understanding of signal protocol for the site. When applicable, equipment will be equipped with a working signal alarm while backing up.

- A communications plan shall be developed by the site to allow the workforce to have communications with operators and spotters. A direct communication technique such as radio communication is preferred. If noise may impede operators to hear radios, then visual alerts (e.g., warning lights) inside the cab that are visible to the operator shall be considered.

4.1.11 Road Construction and Maintenance

For the safest and most efficient worksite, these construction and maintenance rules shall be followed when applicable:

- Elevated haul roads and roads, where risk is high from activities such as building dikes, shall have side berms or barriers that are axle height or greater to accommodate for the largest type of equipment that normally occupies the road. Drainage shall be allowed.

- All curves shall have open sight lines and have as large a radius as practical.

- Haul road/traffic changes shall be communicated to all affected personnel.

- Roadways shall be constructed with a slight crown to facilitate drainage.

- All roadways, including haul roads, shall be routinely maintained in a safe condition, including the elimination or control of dust, ice or similar hazards. Adequate dust control equipment shall be provided on the job site and shall be utilized to control the hazards.

4.1.12 Demobilization of Equipment

Construction equipment should be demobilized when no longer required for the work. The Executive Vice President of Construction should be provided with a status of Tetra Tech-owned construction equipment and scheduled release dates in order to coordinate availability of equipment with other projects.

The Project Manager or designee should request demobilization instructions from the Executive Vice President of Construction or designee to determine the location to receive Tetra Tech-owned equipment.

Construction equipment leaving the Exclusion Zone of a remediation construction project will be decontaminated in accordance with the requirements of DCN 3-9 Decontamination and the site specific HASP.

Individual state regulations may require cleaning of construction equipment leaving a site, not limited to remediation construction, in order to control the spread of microorganisms contained in the soil. Such requirements are to be identified in the project HASP plans.

Revision Date	Document Authorizer	Revision Details
2/16/2012	Chris McClain	Content & Format Revision

This safe work practices (SWP) describes situations where cold stress is likely to occur and discusses procedures for the prevention and treatment of cold-related injuries and illnesses. Cold conditions may present health risks to employees during field activities. The two primary factors that influence the risk potential for cold stress are temperature and wind velocity. Wetness can also contribute to cold stress. Other factors that increase susceptibility to cold stress include age (very young or old), smoking, alcohol consumption, fatigue, and wet clothing. Hypothermia can occur at temperatures above freezing if the individual has on wet or damp clothing or is immersed in cold water. The combined effect of temperature and wind can be evaluated using a wind chill index as shown in Table 1.

Bare flesh and body extremities that have high surface area-to-volume ratios such as fingers, toes, and ears are most susceptible to wind chill or extremely low ambient temperatures. Because cold stress can create the potential for serious injury or death, employees must be familiar with the signs and symptoms and various treatments for each form of cold stress. Table 2 provides information on frostbite and hypothermia, the two most common forms of cold-related injuries.

Training is an essential component of cold stress prevention. Employees are instructed to recognize and treat cold-related injuries during 8-hour health and safety refresher and first aid training courses. When working in cold environments, specific steps should be taken to lessen the chances of cold-related injuries. These include the following:

- Protecting of exposed skin surfaces with appropriate clothing (such as face masks, handwear, and footwear) that insulates, stays dry, and blocks wind;
- Shielding the work area with windbreaks to reduce the cooling effects of wind;
- Providing equipment for keeping workers' hands warm by including warm air jets and radiant heaters in addition to insulated gloves;
- Using adequate insulating clothing to maintain a body core temperature of above 36 °C;
- Providing extra insulating clothing on site;
- Reducing the duration of exposure to cold; and
- Changing wet or damp clothing as soon as possible.

During periods of extreme cold (10 °F or less) workers should use the buddy system to ensure constant protective observation.

Specific monitoring criteria are not established for cold stress. However, employees should be thoroughly cognizant of the signs and symptoms of frostbite and hypothermia (see Table 1) in themselves as well as in coworkers. All instances of cold stress should be reported to the site safety coordinator. Work schedules may be adjusted and warm-up regimes imposed as needed to deal with temperature and wind conditions.

TABLE 1
COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS EQUIVALENT TEMPERATURE

Estimated Wind Speed (in miles per hour - mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
CALM	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* in less than 1 hour with dry skin; maximum danger from false sense of security				*INCREASING DANGER* from freezing of exposed flesh within 1 minute				*GREAT DANGER* that flesh may freeze within 30 seconds			

Trench foot may occur at any point on this chart.

Source: Modified from American Conference of Governmental Industrial Hygienists. 1997. "Threshold Limit Values for Chemical Substances and Physical Agents."

TABLE 2
COLD STRESS CONDITIONS

Condition	Causes	Signs and Symptoms	Treatment
Frostbite	Freezing of body tissue, usually the nose, ears, chin, cheeks, fingers, or toes	• Pain in affected area that later goes away • Area feels cold and numb • Incipient frostbite (frostnip) - skin is blanched or whitened and feels hard on the surface • Moderate frostbite - large blisters • Deep frostbite - tissues are cold, pale, and hard	• Move affected worker to a warm area • Immerse affected body part in warm (100 to 105 °F) water—not hot! • Handle affected area gently; do not rub • After warming, bandage loosely and seek immediate medical treatment
Hypothermia	Exposure to freezing or rapidly dropping temperatures	• Shivering, dizziness, numbness, weakness, impaired judgment, and impaired vision • Apathy, listlessness, or sleepiness • Loss of consciousness • Decreased pulse and breathing rates • Death	• Immediately move affected person to warm area • Remove all wet clothing and redress with loose, dry clothes • Provide warm, sweet drinks or soup (only if conscious) • Seek immediate medical treatment

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Biological hazards, or "biohazards," include plants, animals or their products, and parasitic or infectious agents that may present potential risks to worker health. This safe work practice (SWP) discusses procedures for working with biohazards, preventive guidelines, and first-aid procedures for the most common hazards field staff are likely to encounter. This SWP does not address biohazards such as those associated with medical waste. Procedures for working with this type of biohazard should be addressed in the site-specific health and safety plan (HASP), construction health and safety plan (C-HASP), job safety analyses (JSAs), activity hazard analyses (AHAs), or other health and safety project planning documents on a case-by-case basis.

During preparation for site work, the document preparer should consider which plants, animals, and other biological agents may be encountered; assess their potential risk to project personnel; and attach this SWP to the document if necessary. Office health and safety representatives should become familiar with biological hazards indigenous to the geographical area in which most of their office personnel work and assist in evaluating the risks to personnel on projects staffed from their offices. SWPs for insects, snakes, animals, plants, waterborne pathogens (giardia), and hantavirus are provided below.

1.0 INSECTS

SWPs for reducing the chance of insect bites or stings and for treating bites or stings are listed below.

- Workers should keep as much skin area covered as possible by wearing long-sleeved shirts, long pants, and a hat. Pant legs should be tucked into socks or boots and shirts into pants. In addition, workers should wear light colored clothing.
- A proven insect repellent should be used on bare skin and clothing.
- When possible, tall grasses and brush that could harbor ticks should be avoided.
- Several times during the day and at the end of the work day, each worker should perform a check for evidence of imbedded ticks or previous bites. Particular attention should be paid to the scalp, neck, ankles, back of the legs, and waist.

- When opening well covers, vaults, or other closed items, workers should watch for hornet or wasp nests and black widow or brown recluse spiders. Workers should never reach into spaces with unprotected arms.
- Workers should watch carefully for bees around open soft drinks or food.
- If a worker is stung by a bee, the stinger should be carefully removed, if present. The wound should be washed and a cold pack applied. Allergic reaction should be watched for and is evidenced by extreme swelling, redness, pain, or difficulty breathing.
- If a worker is stung or bit by a spider or scorpion, medical attention should be obtained immediately.

2.0 SNAKES

SWPs for encounters with snakes and for treating snakebites are listed below.

- Workers should avoid walking in areas known to harbor snakes. Workers should be cautious when picking up or moving items that have been on the ground.
- Workers should wear boots made of heavy material that protect the ankles and pants. Heavy work gloves should be worn for picking up items.
- If one snake is encountered, others may be present. Workers should leave the area by retracing their steps.
- If a worker is bitten, the wound should be washed and the injured area immobilized and kept lower than the heart, if possible. Ice or a tourniquet should not be applied to a snake bite. The wound should not be cut. If medical care is more than 30 minutes away from a work site, a snakebite kit should be available on site and workers should know how to use it.

3.0 ANIMALS

SWPs for encounters with animals and for treating associated wounds are listed below.

- If workers encounter a wild animal, the animal should be observed for unusual behavior such as a nocturnal animal out during the day, drooling, an appearance of partial paralysis, irritability, meanness, or a strangely quiet demeanor.

- Workers should never touch the body of a dead animal because certain diseases could be carried by fleas still on the body.

- Workers should avoid animal droppings (including bird droppings). Pathogens, some of which can become airborne, may still be present in the droppings.

- If a worker is bitten, he or she should get away from the animal to avoid further bites. Workers should not try to stop, hold, or catch the animal.

- If the wound is minor, it should be washed with soap and water. Any bleeding should then be controlled, and an antibiotic ointment and dressing should be applied. All animal bite wounds should be watched for signs of infection.

- If the wound is bleeding seriously, the bleeding should be controlled but the wound should not be cleaned. Medical assistance should be summoned immediately.

- If a rabid animal is suspected, immediate medical attention should be summoned. If possible, workers should try to remember what the rabid animal looked like and the area in which it was last seen. The animal should be reported by calling the local emergency number.

4.0 PLANTS

SWPs for plants are as follows:

- Workers should be aware of the types and appearances of poisonous plants in the work site area. Poison ivy, oak, and sumac are the most frequently encountered plants that can cause reaction from casual contact. If a worker is extremely sensitive to these plants, he or she should avoid the area entirely because airborne drift could be sufficient to cause a reaction. Other plants, such as fireweed, can cause painful, short-term irritation and should be avoided as well. Workers should avoid touching face and eye areas after contact with any suspicious plant.

- Workers should wear proper clothing if working in or near overgrown areas. Disposable outerwear should be used, if necessary, and workers should not touch the material with bare hands during removal if the outerwear may have contacted poisonous plants.

- If contact with a poisonous plant has occurred, the affected area should be immediately washed thoroughly with soap and water. If a rash or weeping sore has already begun to develop, a paste of baking soda and water should be applied to the area several times a day to reduce discomfort. Lotions such as Calamine or Caladryl should be applied to help soothe the area. If the condition gets worse and affects large areas of the body or the face, a doctor should be consulted.

- Bushy and wooded areas should be thoroughly checked for thorn-bearing trees, brush, and bramble. In some cases, impalement can cause severe pain or infection.

5.0 WATERBORNE PATHOGENS-GIARDIA

Giardia is a waterborne pathogen consisting of a protoplasmic parasite of the mammalian digestive tract. Giardia is present worldwide, with the highest occurrence in areas with poor sanitation. In the United States, most reported cases are in mountainous regions where drinking water is obtained from streams and is unfiltered or untreated.

Giardia is contracted by ingesting water contaminated with giardia cysts in the dormant state. Giardia parasites can only thrive in the digestive tracts of mammals. Dormant giardia organisms enter water through the feces of infected animals or humans. Giardia symptoms include severe diarrhea and upset stomach. Some people are asymptomatic but can transmit the disease to others. Medical treatment of giardia can be difficult and unpleasant; therefore, prevention is critical. Precautions for preventing exposure to giardia are listed below.

- Workers should assume that all fresh water streams are infected with the giardia organism and not drink any untreated water.

- Team members collecting sediment and water samples from streams should wash their hands thoroughly with soap and water after collecting the samples.

- Giardia parasites are relatively easy to destroy or filter. Water should be treated for drinking or cooking with iodine or another recommended giardia treatment before use.

6.0 HANTAVIRUS

Hantavirus pulmonary syndrome (HPS) is a potentially fatal infection caused by a rodent-borne hantavirus. HPS begins with a brief illness most commonly characterized by fever, muscle pain, headache, coughing, and nausea or vomiting. Other early symptoms include chills, diarrhea, shortness of breath, abdominal pain, and dizziness. In the first identified cases of HPS, this stage of the infection lasted 2 to 5 days before victims were hospitalized. Typically, by the time of hospitalization, victims were found to have tachycardia (a heart rate of greater than 100 beats per minute) and tachypnea (a breathing rate of greater than 20 breaths per minute). Fever was also common. In most cases, death occurred within 2 to 16 days of the onset of symptoms, and victims exhibited pulmonary edema and severe hypotension.

Currently, experts believe that HPS is spread by the deer mouse (*Peromyscus maniculatus*). Though the deer mouse has been found to be the primary host of hantavirus, several other rodent species have also tested positive for the virus. Pinon mice (*Peromyscus truei*), brush mice (*Peromyscus boylii*), and western chipmunks (*Tamia spp.*) are also likely to carry the virus. Also, cases of HPS have been reported in areas of the United States where these particular rodents are not indigenous.

Infected rodents shed the virus in their urine, feces, and saliva. Humans can be exposed to the virus through (1) inhalation of suspended rodent excreta or dust particles containing rodent excreta, (2) introduction of rodent excreta into the eyes or broken skin, and (3) ingestion of food or water contaminated by rodent excreta. HPS has a reported mortality rate of 55 percent. Transmission of hantavirus from infected individuals to healthy persons has not been documented.

Prevention of HPS infection is essential because no known antidote and no specific treatment exists for treating HPS. Therefore, employees should practice risk reduction and control measures. Guidelines for workers in locations that may have rodent infestations or habitats are listed below.

- The best approach for HPS control and prevention is through environmental hygiene practices that deter rodents from colonizing the work environment.

- Information about the symptoms of HPS and detailed guidance on preventive measures should be provided to all employees assigned to field activities.

- Medical attention should be sought immediately for workers who develop a febrile or respiratory illness within 45 days of the last potential exposure to rodents. Attending physicians should be advised of each worker's potential for occupational exposure to hantavirus. Physicians should contact local health authorities promptly if hantavirus-associated illness is suspected. A blood sample should be obtained from the affected worker and forwarded with the baseline serum sample through the state health department to the Centers for Disease Control and Prevention for hantavirus antibody testing.

- Respiratory protective equipment should be worn when handling rodents, when removing rodents from traps, and when working in areas with evidence of rodent droppings or hair. Respiratory protective equipment should include, at a minimum, a half-face air-purifying respirator (APR) or powered APR equipped with a high-efficiency particulate air (HEPA) filter (P100). Full-face regulators may be needed under some circumstances. Respiratory protective equipment should be used in accordance with Occupational Safety and Health Administration regulations.

- Dermal protection should be worn when handling rodents or traps containing rodents, or if contact with contaminated surfaces could occur. Dermal protection should include rubber or plastic gloves that should be washed and disinfected before removal.

- A trap contaminated with rodent urine or feces or in which a rodent was captured should be disinfected with a commercial disinfectant or a 0.4 percent bleach solution. A dead rodent should be disposed of by placing the carcass in a plastic bag containing enough general-purpose household disinfectant to thoroughly wet the carcass. The bag should be sealed and disposed of by burning or by burying it in a 2- to 3-foot-deep hole. Local and state health departments can also provide appropriate disposal methods.

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	TETRA TECH, INC. SAFE LIFTING and CARRYING PRACTICES	Revision Date: 10/1/2008 Document Control Number: 5-19 Page 1 of 2

To prevent injuries and adverse health effects, the following general safe work practices (SWP) are to be followed when lifting and carrying while in an office or field environment. These SWPs establish a pattern of general precautions and measures for reducing risks associated with back injury and trauma associated with improper lifting and carrying of heavy objects. This list is not inclusive and may be amended as necessary.

- First, inspect the area where the load will be lifted, transported, and then deposited. Remove any obstacles that could present a tripping or other hazard.
- Perform a "test lift" by slightly pushing or moving the object to gauge your ability to safely lift/move/deposit the item without injuring yourself. IF YOU ARE NOT CONFIDENT THAT YOU CAN MOVE THE OBJECT WITHOUT INJYURING YOURSELF - THEN EITHER GET A MECHANICAL LIFTING AID OR GET HELP. DO NOT ATTEMPT TO MOVE THE OBJECT YOURSELF.
- Get as close to the object as you can, and bend at the knees (not at the back).
- Assure that can get a firm grasp on the object.
- Keeping the load as close to you body as possible, lift with your legs, and avoid turning or twisting while lifting, carrying, or depositing the load.
- Carry the object in a manner that it does not obstruct your vision and so that you can maintain a clear line of sight of your path of travel and the area where you will set it down.
- Set the object down using the same techniques as you did in lifting it (don't turn or twist, keep it close to your body, use your legs - not your back).

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1.0 PURPOSE

This program provides requirements for identification, location, and avoidance of underground utilities, appurtenances, and structures during intrusive activities, as defined in Section 4.0. The program also addresses actions to be taken in response to encountering or contacting underground utilities.

2.0 SCOPE

These requirements are applicable to all Tetra Tech operations. The procedures address the requirements and recommendations for identifying and locating, working around, and encountering or contacting underground utilities.

3.0 MAINTENANCE

The Vice President, Corporate Health and Safety or designee is responsible for updating this procedure. Approval authority rests with Tetra Tech's Senior Vice President, Corporate Administration. Suggestions for revision shall be submitted to Corporate Administration department.

4.0 DEFINITIONS

4.1 Aggressive Methods

The use of mechanized equipment such as excavators, backhoes, drill rigs, directional drilling, road saws, etc. Non-Aggressive methods involve the use of manual or non-mechanized methods such as hand-digging with shovels and air/hydro/vacuum methods.

4.2 Buffer Zone

As defined in this procedure, the area around a utility where only non-aggressive excavation methods may be utilized, unless specific conditions are met.

The definition cited above, and the excavation requirements and restrictions associated with it, will vary depending on the particular state regulations. Tetra Tech requires the imposition of a four-foot Buffer Zone on all sides of the utility as measured from the outside edges of the utility, both horizontally and vertically. Since most jurisdictions recognize Buffer Zones which vary somewhere in the range of 18 to 36 inches, this distance must be verified by consulting the applicable state regulations before excavating so that adjustments to surface markings can be made to achieve the required four-foot buffer zone.

Referred to as the "Tolerance Zone", "Safety Zone", or "Approximate Location of Underground Utilities" in some jurisdictions.

Information relative to excavation within the buffer zone is contained in Section 5.2.2.4.

4.3 Competent Person

A Competent Person has the ability to recognize hazards associated with underground utilities and the authority to stop or direct operations to ensure the safety of personnel and conformance with this procedure. The Competent Person has an understanding of this procedure, and the "One-Call" system requirements for the jurisdiction where excavation is occurring. The Competent Person must be capable of notifying One-Call agencies and maintaining and tracking One-Call Locate Numbers. Additionally, they must have knowledge of methods and work practices for utility identification, avoidance, and protection.

4.4 De-Energize

As applicable to a utility, to physically eliminate and/or prevent the presence, transmission, flow, or release of energy or materials which may cause harm to personnel or property.

4.5 Excavation

An operation for the purpose of movement or removal of earth, rock, or the materials in the ground, including but not limited to; digging, blasting, auguring, backfilling, test boring, drilling, pile driving, directional drilling, grading, plowing-in, hammering, pulling-in, jacking-in, trenching, tunneling, structural demolition, milling, scraping, tree and root removal (grubbing), fence or sign post installation. Tetra Tech requires that the designated One-Call agency for the applicable jurisdiction be contacted any time an intrusive activity is planned.

4.6 Jurisdiction

The authority having legal jurisdiction relative to regulations and requirements for notification of excavation activities and associated identification and marking. In the United States, the states have jurisdiction, and most consider the regulations applicable when excavation is to be performed in any location, including any public or private way, any company right-of-way or easement, or any public or privately owned land or way.

4.7 Locate

To indicate the existence of a utility by establishing a mark through the use of flags, pins, stakes, paint, or some other customary manner, that approximately determines the location of a line or facility.

4.8 Locate Request

A communication between an entity performing intrusive activities and a utility marking agency (One-Call, etc).

4.9 Observer

The person assigned to visually monitor and, as needed, signal the operator during mechanized intrusive activity when the activity is occurring within four feet of the outside edge of the buffer zone. This person remains in close communication with the equipment operator(s) and will stop the activity if needed.

4.10 One-Call Agency

An entity that administers a system through which a person can notify owners/operators of underground lines or utilities of the intent to perform intrusive activities in proposed public areas.

4.11 Positive Response

Communication with the entity performing intrusive activities, prior to the activity, to ensure that all contacted (typically via the One-Call agency) owner/operators have located and marked the underground utilities.

4.12 Potholing

The practice of exposing an underground facility by safe, non-aggressive excavation methods in order to ascertain the precise horizontal and vertical position and orientation of underground lines or utilities.

4.13 Underground Utility

An underground or submerged conductor, pipe, or structure used in providing electric or communications service (including but not limited to, traffic control loops and similar underground or submerged devices), or an underground or submerged pipe used in carrying, providing, or gathering gas, oil or oil product, sewage, storm drainage, water or other liquid service (including, but not limited to, irrigation systems), and appurtenances thereto. As used in this procedure, utility includes all underground appurtenances and structures.

The following are examples of the types of underground utilities that may be present in a given location:

- Natural gas pipelines
- High voltage electric cables
- Water pipelines
- Fiber optic telecommunications lines
- Steam pipelines
- Gasoline, oil, or other fuels
- Sewer pipelines
- Hazardous Materials
- Underground Storage Tanks (USTs)
- Abandoned underground structures containing hazardous materials, hazardous wastes, and radioactive materials

Note: Electrical and pressurized mechanical underground utilities that are not energized shall be considered as applicable to the requirements of this procedure until they are disconnected and removed or protected by a lockout/tagout system approved by Tetra Tech (see Section 5.2.2.6)

4.14 Underground Utility Owner

Any person, utility, municipality, authority, political subdivision or other person or entity who owns, operates, or controls the operation of an underground line/facility.

4.15 White Lining

The practice whereby the entity which intends to perform intrusive activities pre-marks the site with an outline of the area where intrusive activities will occur. This involves the use of white paint, flags, stakes, or a combination thereof to mark the extent of where work is to be performed. The marking may vary depending on what intrusive activities are to be conducted. For example, for general excavation, an area outline of the excavation shall be marked, while for drilling, the individual boreholes shall be marked. Studies have shown that pre-marking is a practice that does prevent utility contact incidents.

5.0 DISCUSSION

5.1 Responsibilities

5.1.1 Competent Person

The Competent Person shall be responsible for:

- Obtaining a copy of, and understanding the applicable regulations for the state of jurisdiction where the excavation activities are to be performed.
- Contacting the appropriate One-Call agency or private locating service, as applicable.
- Recording One-Call locate numbers.
- If necessary, renewing One-Call locate numbers before expiration.

- Ensuring that white-lining of the area to be excavated is performed.
- Ensuring that a "positive response" has been received from every utility owner/operator identified by the One-Call agency and that they have located their underground utilities and have appropriately marked any potential conflicts with the areas of planned intrusive activities.
- Completion of the Underground Utilities Locating and Marking Checklist (Attachment A) and the Underground Utilities Management Checklist (Attachment B).
- Reviewing applicable AHAs or other client specific requirements with all project members before work begins.
- Conducting training on communication protocols to be used by the excavation observer and equipment operator.
- Ensuring Implementation of appropriate work practices during intrusive activities (including maintaining the prescribed buffer zone for use of aggressive methods).
- Conducting daily inspections of the excavation area to make sure that all markings are intact.
- Maintaining required records.
- Providing the Project Manager or Site Supervisor with all required documentation on a daily basis.

5.1.2 Observer

Whenever intrusive operations with mechanized equipment are being conducted within four feet of the outside edge of the buffer zone, horizontally and vertically, an observer must be assigned to monitor the activities. The observer is responsible for:

- Observing the operation to ensure that the operator stops operations if utilities are observed.
- Reviewing hand signals and other forms of communication with the operator.

- Properly signaling the operator.
- Stopping the operation immediately if the observer's attention must be diverted even momentarily.
- Stopping the operation immediately if a hand signal or other directive is not followed. Operations will not resume until the observer and operator mutually agree that the reason(s) for not complying with the directive(s) are/is identified and fully corrected.
- Maintaining required records, such as logbook entries, or other, as requested by line management.

5.1.3 Line Management

The Project Manager (PM) shall be responsible for:

- Ensuring compliance with this procedure.
- Providing the necessary resources for compliance with this procedure.
- Designating Competent Personnel in consultation with the Site Safety Coordinator prior to the start of work.

5.1.4 Site Safety Coordinator

The Site Safety Coordinator (SSC) shall be responsible for:

- Providing oversight on the implementation of the requirements contained in this procedure.
- Consulting with the PM and Competent Person on underground utility issues.

5.2 Procedure

The following sections provide the requirements and recommendations of this procedure, which are intended to prevent injury to personnel, damage to infrastructure, and associated indirect effects associated with encountering or contacting underground utilities during the execution of

intrusive work. Underground utilities present multiple potential hazards that must be recognized before and during work which occurs near them, therefore, this procedure is divided into sections addressing underground utility identification and location, working around or near underground utilities, and actions to be taken in the event that underground utilities are encountered or contacted. Hazards that may be presented by underground utilities include explosion and fire, electrocution, toxic exposures, pathogens, and drowning.

5.2.1 Identifying and Locating Underground Utilities

The possibility of the existence of underground utilities must be evaluated as early as possible in the planning phase for any project which involves intrusive activities, as defined in Section 4.2. The Project Safety Checklist or equivalent should be used for documentation of the identification of this potential hazard and the procedures to be followed to address them. The following sections describe various methods for identifying and locating utilities on a site. Plans should be verified during the readiness review. The Underground Utilities Locating and Marking Checklist (Attachment A) and the Underground Utilities Management Checklist (Attachment B) must be completed before any activities meeting the definition of excavation in Section 4.2 are conducted. Attachment A is intended to be used as a guide during the process of locating and marking utilities in the area to be excavated. Attachment B is intended to be used as a guide in the overall process of underground utilities management during the course of the project.

All underground utilities on a site involving excavation as defined in Section 4.4, must be located and identified before intrusive activities commence, by one or more of the following entities:

- The Utility Owner
- A Private or Public Utility Locating Service
- An Approved Tetra Tech Competent Person

These options are described in greater detail in the following Sub-Sections:

5.2.1.1 Pre-Planning and the Site Specific Health and Safety Plan

The Site-Specific Health and Safety Plan developed for the project must:

- Identify the location and types of underground utilities that are believed to be present on the site.
- Reference this procedure and describe how it will be implemented on the project.
- Contain an Activity Hazard Analysis in which the hazards associated with underground utilities are identified, as well as the measures used to control them.
- Contain, as an appendix, a copy of the applicable regulations from the state of jurisdiction where excavation activities are to be performed. These can usually be obtained via the Internet.
- Contain clear and concise procedures to be followed in the event that contact with underground utilities occurs.
- Address underground utilities and potential associated scenarios in the emergency response section of the EHSP.

5.2.1.2 "One-Call" Locating and Marking Services

Every state has utility marking service programs having various names such as "One-Call", "Dig-Safe", "Call-Before-You-Dig", "Dig-Safely", and many others. These services will identify the types and locations of any utility that may exist in an area to be excavated, as long as the property is in the public domain.

The appropriate One-Call service for the jurisdiction where the project is located must be contacted prior to beginning excavation work. The One-Call agency should be given as detailed a description of the property as possible; address, cross street, utility pole numbers, physical description, etc.

Notification to the One-Call service shall allow sufficient lead time for the agency to mark the utilities before excavation begins. The lead times vary, but range from two to ten days, depending on the state of jurisdiction.

A complete listing of One-Call agencies and telephone numbers for all states is available in the "Call-Before-You-Dig Call Center Directory", which can be accessed on the Internet at the WebPage (http://www.agc.org/galleries/default-file/State%20One%20call%20Centers%20Laws.doc) sponsored by "Underground Focus" magazine.

Once notified, the One-Call agency will provide the contractor with a unique "locate number" or "reference number". This reference number must be kept in the project files by the Competent Person or designee. Additionally, the reference numbers have expiration dates, which may vary depending on the particular One-Call agency. The valid period of the locate number and required renew notification date shall be requested from the One-Call agency.

On a project with multiple contractors, each contractor must request a separate locate number. Under no circumstances will any other contractor or entity be allowed to "work under our locate number". Subcontractors to Tetra Tech may excavate under the locate number secured by Tetra Tech, provided that they are excavating within the area which was previously white-lined by Tetra Tech and subsequently marked. However, the One-Call agency must be contacted and notified of this arrangement so that the subcontractor can be recorded as working under the existing locate number. If a Tetra Tech subcontractor will be excavating in an area not white-lined by Tetra Tech, then the Tetra Tech subcontractor must request a new locate.

The area where work is to be performed shall be white-lined by Tetra Tech personnel before the locating service goes to the site.

It is good practice to arrange a pre-excavation meeting at the project site with the personnel performing the utility location and marking. This meeting will facilitate communications, coordinate the marking with actual excavation, and assure identification of high-priority utilities.

The One-Call agency should provide the identities of the utility owners that will be notified of the locate request. This information shall be recorded on the Underground Utility Locating and Marking Checklist (Appendix A) and maintained in the project files. The contact person and phone number for each utility owner shall also be recorded.

The utility owners should provide a "positive response" relative to the locate request, which can consist of two types of action by the utility owner. The facility owner or operator is required to 1) mark it's underground utilities with stakes, paint, or flags, or 2) notify the excavator that the utility owner/operator has no underground utilities in the area of the excavation.

The positive responses shall be recorded on the Underground Utility Locating and Marking Checklist (Appendix A) and cross-checked with the list of utility owners that the One-Call agency stated that they would notify. If it is discovered that a utility owner has not provided a positive response, then the One-Call agency must be notified.

Excavation shall not be conducted until positive responses have been received from all utility owners identified by the One-Call agency as having underground utilities on the property.

Before beginning excavation, the excavator must verify that the location marked was correct, and the distinct, color-coded markings of all utility owners are present.

Examine the site to check for any visible signs of underground utilities that have not been located and marked such as pedestals, risers, meters, warning signs, manholes, pull boxes, valve boxes, patched asphalt or concrete pavement, areas of subsidence, fresh sod or grass, lack of grass or vegetation, and new trench lines.

The markings placed by the utility owners must be documented by Tetra Tech using a still, digital, or video camera. The photo-documentation shall be maintained with the project files indefinitely.

The markings placed by the utility owners or marking services shall follow the American Public Works Association Uniform Color Code as described in ANSI Standard Z 535.1. This code appears below.

American Public Works Association Uniform Color Code

Red - Electric Power Lines, Cables, Conduit

Orange - Communications, Telephone, Cable TV

Yellow - Gas, Oil, Steam, Petroleum or Gaseous Materials

Green - Sewers and Drains

Blue - Potable Water Systems

Purple - Reclaimed Water, Irrigation, Slurry Lines

Pink - Temporary Survey Markings

White - Proposed Excavation

5.2.1.3 Private Utility Locating and Marking Services

As discussed in Section 5.2.1.1, One-Call agencies arrange for the identification and marking of underground utilities only on public property, up to the point of contact with private property. In the event that excavation activities are to be conducted on non-public properties, the presence, location, depth, and orientation of all underground utilities within the white-lined area shall be ascertained through records review, including any site plot plans, utility layout plans, and as-built drawings available from the property owner, as well as through interviews with knowledgeable personnel associated with the property. Additionally, the information gathered from these sources shall be verified by physical detection methods (non-aggressive), performance of a geophysical survey, or by procuring the services of a private utility locating and marking service. If any detection methods are to be self-performed, the requirements of 5.2.1.4. must be followed.

The above requirements are also intended to address the potential presence of unknown or undocumented underground utilities, therefore, the area to be excavated must also be evaluated by the PM to determine if the potential for unknown or undocumented underground utilities exist. If the determination is made that the presence of these unknown or undocumented underground utilities is unlikely, then a variance should be requested to eliminate the requirement to identify them.

Variance to this requirement above must be approved by the PM and SSC.

5.2.1.4 Self-Performance of Utility Locating and Marking

The techniques and instruments used to locate and characterize underground utilities can be extremely complicated and difficult to use effectively. Additionally, interpretation of the data generated by this instrumentation can be difficult. The utility marking services described in 5.2.1.1 and 5.2.1.2 are staffed by well-trained, experienced professionals who perform locating activities on a regular basis. For these reasons, it is most desirable that these professional services are used for utility location and marking on projects.

In some instances, such as long-term projects where excavation is a primary task, and the presence of underground utilities is extensive, it may be prudent to self-perform locating and marking activities.

If locating and marking is to be self-performed, all personnel using instrumentation will be trained on the use of the equipment that will be used, and the interpretation of the data.

There are a variety of locating methods which may be utilized for self-performance of utility locating as categorized below:

- Magnetic field-based locators or path tracers
- Buried electronic marker systems (EMS)
- Ground penetration radar-based buried –structure detectors
- Acoustics-based plastic pipe locators
- Active probes or beacons for non-metallic pipes
- Magnetic polyethylene pipe

Before self-performing any underground utility locating on a project, approval must be obtained from the Operating Unit Health and Safety Manager.

5.2.2 Working Near or Around Underground Utilities

After the site has been properly evaluated for the presence of underground utilities, intrusive activities may begin. Since there is no perfect way of eliminating the hazards presented by underground utilities, an effort must be made to perform the tasks following the direction and guidance as described by the following best practices that should be implemented during the execution of the project.

5.2.2.1 Work Site Review

Before beginning intrusive activities, a meeting shall be held between all members of the project team. This shall consist of a review of the marked utility locations with the equipment operators, observers, laborers, etc.

5.2.2.2 Preservation of Marks

During excavation, efforts must be made to preserve the markings placed by the utility owners until they are no longer required. If any markings are obliterated, the One-Call agency must be contacted for re-marking. No intrusive activities are to take place if markings are not visible.

5.2.2.3 Excavation Observer

Whenever intrusive operations are being conducted within four feet of the edge of the buffer zone, an observer must be assigned to monitor the activities. The observer will be designated each day, and a review of hand signals and other forms of communication between the observer and operator will be conducted. The directives of the observer will be followed precisely and immediately by those operating equipment.

5.2.2.4 Excavation Within The Buffer Zone

Performing intrusive activities within the buffer zone requires careful adherence to proper guidelines and procedures to minimize the risk of contact with underground utilities.

The purpose of the buffer zone is to designate and define an area where careful, prudent, and reasonable excavation practices are to be used to prevent contact with underground utilities. However, there may be occasions where it is necessary to perform aggressive excavation methods in this designated area.

The boundaries of the buffer zone as defined in Section 4.1 will be observed at all times during intrusive activities. Aggressive excavation methods (excavators, backhoes, drill rigs) must be restricted to areas outside of the 4-foot buffer zone unless a special exemption to this requirement is obtained.

Consider whether the objective of the project can be completed without performing intrusive activities in the buffer zone at all. This will greatly reduce the risks presented by performing work in close proximity to underground utilities. If after consideration, the determination is made that intrusive activities in the buffer zone are necessary, then a formal exemption request shall be made to the PESM according to the guidelines below.

A request to utilize aggressive excavation methods in the buffer zone may be made if:

There is no other appropriate and reasonable alternative to using aggressive methods in the buffer zone; and

- The utility has been de-energized (and purged if necessary), verified as de-energized, and locked-out (per Section 5.2.2.6); or

- the depth and orientation of the utility has been adequately and visually determined through the use of non-aggressive methods such as air/hydro/vacuum excavation, potholing, probing, hand-digging, or a combination thereof; and
- for utilities containing electrical energy, the depth of the existing water table is below the location of the utility; and
- application for the exemption has been submitted to the SSC; and
- the exemption has been granted and approved in writing by the SSC.

The following conditions will apply to this request:

- Aggressive methods may be used in the buffer zone only to the extent allowed by the applicable state or other jurisdictional regulations.
- Appropriate physical protection measures for exposed utilities as described in Section 5.2.2.5 shall be implemented to eliminate the potential for equipment contact with utilities.
- The extent of the project excavation area to be covered by the exemption request must be specified.
- When evaluating the use of aggressive excavation methods in the buffer zone, the SSC will consider the type of utility involved and the associated risk potential.

Based on this evaluation, the SSC may impose further conditions and requirements, which will be detailed in the HASP.

Even if the above exemption conditions are met, the SSC has authority to deny the request, the reasons for which will be provided.

Unless exempted according to the above provisions of this procedure, only non-aggressive methods may be used within the buffer zone. Non-aggressive, or non-mechanized equipment is used in order to prevent mechanical contact with underground utilities which could result in damage to the utility and create the potential for personal injury and property damage. Following are examples of non-aggressive excavation methods:

- Hand-digging

- Non-conductive hand tools must be used when digging within the buffer zone surrounding underground electrical utilities.
- If conductive hand tools must be used near electrical lines, then the SSC shall be consulted to determine additional requirements relative to safe electrical practices, procedures, and equipment.
- Hydro-excavation (water pressure).
- Air excavation (air pressure).
- Vacuum extraction (soil excavation/removal).
- Air excavation/vacuum extraction combination.
- Aggressive methods may be used for the removal of pavement over a utility, if allowed by the state regulations.

5.2.2.5 Protection of Underground Utilities

It is very important that consideration be given to the protection of underground utilities when performing adjacent intrusive activities. This is necessary not only to prevent physical damage and associated indirect effects, but also to prevent the potential for injury to employees and the public.

When using aggressive excavation methods within the buffer zone around exposed underground utilities, physical protection may be appropriate. Basically, this involves creation of a physical barrier between the mechanized operation and the utility. The following are some possible types of physical protective measures:

- Heavy timbers, similar to swamp mats.
- Sheets of plywood.
- Blasting mats.
- Once exposed, underground utilities no longer have the support provided by surrounding soil and may need to be physically supported to prevent shifting, bending, separation, or

collapse, which could result in damage to the utility, and possibly personnel. Following are suggested support methods:

- Timber shoring underneath the utility.
- Timbers or girders over the top of the excavation fitted with hangers that support the utility.
- Design by a PE for complicated or large applications.
- Utilities must also be protected from objects that may fall into the excavation such as rocks and equipment. This can be accomplished by following these guidelines:
- Cast spoils as far away from the excavation as possible. Excavated and loose materials shall be kept two feet from the edge of excavations, as required by OSHA.
- Relocate large rocks, cobbles, and boulders away from the excavation and sloped spoils piles.
- When vehicles and machinery are operating adjacent to excavations, warning systems such as soil berms, stop logs or barricades shall be utilized to prevent vehicles from entering the excavation or trench.
- Scaling or barricades shall be used to prevent rock and soils from falling into the excavation.
- Barriers shall be provided to prevent personnel from inadvertently falling into an excavation.

5.2.2.6 De-Energizing Utilities

Utilities can carry many types of potential energy, including electricity, flowing liquids, liquids under pressure, gasses under pressure, etc. A release, such as may happen if a utility conveyance is compromised, could result in personal injury, property damage, and other indirect effects. If the white lines of the proposed excavation area overlaps or extends into the buffer zone of a known underground utility, then if at all possible, that utility shall be de-energized to physically prevent the transmission, flow, or release of energy. Conversely, if the buffer zone of the known utility lies outside of the white-lined, proposed excavation area, then de-energization is not required.

The owner of the utility shall be contacted to determine the feasibility and methodology of de-energizing the utility. Plenty of lead-time should be provided for this since it may take utility companies weeks to de-energize some utilities.

Depending on the utility and the material being conveyed, isolation points which may be suitable for de-energizing include but are not limited to the following:

- Electrical circuit breakers
- Slide gate
- Disconnect switches
- Piping flanges
- Other similar devices

When utilities are de-energized, it must be verified by demonstration. This can be accomplished by testing equipment, switching on a machine or lighting, opening a valve, etc. For any current-carrying electrical equipment, such as cables, electrical panels, etc., successful de-energization must be certified through the use of appropriate electrical testing equipment.

Whenever a utility is de-energized, a means of ensuring that the energy isolation device and equipment cannot be operated until the device is removed must be provided. Typically, this is achieved by utilizing a lockout device, accompanied by a written tag that physically controls the configuration of the energy isolation point. Lockout devices include but are not limited to the following:

- Locks
- Chains
- Valve covers
- Circuit breaker hasps
- Blind flanges
- Slip blinds, and

- Multiple lock hasps

When de-energizing and locking out of utilities is practiced, the provisions of DCN 2-16 Control of Hazardous Energy Lockout/Tagout, shall be followed, as applicable.

In the event that a utility is de-energized, but there is no means of adequately providing a physical locking-out of the utility, then a spotter must be posted at the point of isolation to ensure that the utility is not re-energized. The spotter must be supplied with a communication device such as a site radio.

5.2.2.7 Damage Discovery

During excavation, utility damage may be discovered which is pre-existing or otherwise not related to a known contact. Disclosure to the utility owner is very important because the possibility of utility failure or endangerment of the surrounding population increases when damage has occurred. The utility may not immediately fail as a result of damage, but the utility owner or operator must be afforded the opportunity to inspect the utility and make a damage assessment and effect repairs if necessary. The following guidance applies:

- Observe and photograph the utility from a safe distance and determine in there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, or other damages to utility lines, conduits, coatings, or cathodic protection systems.
- The One-Call agency or private location service must be contacted immediately.

5.2.3 Encountering or Contacting Underground Utilities

In the event that encountering or contacting an underground utility occurs, it is imperative that the appropriate actions are taken to minimize damage to the utility, prevent personal injury, and minimize indirect effects.

5.2.3.1 Encountering Underground Utilities

It is possible that underground utilities will be encountered in locations that have previously been "cleared" of having underground utilities by the locating service, or are found outside of the area which has been marked as having underground utilities. In either case, if this occurs, the following applies:

- Intrusive activities must be curtailed
- The One-Call agency or private location service must be contacted immediately
- The PM and PESM must be notified
- No further intrusive activities may be conducted until:
- The One-Call agency/private location service and/or the subject utility owner visit the site;
- Identification of the utility owner and the type of material/energy being conveyed by the utility has been made; and
- The orientation and depth of the subject utility has been determined and suitably marked.
- A Tetra Tech Incident Report and Investigation form must be completed per DCN 2-2 Incident Reporting and Investigation Program. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.

5.2.3.2 Contacting Underground Utilities

If excavation or other equipment being used for intrusive activities makes contact with an underground utility, the following guidelines apply:

- Intrusive activities must be stopped immediately.
- Observe the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, scratched coatings, cathodic protection compromise, material leakage, obvious electrical energy.

- Move all personnel to the evacuation meeting point as described in the SSHP.

EXCEPTION: If an electrical line has been contacted and it is your belief that equipment (such as an excavator) is electrically energized, do not approach the equipment. Order the operator to remain in the equipment until emergency personnel can de-energize the source (unless the equipment is on fire, at which time the operator should jump off of the vehicle and shuffle along the ground to a safe area). Shuffling is required because current flows outward through the soil in a ripple pattern called a power gradient, creating a pattern of high and low potential, Shuffling decreases the chance that these gradients could be bridged, causing current to flow through the body, resulting in electrocution.

- Secure the area to prevent the public from entering.
- Contact emergency responders as specified in the SSHP.
- The One-Call agency or if known, the utility owner must be contacted immediately.
- The PM and SSC must be notified.
- No further intrusive activities may be conducted until:
- The utility owner inspects the scene and after repairs, verifies that all danger has passed.
- The orientation and depth of the subject utility has been determined and suitably marked.
- Permission from the emergency responders to resume work has been given.

A Tetra Tech Incident Report and Investigation form must be completed per DCN 2-2. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.

State and Local regulations must be reviewed to determine if reporting to any additional agencies is required.

5.3 Training

Competent Persons shall have adequate experience and/or training to carry out the requirements of this procedure.

6.0 SOURCES OF INFORMATION

6.1 Organizations

- Common Ground Alliance
- Center for Subsurface Strategic Action (CSSA)
- DigSafely
- National Utility Contractors Association (NUCA)
- National Utility Locating Contractors Association (NULCA)
- Underground Focus Magazine
- NUCA State Listing of One-Call centers
- Utility Safety Magazine

6.2 Vendors and Commercial Sites

- RadioDetection, Inc. (Detection Instruments)
- Heath Consultants (Detection Instruments)
- Ben Meadows Company (Detection Instruments)
- So-Deep, Inc. (Complete Utilities Services)
- Concept Engineering Group, Inc. (Air Excavation Equipment)
- Rycom Instruments, Inc. (Detection Instruments)
- Schonstedt Instrument Company (Detection Instruments)

- Forestry Suppliers, Inc. (Fiberglass Probe – "Fiberglass Tile Probe", Part #77543, Approx. $20.00, Telephone 800-647-5368)

7.0 REFERENCES

Common Ground Study of One-Call Systems and Damage Prevention Best Practices, August, 1999, Sponsored by US DOT.

8.0 ATTACHMENTS

Attachment A – Underground Utilities Locating and Marking Checklist

Attachment B – Underground Utilities Management Checklist

Revision Date	Document Authorizer Name	Revision Details
10/01/2011	Chris McClain	Update

1.0 PURPOSE

The purpose of this procedure is to provide information for projects that will ensure all drilling operations are conducted using established industry standards, requirements, and safe work practices.

2.0 SCOPE

The requirements of this procedure apply to drillers and drilling subcontractors working on Tetra Tech, Inc. (hereinafter referred to as "the Company") projects. This procedure involves all operations for drill rigs including set-up, disassembly, rotary and auger drilling, CPT, DPT, air rotary, core drilling, grouting, service and maintenance, and related operations performed in support of monitoring and recovery well installation, abandonment, soil borings, and geological sampling and exploration.

3.0 MINIMUM REQUIRMENTS

3.1 Responsibilities

3.1.1 Tetra Tech Employees and Subcontractor Personnel

All project site personnel involved with drill rig activities shall have site training/orientation and are responsible for understanding and complying with the requirements of this procedure. All employees shall bring all potential, perceived, or actual unsafe conditions or concerns to the attention of the Site Safety Coordinator (SSC) and/or supervision immediately, or as described in the site-specific Health and Safety Plan (HASP). If they feel their concern is not addressed, then Project Management should be contacted.

3.1.2 Subcontractor Drill Rig Crew

Employees who operate, maintain and work on drill rigs shall have the applicable certifications, qualifications, and training in the operation, maintenance, and safe work practices for drill rigs as required and addressed in the site-specific HASP. The drilling crew will review and follow requirements in equipment operator's manual, drilling safety plan, and site-specific HASP. The drilling safety plan and HASP shall be specific to the type of drilling equipment and operations to be

performed, include all local, state, federal, and client requirements and regulations, and address applicable Environmental Health and Safety topics covered in Tetra Tech H&S Programs. The safety plans shall also address information and safe work practices contained in the National Drilling Association (NDA), Drilling Safety Guide.

It is also the responsibility of all employees involved in drilling operations to:

- Report immediately any equipment that needs repair/replacement.
- Use personal protective equipment (PPE) as addressed in the site-specific HASP.
- Replace any guard or cover removed for inspection, maintenance, or setup before operating equipment.

3.1.3 Line Management

The Project Manager (PM) is responsible for selecting a qualified drilling subcontractor for the project, ensuring all project employees and subcontractors follow the requirements in this procedure and for the health and safety of all Tetra Tech and subcontractor employees on the job site. The PM shall ensure this procedure is included and other appropriate health and safety requirements in the subcontractor's scope of work and specifications.

3.1.4 Project Site Safety Coordinator (SSC) Personnel

SSC Personnel shall:

- Ensure workers, including subcontractor personnel, follow the requirements in this procedure, and are qualified/trained to operate equipment and perform project work activities.
- Ensure all equipment has been inspected in accordance with the manufacturer's requirements and recommendations prior to use.
- Review and approve drilling safety plan for specific activities prior to project start-up.
- Assist Line Management in project oversight and implementing safe work practices based on Tetra Tec environmental health and safety, quality programs, equipment manufacturer's recommendations, the NDA Drilling Safety Guide, and the U.S. Army Corps of Engineers, EM 385-1-1, Safety and Health Requirements Manual, and any

client specific requirements as applicable.

3.2 Equipment Inspections

Initial acceptance inspection for drill rigs and equipment shall be performed when equipment first arrives on site and prior to using. Daily drill rig and equipment inspections shall be performed in accordance with manufacturer's recommendations and documented on Attachment 1, or similar form. Responsibility for equipment inspections shall be addressed in the site-specific HASP and include, but are not limited to the following:

- Structural damage
- Loose nuts and bolts
- Proper tension in chain drives
- Inspection of cables and lines
- Loose or missing guards or protective covers
- Fluid leaks on the drilling equipment and/or truck the rig is mounted on, and all support vehicles
- Damaged hoses and/or damaged pressure gauges and pressure relief valves
- Check and test all safety devices and warning systems daily, such as emergency shut down/deadman switch operation.
- Check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds each time engine is started
- If a boom is used on a support truck, it may be deemed a crane and require a crane checklist prior to use. This should be verified with the client and subcontractor prior to the equipment arriving on site and inspections and use shall be addressed in the safety plan
- Presence of functional safety equipment and tagged fire extinguisher
- Presence of the operator's manual and recent mechanic's checklist as required

Potential, or out-of-the-ordinary, problems shall be documented and reported to supervision

and SHSO/ESS prior to using equipment. Documentation shall also include contacts and determinations with the Project Manager, Project Environmental Safety Manager (PESM), and client if necessary, to determine if the equipment is safe to use, or repairs are required prior to use.

3.3 Maintenance and Housekeeping

Proper maintenance and housekeeping is essential to providing safe drilling operations. All maintenance shall be performed safely in accordance with equipment manufacturer's recommendations. These requirements may include, but are not limited to:

- Keep drill rigs and associated equipment in safe working condition.
- Shut down the drill rig engine to make repairs or adjustments or to lubricate fittings (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidental starting of an engine during maintenance by locking, removing or tagging the ignition key
- Always block the wheels or lower the leveling jacks or both and set hand brakes before working under a drill rig.
- When appropriate and possible, release all pressure on the hydraulic systems, drilling fluid system, and the air pressure systems of the drill rig prior to performing maintenance. In other words, reduce the drill rig and operating system to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs, radiator caps, and other pressurized plugs and caps.
- Do not touch engine or exhaust system of an engine following its operation until they had adequate time to cool.
- Follow the manufacturer's recommendations for using the proper quantity and quality of lubricants, hydraulic oils and/or coolants.
- Replace all caps, filler plugs, protective guards, panels, high-pressure hose clamps, and chains or cables that have been removed for maintenance before returning the drill rig to service.

The following housekeeping practices shall be used:

- Work areas shall be kept reasonably clean and free of debris in order to minimize slip and trip hazards.
- Any leaks or spills shall be promptly cleaned up to minimize slipping, fire hazards, and environmental releases.
- Means shall be provided to convey any hazardous substances away from the rig floor while pulling wet strings of pipe.
- Pipes, drill rods, casings, augers and other drilling tools must be properly placed in racks or sills to prevent rolling and/or sliding.
- Penetration or other driving hammers must be placed at a safe location on the ground and secure from moving.

3.4 Fire Prevention and Protection

The following fire prevention and protection practices shall be used:

- Smoking, open fires, or other potential sources of ignition shall be permitted only in designated areas located at a safe distance from the wellhead of flammable liquid storage areas. Operations, or areas which constitute a fire hazard, shall be conspicuously posted with a sign, "NO SMOKING OR OPEN FLAME."
- Hazardous substances shall be stored in approved containers and properly labeled.
- Never cut/weld on or near fuel tanks.
- Do not use gasoline or other flammable liquids as a cleaning agent on equipment or tools.
- Refuel equipment in a well-ventilated area.
- Do not fill tanks while the engine is running; allow engine and exhaust to cool down. Turn off all electrical switches.
- Equipment, cellars, rig floors, and ground areas adjacent to the well shall be kept free from oil or gas accumulations which might create or aggravate fire hazards.
- Oxygen, natural gas, or liquefied petroleum gas shall not be used to operate spray guns or pneumatic tools.
- Combustible materials, such as oily rags and waste, shall be stored in covered metal

containers. The contents shall be disposed of daily.

- Fire extinguishers shall be located, tagged, inspected, and maintained at the work site. More or larger extinguishers shall be provided where the type of operation produces more hazardous conditions.
- Firefighting equipment shall not be tampered with and shall not be removed for other than fire protection and firefighting purposes.

3.5 Personal Protective Equipment (PPE)

The drilling safety plan and site-specific HASP shall address the required PPE to be used when working around drill rig and on the work site.

Typical PPE required includes, but not limited to:

- Hard hats
- Safety glasses with side shields
- Steel toed boots
- Hearing protection

In addition, the following safe practices shall be used:

- Loose or poorly fitted clothing shall not be worn during drilling operations.
- While on the worksite, an employee shall refrain from, or minimize, wearing jewelry or other adornments which are prone to snagging or hanging and causing injury.
- An employee whose length of hair poses a hazard on the worksite shall keep his or her hair contained in a suitable manner while working. Hair and beard styles shall not interfere with the wearing of respiratory protective equipment.
- An employee, when engaged in work 6 feet or more above the rig floor or other working surfaces must follow Fall Protection requirements in SWP 5-10 Fall Protection Practices.

- A safety harness and any lifeline and lanyard must be used only for safeguarding the employee from falls.
- The safety harness, lifeline, and lanyard must be provided, constructed, inspected, and maintained.
- When working in the mast or derrick, an employee must be provided with a safety harness and a lanyard or lifeline which is adjusted to allow the minimum of drop in case of a fall.

3.6 Drill Rig Utilization and Alterations

Do not attempt to exceed manufacturer's ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes which they are intended and designed for (i.e., auger strings cannot be connected with anything but bolts designed to connect auger strings).

Alterations to a drill rig or drilling tools shall only be made by qualified personnel and only after consultation and approval from the manufacturer, site supervision, PM and SSC.

3.7 Work Site Set-up and Demobilize

Prior to drilling, follow SWP Underground Utilities, requirements and perform adequate site clearing and leveling to accommodate the drill rig equipment and supplies, and provide a safe working area. Drilling shall not be commenced when tree limbs, unstable ground or site obstructions cause unsafe conditions.

The following precautions shall be used when setting up and demobilizing equipment:

- Know the traveling height (overhead clearance), width, length and weight of the drill rig with carrier and know any road or bridge load limits, width and overhead limits, making sure these limits are not exceeded and allowing an adequate margin of safety.
- Always use the assistance of someone on the ground as a guide/spotter when lateral or overhead clearance is close, or uneven terrain, or other conditions warrant.
- Never move a drill rig unless the vehicle brakes are in sound working order.
- Allow for mast overhang when cornering or approaching other vehicles or structures.

- Watch for low hanging electrical lines, particularly at the entrances to drilling sites.
- Never travel on a street, road, highway with the mast (derrick) of the drill in the raised or partially raised position.
- After the drill rig has been moved to drilling site, set all brakes and/or locks, block wheels, and remove all ignition keys when drill is left unattended.

The following safety precautions relating to off-road movement shall be used:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven or hilly ground.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling a side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of gravity. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

3.8 Safety During Drilling Operations

Safety requires the attention and cooperation of every worker and site visitor. Instruct all personnel to "stand clear" of the drill rig immediately prior to and during starting of drill rig engine. Start all engines according to the manufacturer's recommendations.

Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers

are in the correct non-actuating positions and the cathead rope is not on the cathead before starting a drill rig engine.

The following safe drilling practices shall be used:

- Do not drive the drill rig from hole with the mast (derrick) in the raised position.
- Check for overhead obstructions before raising the mast (derrick).
- Maintain minimum clearance from all overhead electric lines as addressed in SWP 5-9 Safe Electrical Work Practices.
- Before raising the mast (derrick), all drill rig personnel (with the exception of the operator) and visitors shall be cleared from the areas immediately to the rear and the sides of the mast. All drill rig personnel and visitors shall be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig shall be re-leveled if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.
- The operator of a drill rig shall only operate a drill rig from the position of the controls. If the operator of the drill rig must leave the area of the controls, the operator shall shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator shall shut down the drill engine before leaving the vicinity of the drill rig.
- Tools shall not be discarded carelessly around the drill rig, and shall be carefully passed by hand between personnel or by use of a hoist line if possible.
- When encountering a "hot spot" during drilling operations involving volatiles, vacate the immediate area and allow the borehole to vent. Resume work after monitoring instruments indicate an atmosphere in compliance with the site-specific HASP.
- If it is necessary to drill within an enclosed area, make certain that exhaust gases are vented out of the area. Exhaust gases can be toxic and some cannot be detected by smell.

- Clean mud and grease from your boots before mounting a drill platform and use hand holds and railings. Maintain three points of contact at all times when climbing or dismounting. Watch for slippery ground when dismounting from the platform.
- During freezing weather, do not touch metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- All air and water lines and pumps should be drained when not in use if freezing weather is expected.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors or animals from stepping or falling into the hole. All open boreholes shall be covered, protected or backfilled adequately and according to local or state regulations on completion of the drilling project.
- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Maintain three points of contact at all times when climbing or dismounting. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

3.9 Safe Use of Wire Line Hoists, Wire Rope and Hoisting Hardware

The use of wire line hoists, wire rope and hoisting hardware shall be as stipulated by 29 CFR 1910, 29 CFR 1926, and the American Iron Steel Institute Wire Rope Users Manual. The following safe practices shall be used:

- Visually inspect all wire ropes and fittings during use and thoroughly inspect them at least once a week for: abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion and damage to lifting hardware. Replace wire ropes when inspection indicates excessive damage according to the Wire Rope Users Manual. Thoroughly inspect all wire ropes which have not been used for a period of a month or more before returning them to service.
- During rig operations, monitor the condition of the wire rope and the reel for uneven or improper spooling.
- End fittings and connections consist of spliced eyes and various manufactured devices. Install all manufactured end fittings and connections according to the

manufacturer's instructions and follow the manufacturer's load specifications.

- If a ball-bearing type hoisting swivel is used to hoist drill rods, inspect and lubricate the swivel daily to assure that the swivel freely rotates under load.
- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 foot (0.3 cm) of the drill rod column above the top of the mast (derrick), do not hoist a rod column with loose tool joints and do not make up, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods with your hands or by tensioning the slipping device.
- Most sheaves on exploration drill rigs are stationary with a single part line. Never increase the number of parts of line without first consulting with the manufacturer of the drill rig.
- Wire ropes must be properly matched with each sheave - if the rope is too large, the sheave will pinch the wire rope - if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger sized wire ropes

The following procedures and precautions must be understood and implemented for safe use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull objects away from the drill rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far away as possible from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope - apply loads smoothly and steadily.
- Avoid sudden loading in cold weather.

- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- All lifting hooks shall be equipped with safety latches.
- Replace damaged safety latches on safety hooks before using.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Inspect and test clutches and brakes of hoists periodically.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves and pinch points as slack is being taken up and when the load is being hoisted.
- Never hoist the load over the head, body or feet of any personnel.
- Never use a hoist line to "ride up" the mast (derrick) of a drill rig.
- Replacement wire ropes should conform to the drill rig manufacturer's specifications.

3.10 Safe Use of Cathead and Rope Hoists

The following safety procedures shall be employed when using a cathead hoist:
Keep the cathead clean and free of rust and oil and/or grease. Clean the cathead with a wire brush if it becomes rusty. Check the cathead periodically, when the engine is not running, for rope wear grooves. Replace the cathead if a rope groove forms to a depth greater than 1/8 inch (3 mm).

- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator shall also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator shall keep careful watch on the suspended tools and shall quickly back away after turning off the engine.
- The rope shall always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.
- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg or any other part of your body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samples, casing or other tools with the cathead and rope methods. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose unbuttoned or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.

- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator must be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

3.11 Safe Use of Augers

The following precautions shall be observed when using augers:

- The operator and tool handler shall establish a system of responsibility for the various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must assure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or figures under the bottom of an auger section when hoisting the auger over other auger sections or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatsoever.
- Avoid using hands or feet to scrape mud or cuttings as auger comes out of the hole. The preferred method would be to use tools such as a long-handled shovel to move auger cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Augers should be cleaned only

when the drill rig is in neutral and the augers are stopped from rotating.

3.12 Safe Practices During Rotary and Core Drilling

Rotary and core drilling tools shall be inspected prior to use. Special precautions for safe rotary or core drilling involve chucking, joint break, hoisting and lowering of drill rods and the following:

- Lubricate and check water swivels and hoisting plugs for "frozen" bearings before use. Use only approved lubrication fluids.
- Check drill rod chuck jaws periodically and replace when necessary.
- Check the capacities of hoists and sheaves against the anticipated weight to the drill rod string plus other expected hoisting loads.
- Only the operator of the drill rig shall brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- Do not break drill rods during lowering into the hole with drill rod chuck jaws.
- Do not hold or lower drill rods into the hold with pipe wrenches.
- If a string of drill rods are accidentally or inadvertently release into the hole, do not attempt to grab the falling rods with your hands or a wrench.
- In the event of a plugged bit or other circulation blockage, relieve or bleed down the high pressure in the piping and hose between the pump and the obstruction before breaking the first tool joint.
- When drill rods are hoisted from the hole, they shall be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.
- If work must progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit shall be equipped with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Do not lean unsecured drill rods against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down

- For air rigs, be aware of the air discharge line and the cyclone. The discharge line from the casing to the cyclone should have a safety chain on either end in the event that the coupler comes loose. Do not stand in the area where the discharge line could hit you if it broke. Do not stand directly downwind where you could get hit by drill cuttings should the discharge line break free of the cyclone.

4.0 DEFINITIONS

4.1 Air Rotary Drilling

This method utilizes air as a circulating medium to; cool the drill bit, bring drill cuttings to the surface and maintain borehole integrity. When drilling with a conventional air rotary system, the cuttings are removed from the borehole using high annular pressure created by an air compressor at the surface. The air that is circulated also acts to cool the drill bit as it circulates from inside the drill rod and out and around the bit.

4.2 Annular Space

The space surrounding the pipe suspended in the wellbore. The outer wall of the annular space may be an open hole or it may be larger pipe.

4.3 Auger Rig

Drilling method in which a hole is drilled by rotating a corkscrew type hollow stem steel drill.

4.4 Cable Tool Drilling

Drilling method in which hole is drilled by advancing a drive barrel and/or hand tool. As the hole is advanced a steel casing is driven by a cable to prevent collapse.

4.5 Cathead

A spool-shaped extension of the draw works shaft used to lift heavy equipment and to make up or break out drill pipe.

4.6 Cone Penetration Testing (CPT)

Cone specialty probes and samplers that when deployed remove soil data for testing pertinent to geotechnical and environmental site investigations.

4.7 Core Drilling

Specifically used to remove a cylinder of material. The material left inside the drill bit is referred to as the *core* and the drilling apparatus used in obtaining a core sample is often referred to as a corer. Core drilling is used for many applications, either where the core needs to be preserved, or where drilling can be done more rapidly since much less material needs to be removed than with a standard bit.

4.8 Cribbing

Logs, 2 X 4s or other non-compressible material used to support an object above the ground/floor.

4.9 Cuttings

Soil or other particles obtained during drilling operations. Cuttings are brought to the surface by circulating mud-laden fluid in rotary drilling or by hollow stem auger drilling. They are bailed out in cable tool drilling.

4.10 Derrick

Any one of a large number of types of load-bearing structures. In drilling work, the standard derrick has four legs standing at the corners of the substructure and reaching to the crown block. The substructure is an assembly of heavy beams used to elevate the derrick above the ground and provide space to install blowout preventers, casing heads, etc. The standard derrick has largely been replaced by the mast for drilling. The mast is lowered and raised without disassembly.

4.11 Direct Penetration Testing (DPT)

Soil probing techniques, also referred to as “Direct Push” techniques, where tools and sensors are inserted into the ground without the use of drilling to remove soil and make a path for the tool. This allows for nominal disturbance to the ground surface and assures sample integrity and data quality.

4.12 Mud

The liquid that is circulated through the wellbore during rotary drilling and workover operations. In addition to its function of bringing cuttings to the surface, mud also cools and lubricates the bit and drill string, protects against blowouts by containing subsurface pressures, and deposits a mud cake on the wall of the borehole to prevent loss of fluids to the formations. Although it originally was a suspension of earth solids, especially clays, in water, the mud used in modern drilling operations is a somewhat more complex three-phase mixture of liquids, reactive solids, and inert solids. The liquid phase may be fresh water, diesel oil, or crude oil and may contain one or more conditioners.

4.13 Rotary Drilling

The drilling method by which a hole is drilled by a rotating bit to which a downward force (drill collars) is applied. The bit is fastened to and rotated by the drill stem, which also provides a passage for the circulating fluid.

4.14 Sheave

A wheel or disc with a grooved rim, especially one used as a pulley.

4.15 Sonic Drilling

This method provides continuous samples in a wide range of soil types, including soils with large particles that preclude sampling by many other techniques. The drill stem and sampler barrel are vibrated vertically at frequencies between about 50 and 180 Hz (hence the name sonic) such that the sampler barrel normally advances by slicing through the soil undisturbed.

DRILL RIGS ATTACHMENT 1
EQUIPMENT SAFETY INSPECTION CHECKLIST FOR SMALL AUGER, ROTARY, AND CORE RIGS

I. Rig Carrier
( ) Overall Appearance
( ) Overall Operation: head/brake lights, turn signals, horn, wipers, tires, steering
( ) Oil Leaks
( ) Fuel Leaks
( ) Fire Extinguisher
( ) Back-up Alarm
( ) Exhaust System
( ) Wheel Chocks
( ) Outrigger Jacks
( ) Fuel Tank Placard(s)
( ) Portable fuel containers
( ) Other: _____
( ) Other: _____

II. Mast
( ) Crown Block ( ) Hinge Pins ( ) Lock Pins/Devices ( ) Lights/Wiring ( ) Safety Climbing Device ( ) Safety Belts/Harness ( ) Racking Board ( ) Ladders ( ) Deadman Anchors ( ) Standpipe ( ) Swivel Hose ( ) Safety Chains/Clamps ( ) Mast Rams/Cylinders ( ) Welds ( ) Lubrication ( ) Other:_____ ( ) Other:_____

III. Rig Engine(s)
( ) Fuel Tank(s) ( ) Exhaust System ( ) Electrical System ( ) Belt/Drive Line Guards ( ) Emergency Shut-down System(s) ( ) Heat Shields ( ) Fluid Leaks ( ) Gauges ( ) Clutches ( ) Other:_____ ( ) Other:_____

IV. Power Train/Drill Unit
( ) Chain/Belt Guards ( ) Fluid Leaks ( ) Driveline Guards ( ) Hydraulic Hoses ( ) Safety Chains/Lanyards

IV. Power Train/Drill Unit (continued)
( ) Gauges ( ) Loose Bolts ( ) Rotary Table ( ) Drive Head ( ) Auger Drive ( ) Other:_____ ( ) Other:_____

V. Pump(s) / Compressor(s)

( ) Sheaf Relief Valve Cover(s) ( ) Pressure Relief Valve(s) ( ) Flowline Safety Clamps/chains ( ) Belt/Chain Guards ( ) Vibrator Line Anchor ( ) Other:_____ ( ) Other:_____

VI. Hoists/Catheads

( ) Chain Guard(s)
  ( ) Spool/Drum wear (>1/8 inch depth), cracks
( ) Sheaves
( ) Safety Devices/Spool Divider
( ) Clutch(s)
( ) Brake(s)
( ) Hydraulics
( ) Wireline Drum-coring
( ) Drive Hammer(s)
( ) Other:_____
( ) Other:_____

VII. Wireline/Catline

( ) Wear/broken strands/kinks ( ) Spooling ( ) Cable Clamps and Thimbles ( ) Cable Ends ( ) Catline Rope Condition ( ) Catline Rope knot taped ( ) Other:_____ ( ) Other:_____

VIII. Hoisting Equipment

( ) Hoisting Plug(s) ( ) Lifting Iron(s) ( ) Elevators ( ) Weight Indicator ( ) Safety Hook(s)-latch in working order ( ) Splice(s) ( ) Slips ( ) Foot Clamps ( ) Chain Wrenches ( ) Rod Pins ( ) Other:_____ ( ) Other:_____

IX. Downhole Equipment

( ) Drillpipe ( ) Drill collars ( ) Core Rod ( ) Core Barrel(s) ( ) Augers ( ) Samplers ( ) Bailers ( ) Center Bit ( ) Other:_____ ( ) Other:_____

X. Miscellaneous Safety Items

( ) Kill Switch - functional ( ) Placards/Warning Signs ( ) Applicable OSHA Postings ( ) First Aid Kit ( ) Applicable Regulation Posting ( ) Emergency Medical Posting(s) ( ) Emergency Procedures ( ) Spill Kit ( ) Hydraulic Lines cabled ( ) Other:_____ ( ) Other:_____

XI. Personal Protective Equipment

( ) Hard Hats ( ) Safety Glasses ( ) Safety boots/shoes ( ) Hearing Protection ( ) Other:_____ ( ) Other:_____

XII. Licenses

( ) Drillers licensed ( ) Hydraulic license ( ) 40-hour HAZWOPER & annual update ( ) Medical clearance ( ) Site-specific training

XIII. Other Items

( ) _____ ( ) _____

COMMENTS:_____

Revision Date	Document Authorizer Name	Revision Details
10/1/2011	Chris McClain	Update

Material Safety Data Sheets (MSDS)

Alconox (Decontamination)

Eye Wash Solution Concentrate (Decontamination)

D-Lead Soap (Decontamination)

Nitric Acid (Laboratory Preservative)

Sodium Hydroxide (Laboratory Preservative)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date 25.05.2012 Revision: 24.05.2012

1 Identification of the substance/mixture and of the company/undertaking

· **1.1 Product identifier**

· **Trade name: ALCONOX**
· **Application of the substance / the preparation** Cleaning material/ Detergent

· **1.3 Details of the supplier of the Safety Data Sheet**
· **Manufacturer/Supplier:**
Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040

· **Further information obtainable from:** Product Safety Department
· **1.4 Emergency telephone number:**
ChemTel Inc.
(800)255-3924, +1 (813)248-0585

2 Hazards identification

· **2.1 Classification of the substance or mixture**
· **Classification according to Regulation (EC) No 1272/2008**


GHS05 corrosion

Eye Dam. 1 H318 Causes serious eye damage.


GHS07

Skin Irrit. 2 H315 Causes skin irritation.

· **Classification according to Directive 67/548/EEC or Directive 1999/45/EC**

Xi; Irritant

R38-41: Irritating to skin. Risk of serious damage to eyes.
· **Information concerning particular hazards for human and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.
· **Classification system:**
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.

· **2.2 Label elements**
· **Labelling according to Regulation (EC) No 1272/2008**
The product is classified and labelled according to the CLP regulation.
· **Hazard pictograms**


GHS05

· **Signal word** Danger

· **Hazard-determining components of labelling:**
Benzenesulfonic Acid, Sodium Salts

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Safety Data Sheet
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Trade name: ALCONOX

(Contd. of page 1)

· **Hazard statements**
H315 Causes skin irritation.
H318 Causes serious eye damage.
· **Precautionary statements**

P280	Wear protective gloves/protective clothing/eye protection/face protection.
P264	Wash thoroughly after handling.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/physician.
P321	Specific treatment (see on this label).
P362	Take off contaminated clothing and wash before reuse.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P302+P352	IF ON SKIN: Wash with plenty of soap and water.

· **Hazard description:**
· **WHMIS-symbols:**
D2B - Toxic material causing other toxic effects

· **NFPA ratings (scale 0 - 4)**

Health = 1
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 1
Fire = 0
Reactivity = 0

· **2.3 Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **3.2 Mixtures**
· **Description:** Mixture of substances listed below with nonhazardous additions.

· **Dangerous components:**		
CAS: 68081-81-2	Benzenesulfonic Acid, Sodium Salts Xi R38-41 Eye Dam. 1, H318 Skin Irrit. 2, H315	10-25%
CAS: 497-19-8 EINECS: 207-838-8 Index number: 011-005-00-2	sodium carbonate Xi R36 Eye Irrit. 2, H319	2,5-10%

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CAS: 7722-88-5 EINECS: 231-767-1	tetrasodium pyrophosphate substance with a Community workplace exposure limit	2,5-10%
CAS: 151-21-3 EINECS: 205-788-1	sodium dodecyl sulphate Xn R21/22; Xi R36/38 Acute Tox. 4, H302; Acute Tox. 4, H312; Skin Irrit. 2, H315; Eye Irrit. 2, H319	2,5-10%

· **Additional information:** For the wording of the listed risk phrases refer to section 16.

4 First aid measures

· **4.1 Description of first aid measures**
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
If skin irritation continues, consult a doctor.
· **After eye contact:**
Remove contact lenses if worn.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:**
Do not induce vomiting; call for medical help immediately.
Rinse out mouth and then drink plenty of water.
· **4.2 Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **4.3 Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Firefighting measures

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:**
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **5.2 Special hazards arising from the substance or mixture**
No further relevant information available.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.

6 Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures**
Product forms slippery surface when combined with water.
· **6.2 Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **6.3 Methods and material for containment and cleaning up:**
Pick up mechanically.
Clean the affected area carefully; suitable cleaners are:
Warm water
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.

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See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **7.1 Precautions for safe handling**
Prevent formation of dust.
Keep receptacles tightly sealed.
· **Information about fire - and explosion protection:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Protect from humidity and water.
· **7.3 Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**

· **Ingredients with limit values that require monitoring at the workplace:**	
7722-88-5 tetrasodium pyrophosphate	
REL (USA)	5 mg/m³
TLV (USA)	TLV withdrawn
EV (Canada)	5 mg/m³

· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing
Wash hands before breaks and at the end of work.
Avoid contact with the skin.
Avoid contact with the eyes and skin.
· **Respiratory protection:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.
· **Protection of hands:**


Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

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· **Material of gloves**
Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber, NR
Neoprene gloves
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**


Safety glasses

· **Body protection:** Protective work clothing

9 Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Powder
Colour:	White
· **Odour:**	Odourless
· **Odour threshold:**	Not determined.
· **pH-value (10 g/l) at 20°C:**	9,5 (- NA for Powder form)
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not determined.
· **Ignition temperature:**	
Decomposition temperature:	Not determined.
· **Self-igniting:**	Product is not selfigniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapour pressure:**	Not applicable.
· **Density at 20°C:**	1,1 g/cm³
· **Relative density**	Not determined.
· **Vapour density**	Not applicable.

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Trade name: ALCONOX

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· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with water:**	Soluble.
· **Segregation coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Solvent content:**	
Organic solvents:	0,0 %
Solids content:	100 %
· **9.2 Other information**	No further relevant information available.

10 Stability and reactivity

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **10.3 Possibility of hazardous reactions**
Reacts with acids.
Reacts with strong alkali.
Reacts with strong oxidizing agents.
· **10.4 Conditions to avoid** No further relevant information available.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:**
Carbon monoxide and carbon dioxide
Phosphorus compounds
Sulphur oxides (SOx)

11 Toxicological information

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:
Irritant
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

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12 Ecological information

· **12.1 Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **12.2 Persistence and degradability** No further relevant information available.
· **12.3 Bioaccumulative potential** Not worth-mentioning accumulating in organisms
· **12.4 Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **12.6 Other adverse effects** No further relevant information available.

13 Disposal considerations

· **13.1 Waste treatment methods**
· **Recommendation**
Smaller quantities can be disposed of with household waste.
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.

· **Uncleaned packaging:**
· **Recommendation:** Disposal must be made according to official regulations.
· **Recommended cleansing agents:** Water, if necessary together with cleansing agents.

14 Transport information

· **14.1 UN-Number**	
· **DOT, ADR, ADN, IMDG, IATA**	N/A
· **14.2 UN proper shipping name**	
· **DOT, ADR, ADN, IMDG, IATA**	N/A
· **14.3 Transport hazard class(es)**	
· **DOT, ADR, ADN, IMDG, IATA**	
· **Class**	N/A
· **14.4 Packing group**	
· **DOT, ADR, IMDG, IATA**	N/A
· **14.5 Environmental hazards:**	
· **Marine pollutant:**	No

(Contd. on page 8)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date 25.05.2012 Revision: 24.05.2012

Trade name: ALCONOX

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· **14.6 Special precautions for user**	Not applicable.
· **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	N/A

15 Regulatory information

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **United States (USA)**
· **SARA**

· **Section 355 (extremely hazardous substances):**
None of the ingredients is listed.
· **Section 313 (Specific toxic chemical listings):**
None of the ingredients is listed.
· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65 (California):**

· **Chemicals known to cause cancer:**
None of the ingredients is listed.
· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients is listed.
· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients is listed.
· **Chemicals known to cause developmental toxicity:**
None of the ingredients is listed.

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.
· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.
· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

· **Canada**

· **Canadian Domestic Substances List (DSL)**
All ingredients are listed.
· **Canadian Ingredient Disclosure list (limit 0.1%)**
None of the ingredients is listed.

(Contd. on page 9)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date 25.05.2012 Revision: 24.05.2012

Trade name: ALCONOX

(Contd. of page 8)

· **Canadian Ingredient Disclosure list (limit 1%)**	
497-19-8	sodium carbonate
7722-88-5	tetrasodium pyrophosphate
151-21-3	sodium dodecyl sulphate

· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Relevant phrases**
H302 Harmful if swallowed.
H312 Harmful in contact with skin.
H315 Causes skin irritation.
H318 Causes serious eye damage.
H319 Causes serious eye irritation.

R21/22 Harmful in contact with skin and if swallowed.
R36 Irritating to eyes.
R36/38 Irritating to eyes and skin.
R38 Irritating to skin.
R41 Risk of serious damage to eyes.

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

1455 Kleppe Lane ◆Sparks, NV 89431-6467 ◆(775) 359-4712 ◆Fax (775) 359-7424
E-mail: haws@hawsco.com ◆website: www.hawsco.com

No. 2080222(12)

Model 9082
Sterile Antimicrobial Preservative Concentrate Eyewash Additive

TO ORDER MORE EYE WASH STATION PRESERVATIVE CONCENTRATE:
Contact your nearest Haws Representative or call Haws Customer Service at 1-888-640-4297, Sparks, Nevada.

WARNING:

1. MUST BE DILUTED WITH **POTABLE** WATER. DO NOT PUT DIRECTLY INTO EYES. Do not use if tamper evident twist-off top is broken or missing.
2. Contact with the eyes and mucosa can cause irritation, redness and pain.
3. **SEE PAGE 2 FOR MSDS AND EMERGENCY CONTACT INFORMATION.**

Mixing Instructions

Follow instructions on the side of each bottle. Units with capacities of 5-20 gallons (18.93 – 75.7L) should be mixed with the full 5 ounces (237 ml) contained in each bottle. It is recommended that the tentative potable water be replaced every 90 days. This procedure may be followed even with weekly 15-second testings. (Water consumed in testing, should be replaced with clean potable water).

Storage Instructions

Product should be stored between 36-104°F (2-40°C) and used between 59-86°F (15-30°C). Use before expiration date.

MATERIAL SAFETY DATA SHEET

SUPPLIER:

Haws Corporation

1455 Kleppe Lane
Sparks, NV 89431
USA

EMERGENCY TELEPHONE

INFORMATION:Telephone 1-888-640-4297 or 1-775-359-4712 Monday - Thursday 6am-4:30pm PST 6am-4:00pm PST Friday

EMERGENCY: If swallowed get medical help or call your Poison Control Center right away

N.D.: NO DATA AVAILABLE N.A.: NOT APPLICABLE

SECTION 1 – PRODUCT IDENTIFICATION

COMMERCIAL NAME:	Model 9082 Eyewash Additive, sterile antimicrobial preservative
CHEMICAL NAME:	
CHEMICAL FORMULA:	1, 6-Di-(N-p-Chlorophenyl diguanide) hexane digluconate ($C_{22}H_{30}Cl_2N_{10}•2C_6H_{12}O_7$)
CHEMICAL FAMILY:	Organic, cationic.
CODE:	C249
PRODUCT USE:	Eyewash flushing **concentrate** for portable 5gal.to 20gal.(18.9L – 75.7L) emergency eyewash stations. MUST BE DILUTED WITH **POTABLE** WATER. DO NOT PUT DIRECTLY INTO EYES. Do not use if tamper evident twist-off top is broken or missing
WHMIS CLASSIFICATION:	N.A.
TDG CLASSIFICATION:	N.A.

SECTION 2 – INGREDIENTS

CONTROLLED INGREDIENTS (Over 1% (w/w) :

CHLORHEXIDINE GLUCONATE BP	CAS: 18472-51-0	1-5%	LD_{50} (MOUSE-ORAL) =1800 mg/Kg
PROPYLENE GLYCOL USP	CAS: 57-55-6	10-20%	

SECTION 3 - PHYSICAL CHARACTERISTICS

PHYSICAL STATE, ODOR & APPEARANCE:	Clear, odourless, water white liquid
THRESHOLD ODOUR:	N.A.
BOILING POINT:	>100°C
pH AT 25°C:	5.0 – 7.0
SPECIFIC GRAVITY AT 20°C. (water=1):	.99
VAPOUR PRESSURE mmHg AT 20°C:	N.A.
VAPOUR DENSITY (air= 1) :	<1
WATER SOLUBILITY:	good
FREEZING POINT:	N.A.
EVAPORATION RATE (WATER=1):	approximately 1
PARTITION COEFFICIENT (WATER/OIL):	N.D. miscible with water.
FLASH POINT:	non-flammable
AUTOIGNITION TEMPERATURE:	N.A.

SECTION 4 – REACTIVITY

STABILITY: Chemically stable under normal conditions.
CONDITIONS TO AVOID: Avoid exposure to heat.
INCOMPATIBILITE: Avoid strong oxidizing materials
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon Monoxide
HAZARDOUS POLYMERISATION: None.

SECTION 5 - FIRE AND EXPLOSION HAZARD

FLAMMABILITY: Non-flammable liquids.
SPECIAL FIRE HAZARDS: N.A.
HAZARDOUS COMBUSTION PRODUCTS: Carbon monoxide and carbon dioxide can be produce.
FIRE FIGHTING MEDIA: Use alcohol-resistant foam, carbon dioxide or chemical powders for small fires. For larger amounts (multiple packages / pallets) of product: Since toxic, corrosive or flammable vapours might de evolved from fires involving this product and associated packaging, self contained breathing apparatus and full protective equipments are recommended for firefighters. If possible, contain and collect firefighting water for later disposal.

SECTION 6 - TOXICOLOGICAL PROPERTIES

EFFECTS OF ACUTE EXPOSURE:
EYES: Contacts with the eyes and mucosa can cause irritation, redness and pain.
SKIN: In normal use, does not cause irritation. However, sensitive individuals may develop minor skin irritation.
INHALATION: N.A.
INGESTION: Chlorhexidine Gluconate has a relatively low LD50 value since it is poorly absorbed by the intestine. It is rather eliminated in the feces. The Isopropyl Alcohol is however more harmful if ingested. It may: irritate the gastro-intestinal track, affect the nervous system, liver and kidneys. May cause nausea, headache and alter vision.

EFFECTS OF CHRONIC EXPOSURE:
Prolonged and repeated exposure by application on the skin may cause a chronic skin irritation.

SECTION 7 - PREVENTATIVE MEASURES

AS NEEDED, APPLY THE APPROPRIATE MEASURES ACCORDING TO THE AMPLITUDE OF EXPOSURE.
SKIN: Use gloves when handling,
EYES: Avoid any contact with the eyes.
RESPIRATORY TRACT: N.A.
OTHER PROTECTIVE EQUIPMENTS: N.A.
VENTILATION: N.A.
IN CASE OF SPILL OR LEAK: Absorb spills with a neutral absorbing material. Rinse with water.
WASTE DISPOSAL: As dictated by the federal, provincial and municipal, rules.
HANDLING PROCEDURES AND STORAGE REQUIREMENTS: Use with care. Keep bottle tightly closed and store at room temperature. Avoid exposure to temperatures above 49^{o}C.

SECTION 8 – FIRST AID MEASURES

EYES: Flush eyes immediately with large volumes of water continuously for 20 minutes. Consult a physician.
SKIN: In case of accidental contact with skin, wash with soap and rinse with water. If irritation appears, it will probably disappear if not, cease using and consult a physician.
INHALATION: N.A.
INGESTION: Do not induce vomiting. Give water In case of non-induced vomiting, lean victim forward to prevent any risk of asphyxia. Never give any liquid to an unconscious person. Get medical attention.

SECTION 9 - OTHER INFORMATION

REVISED IN:	16Aug12 January 3, 2012
REPLACE VERSION OF:	September 1, 1998, March 10, 2009, February 10, 2010

Material Safety Data Sheet

Issue Date: 04/14/06; Rev 1: 10/31/07; Rev 2: 5/27/08

Section 1. Chemical Product and Company Identification

Product Name: D-Lead® Skin Cleanser

Manufacturer: ESCA Tech, Inc.
3747 North Booth Street
Milwaukee, WI 53212
Phone: (414) 962-5323
Fax: (414) 962-7003

email: cservice@esca-tech.com

Transportation Emergency Phone:
1-800-535-5053
InfoTrac
(24 hours, during transportation only)

Product Code #: 4224TM

CAS No.: Not applicable – product is a mixture

Generic Description: Skin Cleaner

Section 2: Composition/Information on Ingredients

Hazardous Ingredient CAS Number	Max % w/ w	OSHA PEL (TWA) (ppm)	ACGIH TLV (TWA) (ppm)
Sodium dodecylbenzene sulfonate (CAS#: 25155-30-0)	2	NE	NE

Section 3: Hazards Identification

Potential Health Effect

EYE CONTACT: As with any soap, avoid contact with eyes. May cause eye irritation.

SKIN CONTACT: Use on irritated or extremely dry skin may aggravate the existing condition.

INGESTION: Not normal route of entry. May cause upset stomach, nausea.

INHALATION: Does not generate vapors at normal temperatures.

Section 4: First Aid Measures

EYE CONTACT: Remove contact lenses. Flush with water for 15 minutes. If irritation persists, get medical attention.

SKIN CONTACT: If skin irritation occurs discontinue use, apply skin lotion.

INGESTION: Do not induce vomiting. Drink 1-2 glasses of water and get medical attention.

INHALATION: Remove person to fresh air.

Section 5: Fire Fighting Measures

Flash Point:	NA
LEL:	NA
UEL:	NA
Extinguishing Media:	Material will not burn.
Unusual Fire and Explosion Hazards:	Material will not support combustion.
Special Fire Fighting Procedure:	NA

Section 6: Accidental Release Measures

Small spills can be mopped up, and floor rinsed with water. For large spills, stop leak at source, contain spill and absorb onto inert medium for disposal. Place absorbent into labeled, closed container, store in safe location until shipped for proper disposal. Dispose in accordance with all applicable local, state and federal waste regulations.

Section 7: Handling and Storage

Handling: Keep out of reach of small children. Avoid eye contact. Avoid tasting or ingesting this product.

Storage: Store at temperatures between 40 °F and 90 °F (4 °C – 32 °C), out of direct sunlight. Heat buildup may cause product to cloud and separate irreversibly. Keep container tightly closed when not in use.

Section 8: Exposure Controls/Personal Protection

General Controls	Avoid eye contact.
Respiratory Protection:	Not required under normal use condition.
Ventilation:	Not required under normal use condition.
Protective Clothing:	None required under normal use condition.
Protective Gloves:	None required under normal use condition.
Eye Protection:	Not required under normal use condition.
Other Protective Clothing or Equipment:	Eye wash station.
Work/Hygienic Practices:	Follow good housekeeping practices.

Section 9: Physical and Chemical Properties

Boiling Point:	210 °F (~100 °C)
Vapor Pressure:	NE
Vapor Density (Air = 1):	>1, same as water.
Specific Gravity (H2O = 1):	1.02 (8.5 lb/gal)
Evaporation Rate (Butyl Acetate = 1):	NE
Solubility in Water:	Complete.
Appearance and Odor:	Clear, yellow liquid with almond odor.
pH:	Max: 8.5

Section 10: Stability and Reactivity

Stability:	Stable.
Conditions to Avoid:	None known.
Incompatibility (materials to avoid):	Should not be mixed with other chemicals. Extended contact with iron or steel will cause soap to separate.
Hazardous Polymerization	Will not occur.
Hazardous Decomposition	Thermal decomposition may produce carbon monoxide and/or dioxide.

Section 11: Toxicological Information

This product has not been tested as a whole.

Section 12: Ecological Information

This product has not been tested as a whole.

Section 13: Disposal Consideration

After use, solution may contain suspended and dissolved heavy metals along with fats, oils and greases. Discharge wastewater in accordance with all applicable local, state and federal regulations and in accordance with all water discharge permits.

Section 14: Transport Information

Proper Shipping Name (49 CFR 172.101):	Compound, Cleaning Liquid, N.O.S.
D.O.T. Hazard Name (49 CFR 172.101):	NA
D.O.T. ID No.:	NA
D.O.T. Hazard Class:	NA

Section 15: Regulatory Information

RCRA (Lists of Hazardous Wastes, 40 CFR 261 Subpart D):	NA
CLEAN AIR ACT (SEC. 112. Hazardous Air Pollutants):	NA
CLEAN WATER ACT (RQ, 40 CFR):	NA
CERCLA: Section 102 (RQ, 40 CFR):	Sodium dodecylbenzene sulfonate: 1000 lb (454 kg)
SARA Title III: Section 302 -304, 40 CFR 355	Components present in this product at a level which could require reporting are: none.
Section 311 - 312:	Components present in this product at a level which could require reporting are: none.
Section 313:	NA
TSCA Section 8(b) Inventory Status:	All ingredients are listed on TSCA Inventory of Chemical Substances or exempt from TSCA Inventory requirements.
Workplace Hazardous Materials Information System (WHMIS):	Sodium dodecylbenzene sulfonate: D2B

State Lists

Sodium dodecylbenzene sulfonate – FL, MA, NJ, PA

This product is not subject to the reporting requirements under California's Proposition 65.

Section 16: Other Information

NA – Not Applicable
NE – Not Established
RQ - Reportable Quantity

MSDS Number: **N3659** * * * * * *Effective Date:* ***11/02/01*** * * * * * *Supercedes:* ***10/15/99***

NITRIC ACID 1.0 N AND 2.0 N VOLUMETRIC SOLUTIONS

1. Product Identification

Synonyms: Azotic acid solution; nitric acid 6.3%; nitric acid 1.0 N volumetric solution; nitric acid 2.0 N volumetric solution; nitric acid 12.6%
CAS No.: 7697-37-2
Molecular Weight: 63.00
Chemical Formula: HNO3 in H2O
Product Codes:
J.T. Baker: 5639
Mallinckrodt: 3510

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	6 - 13%	Yes
Water	7732-18-5	> 87%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Yellow (Reactive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

---

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.
Explosion:
May react explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.
Fire Extinguishing Media:
If involved in a fire, use water spray.
Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place

in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORBï¿½ or TEAMï¿½ 'Low Na+' acid neutralizers are recommended for spills of this product.

---

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect from physical damage and direct sunlight. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Nitric Acid:
OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA)
ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Specific Gravity:
No information found.
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
No information found.

Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.
Conditions to Avoid:
Heat and incompatibles.

---

11. Toxicological Information

For Nitric Acid: Investigated as a mutagen and reproductive effector.

--------\Cancer Lists\--

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

---

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 20L

---

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\-----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\-----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: Yes (Mixture / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**
Label Hazard Warning:
POISON! DANGER! OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED.

HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Store in a tightly closed container.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

****

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SODIUM HYDROXIDE

1. Product Identification

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate
CAS No.: 1310-73-2
Molecular Weight: 40.00
Chemical Formula: NaOH
Product Codes:
J.T. Baker: 3717, 3718, 3721, 3722, 3723, 3728, 3734, 3736, 5045, 5565
Mallinckrodt: 7001, 7680, 7708, 7712, 7772, 7798

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

Inhalation:
Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.
Ingestion:
Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appears days after exposure.
Skin Contact:
Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.
Eye Contact:
Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Chronic Exposure:
Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

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5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Hot or molten material can react violently with water.
Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.
US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

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7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
2 mg/m3 Ceiling
- ACGIH Threshold Limit Value (TLV):
2 mg/m3 Ceiling
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control

the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:

White, deliquescent pellets or flakes.

Odor:

Odorless.

Solubility:

111 g/100 g of water.

Specific Gravity:

2.13

pH:

13 - 14 (0.5% soln.)

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1390C (2534F)

Melting Point:

318C (604F)

Vapor Density (Air=1):

> 1.0

Vapor Pressure (mm Hg):

Negligible.

Evaporation Rate (BuAc=1):

No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.
Hazardous Decomposition Products:
Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.
Conditions to Avoid:
Moisture, dusting and incompatibles.

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11. Toxicological Information

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

--------\Cancer Lists\----------

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Sodium Hydroxide (1310-73-2)	No	No	None

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12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

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13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

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15. Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------
Ingredient                              TSCA  EC   Japan  Australia
Sodium Hydroxide (1310-73-2)             Yes  Yes   Yes      Yes

-------\Chemical Inventory Status - Part 2\----------------------
                             --Canada--
Ingredient                                Korea  DSL   NDSL  Phil.
Sodium Hydroxide (1310-73-2)                Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----
                   -----SARA 302-------SARA 313------
Ingredient                        RQ    TPQ     List  Chemical Catg.
Sodium Hydroxide (1310-73-2)  No    No      No         No

--------\Federal, State & International Regulations - Part 2\----
                         -RCRA-    -TSCA-
Ingredient                           CERCLA     261.33     8(d)
Sodium Hydroxide (1310-73-2)    1000       No         No

Chemical Weapons Convention:  No
TSCA 12(b):  No
CDTA:  No
SARA 311/312:
Acute: Yes
Chronic: No
Fire: No
Pressure: No
Reactivity: Yes         (Pure / Solid)
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Australian Hazchem Code: 2R
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
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