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HEALTH AND SAFETY PLAN FOR SOLID WASTE MANAGEMENT UNIT 22 (SWMU22) FORMER LEAD AZIDE POND NSA CRANE IN

9/1/2011

TETRA TECH

Health and Safety Plan

For

SWMU 22 (Former Lead Azide Pond)
Naval Support Activity
Crane, Indiana

Naval Facilities Engineering Command Midwest

Contract Number N62470-08-D-1001

Contract Task Order F279

September 2011
Revision 1

HEALTH AND SAFETY PLAN

FOR

SWMU 22 (FORMER LEAD AZIDE POND)
NAVAL SUPPORT ACTIVITY
CRANE, INDIANA

Prepared for:

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REVISION 1

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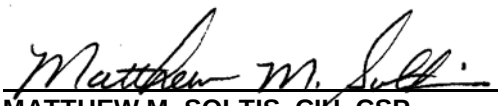

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1.0 INTRODUCTION

The objective of this Health and Safety Plan (HASP) is to provide the safety and health requirements, practices and procedures for Tetra Tech NUS, Inc. (Tetra Tech) and subcontractor personnel at Solid Waste Management Unit (SWMU) 22 (Former Lead Azide Pond) at the Naval Support Activity Crane (NSA Crane), located in Crane, Indiana.

Compliance Objectives:
To meet those requirements established by:

- 29 CFR 1910.120/1926.65
- Applicable sections of 1910 General Industry Standards/1926 Construction Industry Standards (where identified)
- NSA Crane Policies and Procedures

This HASP is to be used in conjunction with the Tetra Tech Health and Safety Guidance Manual (HSGM). The HSGM provides additional detailed information pertaining to hazard recognition and control, and Tetra Tech standard operating procedures. Both documents must be present at the site to satisfy these requirements.

Modification/Changes: This HASP has been written to support proposed tasks and techniques associated with the scope of work as presented in Section 4.0. It has been developed using the latest available information regarding known or suspected chemical contaminants and potential physical hazards associated with the proposed work at the site. Modifications/changes will be made when:

- Changes in the proposed work site conditions and/or
- Suspected hazards change, or
- If new information becomes available, or
- If any person invokes a Stop Work Authority

This document will be modified accordingly. The Project Manager will be responsible for notifying all personnel of changes made.

1.1 AUTHORITY

This work is authorized under the Comprehensive Long - Term Environmental Action Navy (CLEAN) contract, administered through the U.S. Navy, Naval Facilities Engineering Command Atlantic, as defined under

Contract No.: N62470-08-D-1001;
Contract Task Order Number F279

1.2 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines responsibilities for site safety and health for Tetra Tech and subcontractor employees engaged in onsite activities. The personnel assigned to participate in the field work will have the primary responsibility for performing their work tasks in a manner that is consistent with:

- Tetra Tech Health and Safety Policy,
- Health and safety training that they have received,
- Contents of this HASP and identified sections of the HSGM,
- Overall manner that protects their personal safety and health and that of their co-workers.

The following persons are the primary point of contact and have the primary responsibility for observing and implementing this HASP and for overall on-site health and safety.

1.2.1 Tetra Tech Project Manager (PM)

The Tetra Tech PM is responsible for the overall direction of health and safety for this project including the following functions:

- Having Signed Approved documents onsite accessible to all employees and subcontractor personnel including the work plan and this HASP.

- Ensuring recordkeeping meets the objectives specified in this work plan/HASP. This activity includes monitoring field documentation to ensure adequate health and safety practices and action items are properly employed.

- Verifying, where specified, corrective actions are implemented and evaluated.

- Ensuring that project personnel have received training regarding the applicable contents of the work plan, this HASP, and identified elements of the HSGM.

- Providing budgeting for appropriate monitoring, personal protective equipment, decontamination materials, and other project necessities.

- Assuming is ultimately responsible for the actions of his Field Operation Leaders (FOLs) and Site Safety and Health Officers (SSOs) as it pertains to the health and safety measures employed onsite.

- Ensuring when deficiencies are noted that the appropriate control measures are instituted and that this information is communicated to all personnel to ensure it does not happen again. Lessons learned are to be communicated during Tailgate Training sessions by the FOLs and SSOs. This will also insure as the project progresses the efficiency and quality of the work product continually improves.

- Notifying the Navy Remedial Project Manager, Contracting Officer/Contracting Officer Representative, and the Facility Point of Contact in the event of an emergency action/response measure or incident involving injuries, property damage, damage to the environment.

1.2.2 Tetra Tech Project Health and Safety Officer (PHSO)

The PHSO is responsible for developing this HASP in accordance with applicable OSHA regulations and elements of the Tetra Tech Health and Safety Program. Specific responsibilities include:

- Providing information regarding site contaminants and physical hazards associated with the site.
- Conducting Job hazard Analysis for each task in order to provide:
  - Identifying standard work practices to minimize potential injuries and exposures associated with hazardous waste work.
  - Establishing air monitoring and decontamination procedures.
  - Assigning personal protective equipment based on task and potential hazards.
  - Determining emergency action or response procedures as well as identifying emergency contacts and resources nearest to the site to facilitate immediate life saving or non-life threatening care.
  - Identifying general training requirements; location specific training requirements as well as task specific training requirements.
- Modifying this HASP, as it becomes necessary.

To fulfill these objectives, the PM must provide:

- Current and historical data concerning each site to the PHSO.
- Site specific requirements as they may pertain to access, security, hours of operation, points of contact, etc.
- Site control elements including access and control points, possible terrain challenges, sensitive receptors, emergency action requirements(site specific), logistical support components (access to restrooms, telephone communication points) as determined to be necessary.

1.2.3 Tetra Tech Field Operations Leader (FOL)

The Tetra Tech Field Operations Leader (FOL) is responsible for implementation of this HASP with the assistance of an appointed Site Safety and Health Officer (SSO). The FOL manages field investigation/remedial activities, executes the work/sampling plan, and enforces safety procedures as applicable to the work plan. Specific duties include:

- Serving as a liaison with facility and subcontractor personnel.
- Ensuring compliance with the HASP, identified sections of the HSGM, and policies and procedures of NSA Crane of all personnel. Examples of these include:
  - Keep your pass with you at all times
  - Enter only those areas in which you are approved to enter.
  - Follow posted signs including traffic control signs, use of radios, etc.
  - No cell phone use while driving unless hands free devices are employed
- Coordinating site activities within independent areas of investigation such that they may be performed in an effective, efficient, and safe manner.
- Enforcing the buddy system on-site.
- Controlling site entry of unauthorized personnel.
- Assuring availability of all safety equipment. This includes the proper application of the equipment.
- Conduct pre-site surveys prior to the commitment of personnel and equipment. The purpose is intended to identify potential hazards and/or challenges in completing the scope of work.
- Conduct operations surveys to ensure compliance with the elements specified in this HASP, HSGM, and NSA Crane policies and procedures such as Utility Clearance activities.
- Providing logistical support include access to items such as, but not limited to:
  - Potable water for drilling operations
  - Areas for equipment laydown and storage
  - Communication – Points of Contact
  - Utility clearance support, where applicable
  - Hours of operation

- Coordinate Tetra Tech Emergency Action Plan activities with the person(s) whose area the work is being performed. In all cases, upon entering an area the FOL will seek out the person in charge to coordinate
  - Planned work activities
  - Access restrictions; hours of operation; off hour activity
  - Emergency Planning – Not all emergencies will be Tetra Tech's. Information to request
    - Alarm types
    - Emergency evacuation routes
    - Assembly points
    - Who the FOL should report to in such an event that all personnel are accounted for or missing personnel.

1.2.4 Tetra Tech Site Safety and Health Officer (SSO)

The SSO supports site activities by advising and assisting the FOL on the aspects of health and safety onsite. These duties may include:

- Coordinating and supporting health and safety activities with the FOL through implementation of this HASP and applicable elements of the HSGM.

- Evaluating and communicating with the PHSO concerning the selection, application, inspection, and maintenance of personal protective equipment, air monitoring instruments, and other site equipment and materials. The purpose of this evaluation is to insure these items are meeting the identified objectives as they are presented in the field or that they are modified to do so.

- Confirm that site personnel meet appropriate training and medical clearance/surveillance requirements identified.

- Conducting site-specific training, periodic safety meetings (Tailgate Safety Meeting), and periodic inspections/self assessments/pre-activities site surveys.

- Verifying of decontamination procedures are being implemented as defined in the HASP.

- Implementing where appropriate safety and health programs including Hazard Communication, Hearing Conservation, and other associated health and safety programs as they may apply to site activities.

- Coordinating emergency action/ response procedures and follow-up.

- Investigating accidents and injuries (see Attachment I - Illness/Injury Reporting Procedure and Form/Total System).

- Providing input to the PHSO regarding the need to modify, this HASP, or applicable health and safety associated documents as per site-specific requirements.

- Observing and monitoring field team members for symptoms of exposure, heat/cold stress as well in determining the proper use and application of (personal protective equipment) PPE and associated safety equipment.

- Performing site surveys along with the FOL prior to committing personnel or resources. The objective of this survey is to identify hazards that may be presented to site personnel. Then take measures to flag/identify, remove/mitigate; or barricade. In addition, as part of this measure selected entry and exit routes will be established as well as emergency assembly points.

Compliance with the requirements stipulated in this HASP will be monitored by the SSO and coordinated through the Tetra Tech PM, PHSO and, the Tetra Tech Health and Safety Manager.

1.2.5 Health and Safety Manager (HSM)

Tetra Tech Health and Safety Manager (HSM) is responsible for providing the CLEAN Health and Safety Program and the PM with assistance and support with regard to all regulatory and safety aspects of site activity. The HSM is responsible for the following:

- Overseeing the development and implementation of this HASP.
- Visiting the site as needed to audit the effectiveness of these documents.
- Remaining available for project emergencies.
- Evaluate the application of occupational exposure monitoring/air sampling data and direct the adjustment of action levels by the PHSO as necessary.
- Serving as a quality control staff member.
- Approving/signing this HASP indicating reviewed and approved.
- Following up on information generated through audits/evaluations to insure corrective measures have been completed and are affective.
- Evaluating the Tetra Tech Health and Safety Program based on information derived from audits, self assessments, incidents and near misses to determine where improvements may be made.

- Serving as the arbitrator and final authority as it may pertain to dispute resolution regarding health and safety issues associated with this project.

Note: In some cases, one person may be designated responsibilities for more than one position. For example, the FOL may also be responsible for SSO duties. This action will be performed only as credentials, experience, complexity of the tasks, and availability permits. This should be evaluated on a case by case basis by the PM and HSM. This practice is strongly discouraged when possible as it overloads one person with an enormous amount of duties and creates an imbalance in which some practices may suffer in a measure to get the job done.

1.2.6 Tetra Tech Employees and Subcontractor Personnel

One of the founding principles of the Tetra Tech Health and Safety Policy is participation within the process. Therefore, Tetra Tech and subcontractor employees are responsible for:

- Understanding and following direction provided in this HASP and other project plans and as provided under the direction of the SSO and/or the FOL. Opportunities will be given to ask questions regarding the information provided in these documents during site-specific training, tailgate and safety meeting sessions and/or course at any time during the project.

- Reporting unsafe conditions or incidents to the SSO and/or FOL.

- Satisfactorily completing/meeting necessary training and medical surveillance requirements.

- Completing the Medical Data Sheet(s) and provide this information to the SSO. In such cases where site activities may present an increased hazard to certain site personnel (such as allergies to bee stings or to identified medications) site personnel will be required to carry their doctor recommended antidote kits and to provide instruction to personnel they work with on the use of these devices.

- Attending site-specific training and periodic safety meetings.

The Tetra Tech NUS, Inc. Health and Safety Program are founded on the principal elements that our managers and employees:

- Recognize a personal responsibility for their own health and safety and for actions that affect the health and safety of fellow employees.

- Integrate safety and health into all aspects of their work, with the well-being of themselves and their follow employees as their primary concern.

- Take an active role in the Health and Safety Program by providing input and constructive criticism for the overall improvement of the program.

1.3 STOP WORK AUTHORITY

All employees are empowered, authorized, and responsible to stop work at any time when an imminent and uncontrolled safety or health hazard is perceived. In a Stop Work event (immediately after the involved task has been shut down and the work area has been secured in a safe manner) the employee shall contact the Project Manager and the Tetra Tech HSM. Through observations and communication, all parties involved shall then develop, communicate, and implement corrective actions necessary and appropriate to modify the task and to resume work.

1.4 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: Naval Support Activity Crane **Address:** Crane, Indiana

Remedial Project Manager: Howard Hickey **Phone Number:** (847) 688-5999

Site Contact: Thomas Brent **Phone Number:** (812) 854-6160

Site Address: 300 Highway 361 Crane, Indiana 47522-5001

Purpose of Site Visit: Within Revision 1, an expanse in the drilling types and locations has been added to the existing activities which included soil, sediment, groundwater, and surface water sampling. See Section 4.0 for more detail or the work plan.

Proposed Start-up Date: October 2011 until completion

Project Team:

Tetra Tech Personnel:	Discipline/Tasks Assigned:	Contact Information:
Tim Evans, P.G.	Project Manager (PM)	(412) 921-7281 (724)766-3252 Cell
TBD	Field Operations Leader (FOL)	
Matthew M. Soltis, CIH, CSP	Health and Safety Manager (HSM)	(412) 921-8912
Tom Dickson, CSP	Project Health and Safety Officer (PHSO)	(412) 921-8457 (412) 720-3006 Cell
TBD	Site Safety Officer (SSO)	

Subcontractor personnel/ Services	Discipline/Tasks Assigned:	Contact Information:
TBD	Drilling Subcontractor	Office Cell
TBD	Analytical Laboratory	Office Cell
Indiana Underground Plant Protection	Utility Clearances	1-800-382-5544 Office or 811 National Clearing house

Hazard Assessment (for purpose of 29 CFR 1910.132) for HASP preparation has been conducted by:

Prepared by: Tom Dickson, CSP

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section has been developed as part of a planning effort to direct and guide field personnel in the event of an incident or an emergency that could occur en route to or on station.

Tetra Tech will provide initial response measures for incidents such as:

- Initial fire-fighting support and prevention.
- Initial spill control and containment measures and prevention.
- Removal of personnel from emergency situations.
- Provision of initial medical support for injury/illness requiring only first-aid level support.
- Provision of site control and security measures, as necessary.

Incidents and conditions above this level of participation are and will be considered emergencies. These events are considered beyond the capabilities of field personnel and/or available resources to provide emergency response safely. Therefore, the emergency response agencies listed in this plan are capable of providing the most effective response and will be designated as the primary responders in the event of an emergency. These agencies are located within a reasonable distance (within 4 minutes) from the area of site operations, which ensures adequate emergency response time.

2.2 EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, the following are considered emergencies that could result from travel to or associated with the chemical and/or physical hazards encountered on station. These are as follows:

- Striking a utility – Field personnel are not equipped to respond to damaged utilities. This will be supported by NSA Crane Public Works Department.
- Severe injury – Those requiring more than simple first aid treatment.
- Vehicle accidents – Those requiring Police participation; injury, and property damage.
- Fire and/or explosion - On Station or during Hot Work operations
- On-Station emergency

These are considered the most predominant hazards that through their occurrence are considered emergencies. To minimize the potential occurrence, the following actions will be employed:

- Effective communication with the Area Operations Manager – Not all emergencies will be Tetra Tech related. The FOL/SSO will request the Emergency Action Plan for the facility. From this they will be instructed as to

  - Alarm types
  - Evacuation routes and assembly points
  - Emergency notification
  - Allow the FOL/SSO to share our intended response measures to be taken during incident response; chain of command; prevention and protection methods to be employed to minimize the potential occurrence of an incident and/or emergency.

- Effective communication with responding Agencies – In order to receive assistance those that would respond must be informed of your activity and the types of emergencies that could occur. Effective communication will allow rapid response and will allow the responding agencies to respond with some indication as to what they may face. This will involve contacting emergencies services as part of initial site mobilization to ensure that they are aware that Tetra Tech and our subcontractor personnel will be onsite; our location; and our activities.

Information Requirements:

The following information has been developed or will be collected, maintained onsite, and made available to the responding agencies. This information will include the following:

- Identifying and mapping the closest hospital to the site. The Bloomington and Bedford Hospitals are the closest full serve provider. Each hospital is greater than 20 miles from the site.

- Emergency Notification - phone numbers. These are provided as Table 2-1.

- Onsite personnel Medical Data Sheets. All site personnel will be asked complete a Medical Data Sheet. On this sheet they will be asked to provide information they would want medical personnel to know should they be incapacitated.

- Material Safety Data Sheets (MSDSs) for all chemicals brought onsite including volumes, storage locations and hazards associated with these chemicals.

2.3 EMERGENCY RECOGNITION AND PREVENTION

Many of the efforts described in this HASP are intended to stop an emergency from happening in the first place. Some of these are as follows:

Potential Emergency: Damaging an underground utility or striking an overhead utility.

Planned Control Measure: Utility location and clearance will occur in accordance with Indiana Underground Plant Protection Service (1-800-382-5544) or utilize 811 National Clearinghouse) protocol for utility location and avoidance to minimize potential damage to buried.

In addition, Tetra Tech Utility Locating and Excavation Clearance Procedures (Section 7.0 of the HSGM) will be employed in tandem with these procedures. Within this SOP direction is provided to the field crew concerning passive detection methods to identify subsurface structures. These will include but not limited to:

- Non-intrusive survey methods (Ground Penetrating Radar, etc.)
- Pot-holing can be conducted using hand tools or through more extravagant methods such as an air knife/vacuum extraction system to verify the location of the utility prior to excavating/drilling in that area.
- Examine the area and building where utilities enter and exit.
- Area will be surveyed for above ground monuments
- As this facility is not extremely old, the as-builts should be available concerning buried utility lines.
- The FOL will contact all non-responding utility owners to confirm the absence of utilities in the area. This will be recorded in the Project log book.
- The Excavation Ticket will remain active and onsite during ongoing activities.
- Follow NSA Crane procedures for utility locating and clearance.

Planned Control Measure: Jobsite Hazard Evaluation Site Surveys - As part of early recognition the FOL and/or the SSO will conduct the following activities:

- An initial site walk through will be conducted prior to the commitment of personnel or equipment. The purpose of this walk through will be to examine the site for conditions that may predispose field personnel to potential hazards including:

  - The existence of overhead power sources or process lines near where equipment will operate.
  - Surface monuments indicating underground utilities in the area (manhole covers, valve boxes, cathodic protection test points, etc.).

  - Areas that may require alterations of traffic patterns or scheduling when the work will be conducted.
  - Physical hazards within the work area.
  - Terrain challenges.

- Periodic operations surveys – FOL and/or the SSO will conduct these surveys for the purpose of
  - Ensuring field personnel are following protective measures specified within this HASP (specifically stated in the AHAs).
  - Reviewing the initial hazard assessments to insure they reflect the hazards as it may pertain to site specific conditions.
  - Preparing for Emergencies. This includes staging emergency equipment, adequate site control measures, identifying site personnel who will engage incidental response measures and reviewing what measures will be taken and when and by who prior to declaring an emergency.

These surveys should be documented within the project logbook. The results of these surveys are not intended to be disciplinary in nature, rather to identify areas of need improvement, where applicable. The results of these surveys are to be discussed with the field personnel as part of the Tailgate Safety meetings.

Potential Emergency: Severe injury

Planned Control Measure: It is the intent through the application of this HASP and elements of the HSGM to control such events through:

- Insuring all personnel are adequately trained and are medically qualified to perform such work.
- Providing initial project training supported by ongoing measures as the project continues.
- Conducting equipment inspections to insure no one gets hurt due to faulty equipment.
- Conducting site and operations surveys to identify hazards within the work zone and to correct deficiencies noted to avoid incidental occurrences or those that could lead to an emergency.
- Utilizing trained professionals to recognize, respond, and control hazardous conditions.

Through the incorporation of these measures significant injuries can be controlled and avoided. If all measures fail, provisions for addressing this emergency must be considered. As the distance to the closest medical assistance is greater than 4 minutes (life threatening; 15 minutes non-life threatening) at least two First Aid/CPR-trained personnel will be onsite to provide emergency first aid until such time emergency care can be obtained at all times. While it has not been the general practice to identify the Medical Clinic at Crane for emergency treatment it is likely injured will be transported there for stabilization.

During working hours the medical facility on NSA Crane can be utilized for emergencies. As part of the emergency response teams responding to an incident they will transport to this location.

The FOL and/or the SSO will also:

- Identify where the closest access point for emergency vehicles is
- As part of the pre-planning, have an emergency escape route and emergency assembly point planned in advance. Record distances and turns when entering the remote area so you can relay this location to emergency crews. Do not rely on your ability to remember in an emergency. The emergency assembly point should be selected based on
  - Identifiable landmark from which emergency crews may be directed.
  - Emergency assembly point will be selected for all operations.
  - The FOL will account for all personnel at this assembly point. Personnel will remain at the assembly point until the FOL or responding agency has directed them they may leave the area.

- Record building numbers and gate access points. Where possible for remote locations, it is recommended that coordinates be recorded to facilitate location.

While it has been the practice that Tetra Tech and subcontractor personnel cannot employ on station medical support services it is assumed that if responding agencies retrieved an injured person they would be transported there at least for stabilization. In situations where immediate transport is required, select at least a 250x250 feet area without power lines or other aerial interference that a medical support helicopter could be landed to remove severely injured persons.

Note: If this area is to be on station, obtain permission first, as an element of the Emergency Response Measures to be employed for severe life threatening accidents. Measures to control such accidents have been incorporated into this HASP.

Potential Emergency: Vehicle Accident

Planned Control Measure: Persons are more likely to be injured in a vehicle accident than a work place injury. The following measures will be employed to minimize the potential for a vehicle accident.

- Make sure all drivers are Tetra Tech drivers are approved drivers
- Make sure subcontractor personnel will have suitable license(s) for the type of vehicles to be operated. Such as
  - All persons operating vehicles will have a State License authorizing them to do so.

  - For vehicles of >26001 lbs single or combination, a CDL will be required

- Avoid distracted driving:
  - No cell phone use while driving unless hands free devices are employed
  - Avoid eating, drinking, playing with the radio, etc. during driving
  - Carry in vehicles the Tetra Tech Incident Reporting Form IR-C to record pertinent information should Tetra Tech personnel be involved in an accident.
  - Make sure you can use your phone for photos or carry a disposable camera. Record accurate notes, locations, witnesses, etc. should this information be needed in the future. This will all be on the IR-C Form.
  - If you are tired or fatigued, switch driving responsibilities if you are travelling with someone or rest before proceeding.
  - Use the 4-second rule when determining the travel distance between you and the vehicle in front of you. This is especially pertinent for heavy rigs or combination vehicles
  - Emergency markers and a High Visibility Vest will be kept in the car/truck to warn others approaching the accident to proceed with caution and to increase your visibility. If possible move all vehicles out of the travel lanes.
  - Do not attempt to argue whose fault the accident was. Gather information and be respectful to the authorities and others involved.
  - DO NOT admit fault.

Potential Emergency: Fire and/or explosion

Planned Control Measure: Fire and/or explosion will be controlled through fire prevention measures. These include:

- There is no hot work tentatively planned [e.g., welding, oxy/acetylene torch cutting, spark producing tools (grinders)] on station. If hot work needs to be performed, the pieces will be removed from the station where possible. If not, fire prevention/control measures will be incorporated such as removing all combustibles within 35 feet; completing the Tetra Tech Hot Work Permit; and applying for and securing Hot Flame Permit issued by Fire Prevention for all Explosive, High-Hazard-type operations, and non-explosive operations. See Section 5.4 and 6.2 for additional detail.
- Suitable fire suppression equipment (this can be fire extinguishers or source of water based on the anticipated fire hazard type) will be maintained onsite, inspected, placed in readily accessible locations (within 75 feet of travel for Class A fires and within 50 feet of travel for Class B fires), and ready for use.

Potential Emergency: On-Station Emergency

Planned Control Measure: Report to a designated emergency evacuation assembly point identified by the Station. This assembly point will be at an area where the responding emergency response agency will report to prior to addressing the emergency. If the facility does not have provisions set in place (emergency evacuation routes and assembly points) these will be temporary assembly point selected should an event occur. See Section 2.3 for the temporary selection of emergency assembly points.

2.4 EMERGENCY CONTACTS

Prior to initiating field activities, personnel are thoroughly briefed on the emergency procedures to be followed in the event of an accident. Table 2-1 provides a list of emergency contacts and their associated telephone numbers. Any pertinent information regarding allergies to medications or other special conditions are provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite (see Attachment II).

TABLE 2-1
EMERGENCY CONTACTS, NSA CRANE, INDIANA

CONTACT	TELEPHONE
Base Emergency Numbers* (Fire Department, Base Security, Ambulance) • If dialing from an on-base phone: • If dialing from cell or off-base phone: Note: You may dial 911 from a cell phone, but then must also notify the Security Department that emergency vehicle(s) from civilian providers are enroute. Make sure if you call 911, inform the Dispatcher that this is a government facility. It is recommended that the request for assistance be requested through Security services only.	9-1-1 (812) 854-3300 or (812) 854-1333
Base Environmental Office	(812) 854-3114
Bedford Ambulance	(812) 279-6545
Bloomington Hospital (Bloomington, Indiana)	(812) 336-9515
Bedford Medical Center (Bedford, Indiana)	(812) 275-1200
Indiana Underground Plant Protection Services	1-800-382-5544 or 811
Poison Control Center	(800) 222-1222
National Response Center	(800) 424-8802
Base Contact, Thomas Brent	(812) 854-6160
Project Manager, Tim Evans	(412) 921-7281
Tetra Tech Field Operations Leader, TBD	TBD
Tetra Tech Site Safety Officer, TBD	TBD
Tetra Tech Office, Cincinnati	(513) 251-0200
CLEAN Health and Safety Manager, Matthew M. Soltis, CIH, CSP	(412) 921-8912
Human Resources, Marilyn Duffy	(412) 921-8475
Tetra Tech Project Health and Safety Officer, Tom Dickson	(412) 921-8457 (412) 720-3006 (cell)
WorkCare	1-800-455-6155 and enter Extension 109

***NOTE:** On-base extensions 3300 and 1333 are the primary emergency phone numbers. From an NSA Crane phone, on Base extensions must be preceded by "854". Off-base numbers can only be reached by dialing "991" first. Furthermore, the emergencies involving site activities should subsequently be reported to the Environmental Protection Department (x -3114/1132/6160).

2.5 EMERGENCY ROUTE TO HOSPITAL

Directions to the Bloomington Hospital:
601 West Second Street
Bloomington, IN 47402
812.353.5252
webmaster@bloomingtonhospital.org

Turn right out of SWMU 22 onto HWY 45. Veer right at the intersection of HWY 5 and HWY 45 to stay on HWY 45. Exit NSA Crane on H-45 through the Bloomington Gate. Follow Highway 45 North to Bloomington at Highway 45 and Highway 37. Continue going straight over the overpass (Bloomfield Road). Follow Bloomfield Road North; this road turns into 2nd Street. Follow 2nd Street, hospital will be on the right (601 West 2nd Street). The map below shows the route from the Bloomington Gate (A) to the Bloomington Hospital (B).

FIGURE 2-1
MAP TO
BLOOMINGTON HOSPITAL ROUTE MAP (BLOOMINGTON GATE)

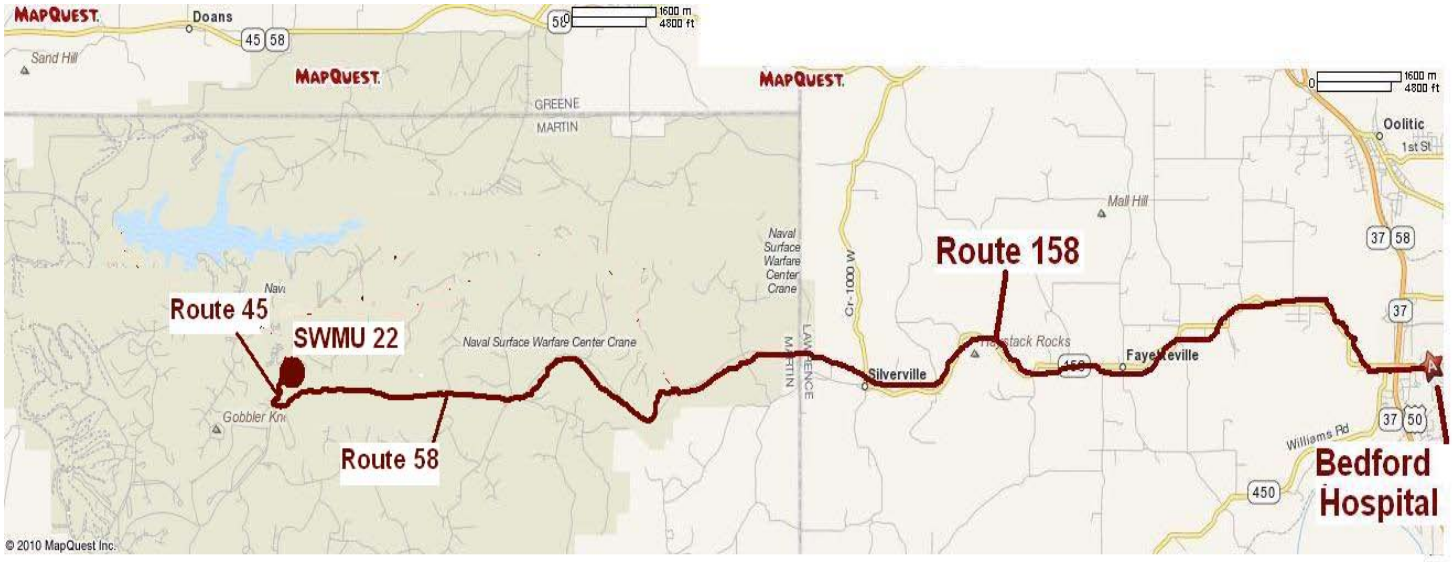
****Note: The Bloomington Gate is open 24 hours.**

Directions to Bedford Medical Center:*

2900 16th Street
Bedford, Indiana 47421

Turn left out of SWMU 22 onto HWY 45 going South. Turn left onto HWY 58. Follow HWY 58 all the way out of the base – stay straight to go onto State Highway 158. Head West on State Highway 158. State Highway 158 becomes 16th Street upon entering the City of Bedford. The medical center is on the right shortly after Plaza Drive.

FIGURE 2-2
MAP TO
BEDFORD MEDICAL CENTER ROUTE MAP (BEDFORD GATE)
***Note: The Bedford Gate is open only from 0600 - 0830 and 1500 - 1800 hours.**



***NOTE:** The Bedford Gate is open only from 0600 - 0830 and 1500 - 1800 hours, whereas the Bloomington Gate is open 24 hours. Maps indicating the travel route from the site to the hospitals are included as Figures 2-1 and 2-2.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide hazard information from Table 6-1 to medical service personnel.

2.6 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

Tetra Tech personnel will be working in close proximity to each other at SWMU 22. As a result, hand signals, voice commands, and line of site communication will be sufficient to alert site personnel of an emergency.

If an incident occurs, the following procedures are to be initiated:

1. Alert other field personnel
2. Initiate incidental response measures (employ fire extinguishers, spill pads, first aid, etc.)
3. If the FOL and/or the SSO are not onsite, alert them of the occurrence.
4. Initiate care and transport for injured where applicable.
5. Notify WorkCare of the incident and where treatment is being provided. Notify the Doctor providing care, that to expect calls from Work Care.
6. The SSO will initiate Incident Investigation to determine cause and effect using the Incident Forms provided or Total. As part of this effort, the Incident Reporting Forms will be completed. This information will be entered into the TOTAL Reporting System as soon as possible.
7. The FOL will notify the PM and HSM of the occurrence, response measure, and measures to insure it does not happen again.
8. The PM or FOL will notify Mr. Tom Brent of the occurrence.
9. The occurrence and the cause for the occurrence will be reviewed at the Tailgate Safety Meeting. Where necessary retraining will be conducted to minimize or eliminate the re-occurrence.
10. Restock expended supplies.
11. The PHSO will review the HASP to determine the need for modification.

If an incident is not controlled in the initial response stages or if an emergency occurs requiring evacuation the following measures will be conducted:

1. Initiate the evacuation
2. Call Base Security at [on-base phone 911 or 812-854-1333 (off-base/cell phone)] – Inform the dispatch of the emergency, remain on the line, and answer all questions pertaining to the incident (type of emergency, number of injured, etc.) so they may send the proper personnel and equipment.
3. The FOL and/or the SSO will account for all personnel. At this time personnel may be deployed at unaffected areas to serve as perimeter security until responding agencies arrive.
4. The FOL will notify Mr. Tom Brent of the occurrence.

The FOL will notify the PM and HSM and begin the incident investigation using Attachment I.

2.7 PPE AND EMERGENCY EQUIPMENT

The following represent emergency equipment to be maintained on-site during operations.

- Fire extinguisher(s)
- A first-aid kit(s)
- Spill Response Equipment
- Eye wash unit(s)
- Safety Cans

2.7.1 Fire Extinguisher Types

Portable fire extinguishers will be of Type A/B/C, so that they can be effective on any type of fire that is likely to occur at this work site. Capacity has been determined based on potential use. In this case recognizing the fuel capacity of the HSA/Air Rotary/DPT unit and any portable storage to supplement the supply as needed.

- HSA/Air Rotary – 4A:60:BC (Fire Extinguisher rating – minimum)
- DPT Rig - 2A:20:BC (Fire Extinguisher rating – minimum)

All site personnel will be instructed in the placement and use of these devices as part of their initial site-specific health and safety training session. If it is maintained in a tool box, support vehicle, the outer container will be appropriately marked to allow quick access. Materials and equipment also stored in these storage locations will not restrict immediate access. During site-specific training, the personnel will be reminded concerning the use of portable fire extinguishers. This will cover the following aspects:

- Proper use of portable fire extinguishers (P.A.S.S. – **P**ull pin, **A**im discharge hose at the base of the fire, **S**queeze the activating handle, and **S**weep the fire from a side-to-side motion.
- Requirement to notify other workers immediately in the event of any fire
- Authorization to use portable fire extinguishers only on small fires that can be extinguished with only one extinguisher. Fires greater than the capacity of one fire extinguisher will be considered an emergency and will require the responding agencies to be notified.
- The need to observe the area after the fire has been extinguished to monitor for flashback

Note: Hot work operations are not anticipated as part of this scope of work. The area will be examined to remove all combustibles and to support general housekeeping as a preventative measure. All coring and drilling operations will be wet cut or drill; therefore, elevated temperature applications are not anticipated. Should Hot work need to be conducted; a Hot Flame Permit issued by Fire Prevention will be

issued. This permit will be good for up to 28-days if so requested. If the information contained in the Hot Flame Permit adequately covers the information required in the Tetra Tech Hot Work Permit the SSO may elect not to complete the second.

Inspection: The fire extinguishers will be inspected once/month and the inspectors initials will be add to the tag along with the date of the inspection. Criteria will include:

- Adequately marked placement
- Adequate pressure
- No apparent physical damage
- All tamper indicator devices are in place
- Hydrostatic testing date is within the recommended 12 year time frame.

2.7.1.1 Safety Cans

An additional fire and spill prevention device will be the use and application of safety cans. Safety cans are designed to control the flammable vapors of gasoline and diesel fuel and to provide a safe and convenient means for storage and transfer. Underwriters Laboratories (UL) *approved* safety cans should be used to carry, dispense, and store gasoline in quantities up to five gallons. *Approved* safety cans have several basic design qualities:

- They have a spring loaded cap that closes the spout automatically when released. Tension in the spring forces the cap closed and provides a leak proof seal.

- The spring tension is also designed to lift the cap slightly in the event of excessive internal vapor pressure inside the can. This automatically vents off vapors at approximately five psi internal pressure, to prevent the can from rupturing or exploding if it is exposed to excessive outside heat.

- The spout is also equipped with a flame arrester screen designed to prevent outside fire from reaching the gasoline inside the can. This is the same type of screen that is found in marine gasoline engine carburetors. With the screen in place, if the can is involved in a fire, the vapors will burn around the spout, but will not permit an internal fire or explosion. This screen must not be removed or damaged.

2.7.2 First-Aid Kits

At least one first-aid kit will be maintained at the job-site. The kit must be a Type III, 16-unit kit meeting the specifications of American National Standards Institute (ANSI Z308.1-1998), and the basic fill

requirements as specified in USACE EM 385-1-1, Section 3. These minimum fill requirements are listed in Table 2-2. It is the SSO's responsibility to inspect the kit as part of initial site mobilization and at least weekly thereafter to ensure that the minimum basic fill requirements are maintained.

TABLE 2-2
FIRST AID KIT BASIC (MINIMUM) FILL REQUIREMENTS

Unit First Aid Item	Minimum Size or Volume (Metric)	Minimum Size or Volume (US)	Item Quantity per Unit Package	Unit Package Size
*Absorbent Compress	60 sq. cm	24 sq. in.	1	1
*Adhesive Bandage	2.5 x 7.5 cm	1 x 3 in.	16	1
*Adhesive Tape	457.2 cm	5 yd. (total)	1 or 2	1 or 2
*Antiseptic Swab	0.5 g	0.14 fl. Oz.	10	1
Antiseptic Wipe	2.5 x 2.5 cm	1 x 1 in.	10	1
Antiseptic Towelette	60 sq. cm	24 sq. in.	10	1
Bandage Compress (2 in.)	5 x 91 cm	2 x 36 in.	4	1
Bandage Compress (3 in.)	7.5 x 152 cm	3 x 60 in.	2	1
Bandage Compress (4 in.)	10 x 183 cm	4 x 72 in.	1	1
*Burn Treatment	0.5 g	0.14 fl. oz.	6	1
Eye Covering, with means of attachment			1	1
Eye Wash	30 ml	1 fl. oz. total	1	2
Eye Wash & Covering, with means of attachment			1	2
Surgeons or Dust Mask**			2	1
Roller Bandage, 4 in.	10 x 550 cm	4 in. x 6 yd.	1	1
Roller Bandage, 2 in.	5 x 550 cm	2 in. x 6 yd.	2	1
*Sterile Pad	7.5 x 7.5 cm	3 x 3 in.	4	1
*Triangular Bandage	101 x 101 x 142 cm	40 x 40 x 56 in.	1	1
Nitrile Surgeons Gloves**	Medium and Large		4 pair	1
MicroShield CPR Mask**			2	
Surgeons mask**			4	
Safety Glasses**			1 pair	
Hospital Map & Emergency Phone Number Listing			1 copy	
Medical Data Sheets***			Completed copies	

* Minimum mandatory contents for basic fill kit. Additional items from this table are needed to meet 16-unit kit requirement.
** - These items are those intended to support protection against bloodborne pathogens.
*** - Having these items contained within the First Aid kit will provide immediate access in the event of an injury.

Note: There are commercially available units marked as OSHA- and ANSI-approved. These are sufficient provided adequate means for providing bloodborne pathogen protection is included or incorporated by the FOL and/or the SSO.

2.7.3 Spill Response Equipment

Work activities will be conducted in a manner that spills will be prevented; major spills are not anticipated in the performance of planned site activities. Items that will be maintained on -site to respond to minor spills, if they occur, include the following:

- Shovel/rake/broom
- Adsorbent material (such as kitty litter or oil-dry)
- Oil Pads
- PPE
  - Nitrile outer gloves
  - Splash Shield
  - Impermeable over-boots
  - Rain suit or impermeable apron

As the investigation proceeds, spills that could potentially threaten the environment are those associated with the resource deployment or due to equipment failure. Simple measures will be implemented to address these, including:

- Placing a spill pad under the hydraulic lines to capture potential rupture.
- Placing spill pads under the unit during fueling to capture incidental spills.
- Placing plastic sheeting under the DPT/Drill rig to capture hydraulic fluid should a line rupture. Exercise care not to extend the plastic into the area where the driller and helper must walk/work.
- Having spill pads at the operation ready to respond should a release occur. The quicker response is rendered the likelihood of environmental damage is greatly reduced.

2.7.4 Eyewash Units

Through the course of this work, the potential for field personnel to encounter corrosive materials are:

- During well construction – grout
- During groundwater sampling - preservatives

In order to minimize potential tissue damage, portable eyewash units will be readily available when working with these corrosives. It is the intent of these portable units to provide immediate relief until a fixed unit or medical attention maybe obtained. Potable water, bottled water also may be used as circumstances dictate.

The eyewash units will be inspected weekly. The portable units will be inspected for expiration date, immediate access, and proper storage to facilitate an ambient wash.

2.8 DECONTAMINATION PROCEDURES / EMERGENCY MEDICAL TREATMENT

Based on the hazard assessment and PPE selection, decontamination will consist of the removal of protective garments including nitrile gloves, safety glasses, hard hat, and affected field attire. There will be no additional decontamination in support of medical treatment.

Tetra Tech and subcontractor personnel are only permitted to provide treatment to the level of their training. It should also be noted that first-aid shall be administered voluntarily with the exception of those persons trained and designated to provide this service.

Emergency medical treatment will be initiated under the following guarded restrictions:

- Scene Safety – prior to providing emergency assistance, personnel will insure the area is safe to approach.
- The FOL and/or the SSO have been notified of the incident if they are not present.
- Emergency services 911 (on-base phone), (812) 854-3300 or (812) 854-1333 (off-base phone) have been called and are enroute.

Those providing emergency medical treatment will take the necessary precautions to prevent direct contact with the injured person's body fluids. This may be accomplished through the employment of the following measures:

- Give attention to emergency health problems -- breathing, cardiac function, bleeding, and shock.

- Transfer the victim to a medical facility designated in this HASP by suitable and appropriate conveyance (i.e. ambulance for serious events) or through self transport.

- Use sterile gloves when handling cuts, abrasions, bites, punctures, etc. or any part of the injured person. The use of safety glasses and surgeons masks maybe necessary if there is the potential for uncontrolled spread of body fluids. The PHSO will be immediately notified in event that personnel

providing emergency first-aid come into contact with body fluids or other potentially infectious tissues. Measures described here are universal precautions and body substance isolation associated with the Tetra Tech Blood Borne Pathogen Program.

In order to engage these protective measures, the FOL and/or the SSO shall ensure that these items are part of their first-aid kit. General first aid instructions will also be provided in each First Aid Kit.

Personnel identified within the field crew who will provide First Aid and CPR support will also provide training documentation associated with the elements of the BBP.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed on-site (see Attachment II).

2.9 INJURY/ILLNESS REPORTING

2.9.1 Incident Report Form

If any Tetra Tech personnel or subcontractor personnel under Tetra Tech supervision are injured or develop an illness as a result of working on site, the Tetra Tech "Incident Report Form" (Attachment I) must be followed. Following this procedure is necessary for documenting of the information obtained at the time of the incident.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide information on the chemical, physical, and toxicological properties of the subject chemical(s) to medical service personnel.

If needed and once completed, the appropriate personnel on the incident report form (Attachment I) should be notified and their signatures obtained. Once signed, this form should be stored on site and filed. This form contains information relating to employee health and must be used in a manner that protects the confidentiality of the employee to the extent possible.

2.9.2 TOTAL Incident Reporting System

TOTAL is Tetra Tech's online incident reporting system. Site employees can use TOTAL to directly report health and safety incidents, notify key personnel, and initiate the process for properly investigating and addressing the causes of incidents, including near-miss events. An incident is considered any unplanned event. It may include several types of near misses, events where no loss was incurred, or incidents that

resulted in injuries or illness, property or equipment damage, chemical spills, fires, or damage to motor vehicles.

TOTAL looks like the incident reporting form in Attachment I. TOTAL is an intuitive system that will guide you through the necessary steps to report an incident within 24 hours of its occurrence. Behind the scenes, TOTAL is a powerful tool for Health and Safety professionals and will help Tetra Tech to better track incidents, analyze root causes, implement corrective action plans, and share lessons learned. The ultimate result is a more safe and healthy working environment.

TOTAL is maintained on the Tetra Tech Intranet site at https://my.tetratech.com/

Once on the "My Tetratech" site, TOTAL can be found under the Health and Safety tab, Incident Reporting section, select "Report an Incident (TOTAL)". This will connect you directly to TOTAL. TOTAL can also be accessed directly from the internet using the following web address: http://totalhs.tetratech.com/

Note: When using the system outside the Tetra Tech intranet system or when operating in a wireless mode, a VPN connection will be required. The speed of the application may be affected dependent upon outside factors such as connection, signal strength, etc. Enter the system using your network user name and password. The user name should be in the following format - TT\nickname.lastname.

3.0 SITE BACKGROUND

3.1 SITE HISTORY

NSA Crane is located in Crane, Indiana approximately 75 miles southwest of Indianapolis and 71 miles northwest of Louisville, Kentucky. The facility encompasses approximately 100 square miles (64,463 acres) in Daviess, Greene, Lawrence, and Martin Counties. It is located in a rural, sparsely populated area. The acreage surrounding the base is either wooded or farmed land. The facility, originally called Naval Ammunition Depot (NAD) Burns City, was opened in 1941 to serve as an inland ammunition production and storage center. Today, NSA Crane's mission is to "provide quality and responsive engineering, technical and material support to the Fleet for combat subsystems, equipment and components, microelectronic technology, microwave components, electronic warfare, acoustic sensors tests, engineering pyrotechnics, small arms, electronic module test and system command." Under the Single Service Management Program, a segment of the Center's mission is to provide support (including environmental protection) to the Crane Army Ammunition Activity (CAAA). The Army is tasked with the production and renovation of conventional ammunition and related items, the performance of manufacturing, engineering, and product quality assurance to support production; and the storage, shipment, demilitarization, and disposal of conventional ammunition and related components. Because of the nature of the Army's operations, CAAA contributes significant financial support for the environmental program through an Inter-Service Support Agreement.

3.2 SWMU 22

SWMU 22 is located along Highway H-45 in the north-central area of NSA Crane, about a mile and a half south of Lake Greenwood. SWMU 22 sits at an elevation around 760 feet mean sea level (msl). The east and south sides of the site slope gently down to an elevation around 650 feet msl. The area surrounding SWMU 22 is occupied by buildings with forestation on three sides of the complex forested.

The nearest surface water drainage, a headwater to Turkey Creek, is located approximately 550 feet east of the Site. The headwater of Turkey Creek flows into Turkey Creek proper approximately 1-1/2 miles south of the Site.

The nearest residences are approximately 5 miles northwest of the Site in the village of Crane, which is located just west of NSA Crane. See Figure 3-1.

FIGURE 3-1

SWMU 22, LEAD AZIDE POND LOCATION

SWMU 22 is the area referred to as the Explosive Actuated Device (EAD)/ Booster Area or the "Backline". The Booster Area was designed and constructed to load 5-inch rockets during World War II. EADs were loaded with explosives such as lead azide, lead styphnate, tetryl, Royal Demolition Explosive (RDX), and black powder. Building 136 was used for the propellant portion, Building 138 was the pressing building for warheads, and Building 2520 was the final assembly building. A conveyor tunnel connected Buildings 136 and 2520 in support of the former process. The area is currently operated by the Army and is involved in the production of small explosive charges and fuse maintenance. The buildings associated with the Backline are scheduled to be demolished in 2011. An unlined retention pond (i.e., the lead azide pond) was located at the northern end of the Backline. It received overflow wastewater from sumps associated with the process buildings. The retention pond was removed in 1981. Information about SWMU 22 since the initial sampling in January and April 2011 identified various other primary explosives [i.e., RDX, pentaerythritol tetranitrate (PETN), trinitrotoluene (TNT), and nitroglycerin] that were been used in the Booster Area, principally in Building 138.

4.0 SCOPE OF WORK

This section describes the project tasks that will be performed at NSA Crane – SWMU 22. The planned activities involved in this effort are presented in detail in the Sampling and Analysis Plan developed for the project. If new tasks are to be performed at the site this HASP will be evaluated and be modified accordingly.

Specific tasks to be conducted at SWMU 22 include the following:

- Mobilization/Demobilization
- Drilling/Soil boring/Monitoring Well Installation using:
  - Air Rotary Drilling for monitoring wells to be installed into bedrock
  - Hollow Stem Auger (HSA) for soil samples and monitoring wells to be installed into the overburden
  - DPT Drilling - Surface and subsurface soil sampling
- Multimedia sampling
  - Sediment sampling using a trowel, in the top 6 inches of the sediment surface.
  - Surface water sampling via direct filling of bottles from the surface water body. The sampling will be in mainly in small drainages, but a couple will be from a stream that may be 2-3 feet deep and up to 10 feet across.
  - Monitoring well development/groundwater measurements/groundwater sampling using low flow purge and sampling methods. Groundwater sampling will be accomplished using bladder pumps.
- Investigation-Derived Waste (IDW) Management – This activity includes the containerization of soil/rock cuttings; purge and decontamination waters and the staging of these containers into a designated area.
- Decontamination – This activity includes low and high pressure decontamination using a pressure washer.

For more detailed description of the associated tasks refer to the individual Work Plans. If additional tasks are determined to be necessary, this HASP will need to be amended and a hazard evaluation of the additional tasks performed.

5.0 GENERAL SAFE WORK PRACTICES

Within the Activity Hazard Analysis (AHAs) task specific hazards are identified along with the intended control measure. The purpose of this section is to identify general safe work practices that will be employed as general precautionary measures to assist in the control of these hazards.

Section 5.0 presents additional information on hazard anticipation, recognition, and control relevant to the planned field activities.

5.1 GENERAL SAFE WORK PRACTICES

The following general safe work practices are to be followed when conducting work on-site.

- Eating, drinking, chewing gum or tobacco, taking medication, or smoking in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists is prohibited. The purpose is intended to minimize the potential for hand to mouth transfer resulting in exposure through ingestion. The primary contaminants of concern are particulates including arsenic and lead. Exposure routes are established through inhalation or hand to mouth activities.

- 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 hands cleaning products or wipes will be used, followed by actual hands-washing as soon as practicable upon exiting the site. As the primary contaminants are metals it is recommended that wipes such as D-Lead be used to remove contaminants (metal and metalloids) from the hands.

- Avoid contact with potentially contaminated substances including puddles, pools, mud, or other such areas. Avoid, kneeling on the ground or leaning or sitting on equipment. Keep monitoring equipment away from potentially contaminated surfaces.

- Plan and mark entrance, exit, and emergency evacuation routes.

- Rehearse unfamiliar operations prior to implementation.

- Buddies (Section 9.7) should maintain visual contact with each other and with other on-site team members by remaining in close proximity to assist each other in case of emergency.

- Establish appropriate safety zones including support, contamination reduction, and exclusion zones.

- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Non-essential vehicles and equipment should remain within the support zone.

- Immediately report injuries, illnesses, and unsafe conditions, practices, and equipment to the SSO.

- Observe co-workers for signs of toxic exposure and heat or cold stress.

- Inform co-workers of potential symptoms of illness, such as headaches, dizziness, nausea, or blurred vision.

5.2 DRILLING SAFE WORK PRACTICES

Pre-Drilling

- All drilling equipment will be inspected and approved for use. The Equipment Inspection Checklist for Drill Rigs found in Attachment III will be used for this purpose. All drill rig inspections will be conducted by a Qualified Person familiar with Drill rig operation and safety features as well as elements of the Inspection checklist.

- All drillers will be properly trained on the type of equipment to be used and will carry a license or certificate, if required by the State, attesting to this competency.

- Drilling or other operations with drill masts or other projecting devices must be further than 20 feet in any direction from overhead power lines. Prior to any subsurface investigations, the FOL shall ensure that, the locations of all underground utilities are identified and marked prior to initiating any subsurface activity. Those within 5 feet of the intended borehole will be pot-holed to positively identify the location.

- Hand signals with the driller will be established for operation or cessation of activities prior to the commencement of drilling activities.

- All drill rigs (including DPT with rotating components) and other machinery with exposed moving parts must be equipped with an operational emergency stop device. All personnel working in close proximity must be aware of the location of this emergency stop device and its operation. This device will be tested initially (and then periodically, at least daily) to insure its operational status. The driller shall only leave the controls for instance to assist the helper moving augers or flights when there is a standby person able to activate the emergency stop device.

- Ensure that all machine guarding is in place and properly adjusted.

- All personnel working in the vicinity of the drill rig while it is operating shall secure all loose clothing, jewelry, hair, and other potential snag and entanglement hazards.

- Only manufacturer-approved equipment may be used in conjunction with site equipment (i.e. pins for auger flights etc.). Pins or other protruding items from rotating equipment that creates a snag point shall not be permitted.

- The Drill Rig will be blocked and levelers used to prevent inadvertent movement, where applicable. Cribbing creating a larger surface area should be used when supporting ground is soft.

During Drilling

- The driller will announce that he/she is about to engage the drilling mechanism and ensure all are clear.

- The driller may leave the controls only when tools are stopped or when all personnel are clear of the rotating equipment.

- A long-handled shovel or equivalent shall be used to clear away drill cuttings from the hole and rotating equipment. Never use hands or feet for this purpose.

- A remote sampling device must be used to sample drill cuttings near rotating tools. The driller shall shut down operations if the sampler must go near the tools to obtain samples.

- Climbing a drill mast while equipment is rotating is prohibited.

- Climbing a drill mast without use of ANSI-approved fall protection (i.e. belts, lanyards and a fall protection slide rail) or portable ladders which meet OSHA's requirements is prohibited.

- The work area around the point of operation will be cleared to the extent possible to remove any trip hazards near or surrounding operating equipment.

- The driller's helper will establish an equipment staging and laydown plan. The purpose of this is to keep the work area clear of clutter and slips, trips, and fall hazards. Mechanisms to secure heavy objects such as augers will be provided to avoid the collapse of stacked equipment.

- Minimize direct contact to the extent possible with contaminated tooling and environmental media. In order to minimize contact with potentially contaminated tooling and media and to minimize lifting hazards, multiple personnel should be used to move auger flights and other heavy tooling.

- Potentially contaminated tooling will be placed on polyethylene sheeting for storage and wrapped for transport to the centrally located equipment decontamination area.

- Support functions (sampling and screening stations) will be maintained a minimum distance from the Drill Rig of the height of the mast plus five feet, but not less than 35 feet around the rig.

- Only personnel absolutely essential to the work activity will be allowed in the exclusion zone.

- Keep boots and gloves clean of mud and well construction materials as these may facilitate a slip and fall.

- Use help to move auger flights and drill rods when mechanical assistance is not available.

- Keep in mind, drilling is physically demanding; extending work over 10 hours/day can result in fatigue and possible injury.

- Of the drilling methods to be employed, the air rotary application has the greatest potential for exposure to site contaminants as it employs air pressure to drive out the cutting. A collection hood (shroud) shall be installed over the borehole and trunk line should be positioned downwind of the drilling and sampling station.

After Drilling

- During maintenance, use only manufacturer provided/approved equipment (i.e. auger flight connectors, etc.). During such time, potential and kinetic energy will be positively controlled.

- Equipment used within the exclusion zone will undergo a complete decontamination and evaluation by the FOL and/or the SSO to determine cleanliness prior to moving to the next location, exiting the site, or prior to down time for maintenance.

- Motorized equipment will be fueled prior to the commencement of the day's activities.

- When not in use drill rig will be shutdown, and emergency brakes set and wheels will be chocked to prevent movement.

- Investigative areas will be restored to equal or better condition than original to remove any contamination brought to the surface and to remove any physical hazards. In situations where these hazards cannot be immediately removed, the area will be barricaded to limit access.

5.3 GROUNDWATER SAMPLING SAFE WORK PRACTICES

Groundwater sampling will be conducted using bladder pumps. These pumps are driven using nitrogen gas. As a result, compressed gas hazards must be recognized along with some of the general practices to minimize groundwater sampling associated hazards. The following safe work practices will apply to groundwater sampling from well screen points, temporary wells and permanent wells.

During Set Up

- Scene safety – When approaching an established or new well location always examine the area surrounding the well. Well pads are a favorite sunning spot for snakes; protective casings provide a controlled nesting environment for spiders such as the widow variety (Black, brown and red) as well as bees/wasps nests. Any collected brush near the well location will often serve as a nesting or hunting location. Again, examine the area for hazards during your set up. Remember where the hazards will come from (the brush, the water, etc.) so place yourself where you can monitor hazards of this nature. Ticks and turkey mites have been a major problem at NSA Crane. A focused diligence should be applied to control this hazard. It is generally thought as this work will be conducted in and around the building complex hazards of this nature will be minimized.

- When removing the well gripper cap (j-plug) from the monitoring well, do so at a fully extended arms length. That way, if the well is pressurized and the cap is released under pressure you will not get struck. Wear nitride gloves and safety glasses during this activity.

- Walk away to minimize exposure to off gassing. This will also allow the well to equilibrate prior to purging and sampling. This is not suspected to be the gas at SWMU 22 as the predominant amount of contamination is metals.

- To minimize potential inhalation of off gas products, keep a lid placed loosely on your collection bucket during sampling. Position yourself up wind, and always keep the lid on your bucket when it is in your transport vehicle. This measure, and the use of mortar tubs as secondary containment, support the spill containment measures specified in this plan during sampling and transport.

- Keep wires and hoses to your power source, as well as, your water quality meter leads collected to minimize trip hazards in and around the wells and well points. Keep hoses collected and out of pedestrian pathways to minimize trip and fall hazards.

- Practice good housekeeping. Keep your equipment clean and wiped down; keep your work area orderly; Wipe down the outside of the IDW buckets to minimize contact and/or off gassing in your vehicle during transport

- Do NOT fill transport buckets or drums greater than 80% to minimize lifting and potentially spilling the contents.

- Wear safety glasses and nitrile gloves when handling sample bottleware with preservatives. These are corrosives in many cases and will result in injury to tissue at al points of contact. Have an eyewash at the ready. After you have been splashed is no time to look for it.

- Carry all sample bottleware in a hard-sided container, so if you fall you will not impale yourself with shards of glass.

- Practice safe cutting practices when cutting tubing, etc. See Section 4.13 of the HSGM.

For additional safe work practices and how they may apply to the tasks being conducted, see Section 13.0 of the HSGM.

5.3.1 Compressed Gases – Cylinder Safe Work Practices

Prior to purchase, transportation, or use inspect the cylinders condition, including:

- Check the cylinder head and body for deformities. Cylinders can be rolled on flat surface. If it wobbles this may indicate the body it has been distorted due to over pressurization, damage, or a construction flaw.

- Determine the condition of the cylinder sidewalls; look for rust, pitting, deformities (e.g. dents) or any condition that may cause the cylinder to fail.

- Look for damage that occurred during transportation.

- Ensure the cylinder is properly labeled regarding the cylinder contents.

- If cylinder head is threaded ensure that a proper cylinder valve cover is in place as well as the proper gauge. Flammable gases will be reversed threads versus non-flammable.

- Always use the proper regulator for each cylinder. Don't use an adaptor or other connections to attach a regulator to a gas cylinder. If it is the correct regulator, it will fit easily on the existing connection.

- Rent the proper size cylinder knowing you may have to physically transport to certain well locations (lifting hazards). As various cylinder manufacturers have different designation, cylinders should not exceed 7x33 (80 Air Gas; 16 Air Liquide; Q size Praxair; B Scott). Transportation of single cylinders this size is permitted under Materials of Trade. Check with the PHSO before transporting multiple bottles as this Materials of Trade provision may be negated based on volume.

If cylinder irregularities are found secure the area, allow no one to approach the cylinder. Have the vendor retrieve the cylinder. **UNDER NO CIRCUMSTANCE MOVE OR TRANSPORT A DAMAGED CYLINDER.** If the vendor will not respond to the site call the Health Sciences Group in Pittsburgh for further instructions.

When using a compressed gas cylinder:

- Wear appropriate personal protective equipment when working with cylinders including:
  - Safety glasses; leather work gloves (make sure there is no oil or grease on the gloves), and steel toed safety boots
- Flame retardant garments for hot work operations.
- Do NOT use oil or grease to lubricate any part of the cylinder or gauges.
- Do NOT use oily rags to clean valves or gauges.
- Flash back arrestors will be used for all oxy/acetylene operations.
- Keep the protective hood or cap in place when not in use.
- The cylinder shall be secured in a cart or other device to permit movement within the general work area and to provide security when in use.
- Liquid stage gases such as acetylene or propane will be transported, used, and stored in a vertical upright position.

Storage Procedures:

- Always store cylinders in an upright position

- Secure all cylinders to a fixed support with chains, or other substantial restraining device.
- When cylinder is not in use keep the valve protective cap securely in place.
- Store cylinders away from heat and electrical sources.
- Store in a well-ventilated area designated for cylinders only. Cylinders will not be stored with any other site equipment.
- Empty cylinders will be marked "Empty" or "MT" and segregated from full cylinders.
- Keep cylinder valves closed when not in use with cap in place. This includes empty cylinders.
- Store and properly secure cylinders in a well ventilated location. The use and storage of flammable or combustible gases maybe restricted at the location. Always seek Advance approval before bringing compressed gas cylinders onsite.
- All cylinders utilized onsite shall be free of corrosion and inspected/tested per Department of Transportation (DOT) requirements. Any cylinder that does not meet DOT inspection requirements must be tagged “Do Not Use” and removed from the property.
- Keep oxidizing gases separate from fuel gases.
- Locate cylinder storage areas in an area away from vehicle traffic, equipment movement, pedestrian traffic, and doorways (exits), and windows.
- If flammable gases are involved, post the area restricting smoking or other open flames from at least 50-feet surrounding the storage area.

Marking and Labeling

- Cylinders must be properly labeled, including the gas identity and appropriate hazard.
- Material Safety Data Sheet (MSDS) must be obtained for all gases brought on site. Personnel will be familiar with the hazards of that particular gas.

Transportation of Compresses Gas Cylinders

- The Tetra Tech policy for transporting compressed gas cylinders is to first rely on having a vendor deliver the cylinders to the work site. This avoids having personnel transporting cylinders in private vehicles thus eliminating the possibility of accidents and injuries. But if vendor delivery is not possible, the transportation of compressed gas cylinders will be permitted under the following under the provisions of 49 CFR 173.6 (a)(2) Materials of Trade:
  - (a)(2) A Division 2.1 or 2.2 material in a cylinder with a gross weight not over 100 kg (220 pounds), or a permanently mounted tank manufactured to the ASME Code of not more than 70 gallon water capacity for a non-liquefied Division 2.2 material with no subsidiary hazard.
  - Cylinders do not exceed 66lbs for flammable gases (Liquefied Division 2.2)

- Cylinders must be secured in the vehicle with chains or tie down devices that do not allow the cylinder to move or break free.
- Cylinders must be adequately cushioned to prevent banging against other objects or equipment.
- Cylinders must be labeled with the appropriate hazard (e.g.: Flammable Gas label for Hydrogen). The supplier will provide labels.
- Personnel are responsible for obtaining the appropriate MSDS for the product from the supplier:
- The MSDS must remain in the vehicle while the cylinder is being transported.
- The MSDS must also be maintained in the site Hazard Communications Folder.
- Cylinders transported must have their valve caps tightly secured and in place.

A Compressed Gas Cylinder Checklist has been included with the groundwater development and sampling AHA. This can be used as a training tool as well as a verification that all control measures as stated have been completed.

6.0 HAZARD ASSESSMENT AND CONTROLS

This section provides reference information regarding the chemical and physical hazards which may be associated with activities that are to be conducted as part of the scope of work.

6.1 CHEMICAL HAZARDS

Based on historical information and the most recent sampling data, the predominant chemical contaminants assumed to be encountered at this site are metals (arsenic, chromium, and lead) and explosive compounds. In addition, we need to prepare for monitoring and/or sampling for silica dust that will likely be encountered when drilling into bedrock. Table 6-1 shows the Contaminants of Potential Concern (COPCs) and their maximum concentrations previously detected on the site along with which media they were detected in.

TABLE 6-1
COPCs MAXIMUM CONCENTRATIONS
PREVIOUSLY DETECTED

Contaminant of Concern	Highest Concentration Previously Detected	OSHA PELs; ACGIH TLV-TWA	Airborne Concentration needed to result in overexposure
Sediments			
Arsenic	12.3mg/kg sediments	ACGIH 0.01mg/m^3 OSHA 0.01mg/m^3 (inorganic compounds)	312.5 mg/m^3
Chromium (as Chromium VI*)	38.6 mg/kg sediments	ACGIH 0.01mg/m^3 OSHA 0.005mg/m^3 (inorganic compounds)	31.25 mg/m^3
Lead	53 mg/kg sediments	ACGIH 0.05mg/m^3 OSHA 0.05mg/m^3 (inorganic compounds)	86.81 mg/m^3
Surface Soils			
Arsenic	7.9 mg/kg surface soils	ACGIH 0.01mg/m^3 OSHA 0.01mg/m^3 (inorganic compounds)	312.5mg/m^3
Lead	11.8 mg/kg surface soils	ACGIH 0.05mg/m^3 OSHA 0.05mg/m^3 (inorganic compounds)	86.81mg/m^3
Subsurface Soils			
Arsenic	4.9 mg/kg subsurface soils	ACGIH 0.01mg/m^3 OSHA 0.01mg/m^3 (inorganic compounds)	312.5mg/m^3
Lead	144 mg/kg subsurface soils	ACGIH 0.05mg/m^3 OSHA 0.05mg/m^3 (inorganic compounds)	86.81mg/m^3
Surface Water			
RDX	0.82 µg/L in surface water	ACGIH 0.5 mg/m_3 OSHA 1.5mg/m^3	NA
Lead	9.6 µg/L in surface water	NA	NA
Arsenic	1.5 µg/L in surface water	NA	NA

Table Notes:

- TWA_8: Average air concentration over an 8-hour work period that is not to be exceeded.
- *: CrVI is used as the worse scenario as it pertains to toxicity and risk. While the liklihood will be to encounter CrIII the risk will be based on CrVI.

The information provided in column 4 of Table 6-1, provides the necessary dust levels that would have to be achieved to reach an exposure concern for these single compounds. These projected dust levels are based on the maximum concentration encountered associated with the most recent sampling event. The concentrations noted are consider negligible and do not present an over exposure concern providing the good work hygiene, diligent decontamination, and associated safe work practices are employed.

6.1.1 Silica Dust Exposure Concern

Initial mathematical calculations indicate that arsenic, chromium VI, and lead are to be of low concern based on source concentrations. Worst case scenarios indicate dust concentrations would have to reach 40 mg/m^3 for an exposure potential to be realized.

However, the potential for exposure to silica (α-quartz, cristobalite, and tridymite) that may present an exposure hazard associated with drilling into the bedrock. As monitoring or analysis for silica dust has not been conducted at this site, it is intended through the concurrent sampling effort to quantify and qualify these potential contaminants to determine if a risk exists.

TABLE 6-2
SILICA DUSTS

Chemical	ACGIH	OSHA
Silica All fractions	0.025 mg/m^3	See 1910.1000 Z-3 Mineral Dusts

The basis of this air sampling/monitoring will be to evaluate exposure potential as it may pertain to the flushing media (air only; air and water) as well as the effectiveness of the engineering controls employed to control dust emissions (shroud, air movement assisted trunk line, etc.).

Silica Dust– Airborne concentrations of silica maybe generated during air rotary drilling activities as the drilling stem is advanced into the bedrock. It is estimated that the vast amount of dusts generated will be crystalline α-quartz. Initial exposure to silica dust can cause irritation of the eyes, nose, and throat like most other dusts. However, if excessive amounts of silica dust are breathed into the lungs, especially over a period of time, it can cause damage to the lung tissue and a resulting condition known as silicosis. Other than some breathlessness during exercise, the disease can remain free of symptoms for 10 to 20 years after exposure. As the scar tissue generation increases, so does breathing difficulty.

The most common form of silicosis develops after long exposure to relatively low concentrations. Once the disease has begun, it will continue to progress even if the worker is removed from further exposure. There is no medical treatment for silicosis. People with silicosis are also at greater risk of developing lung cancer. In 1996 the International Agency for Research on Cancer classified crystalline silica dust as a human carcinogen.

The size of the silica particles is important in causing the disease. Larger particles are usually prevented from reaching the lung's small air sacs, it is the smaller particles (less than 10microns) that are the most dangerous.

The development of silicosis depends on a number of factors including:

- The amount and kind of dust inhaled. The most predominant kinds associated with silicosis are with crystalline quartz, crystalline tridymite, and crystalline cristobalite. For SWMU 22 it is anticipated that the bulk of the product to be α-quartz, versus tridymite and cristobalite crystalline structures as these require extreme pressures and heat to develop.
- The percentage of free silica in the dust – Bedrock shale and sandstone are anticipated to be comprised largely of crystalline α-quartz.
- The form of silica – Crystalline α (alpha) quartz
- The size of the silica particles – This will be largely based on the competency of the rock and the drill bit.
- The duration of exposure – Exposure duration will be over a 10-day period, several hours/day intermittently
- The individual's natural body resistance
- The presence or absence of complicating factors (such as infection).

The only effective protection against silicosis is to prevent silica dust in the air. There a number of simple control measures that can be taken to control exposure to crystalline silica dust as are discussed in the following engineering controls.

Engineering Controls

To control airborne silica dusts, the following measures will be employed:

- The drilling rig will be equipped with a shroud and trunk line to capture and contain dusts and to direct their discharge generated during the drilling process away from the work area. The trunk line then can be used to move these dust away from the driller/driller's helper to a downwind position. This control

can be fitted with an assisted vacuum to capture and control more dusts. Where this is possible, its use and application is recommended.

- Use tools fitted with a water attachment to suppress dust. The flushing media can be air & water or just air. The use of water can assist in controlling but not eliminating the generated dusts.

Decontamination of tools and clothing

- Regular vacuuming (equipped with a High Efficiency Particulate Air Filter (HEPA) and wet sweeping of floors and machinery to remove settled dust is particularly important to stop dust being kicked back into the air. Work clothing should be vacuumed before removal. Under no circumstances should **dry** sweeping take place in areas where silica dust could be present.

Respiratory Protective Equipment

- This should be looked at as a last resort when all other preventative solutions possible have been put in place. Respiratory Protective Equipment can vary from a simple disposable mask to a full respirator supplying clean air for particularly high concentrations of dust. In all cases, the equipment should fit properly and be regularly cleaned and checked. Dust masks are unsuitable for use with a beard, and in these cases, an air supplied respirator with a hood or a helmet and visor should be used. If respiratory protective equipment is used even in a voluntary scenario, then the SSO will be responsible for the implementation of the respiratory protection program. See Section 9.0 of the HSGM

All these preventive measures should not be looked at in isolation but in combination with each other.

Dust levels in the air should be monitored by a competent person. The exposure limit for silica dust (respirable quartz) is 0.025 mg/m^3. See Section 7.0 for monitoring recommendations.

6.1.2 Explosive Compounds

SWMU 22 Lead Azide Pond was an area used for the construction of initiating explosives. The following is intended to provide you information concerning these compounds as they may be experienced as a whole product versus the component derivatives discussed above.

The primary routes of exposure for explosive compounds are skin contact possibly absorption, then ingestion or inhalation of the particulates.

The following information is intended to provide limited physical properties as well as signs and symptoms of overexposure to these compounds. This information is provided as the source compounds from which some of the chemical components maybe derived. Therefore, exposure first will be derived from the source material then the degradation products.

RDX (**R**esearch **D**epartment E**x**plosive, aka **R**oyal **D**emolition E**x**plosive). Its chemical name is cyclotrimethylenetrinitramine. This material is stable at room temperature and will burn rather than explode in the absence of a detonator. It is a colorless odorless solid, but is most reactive in its crystalline form. RDX is destroyed by both UV light and anaerobic processes; therefore it does not accumulate in sediments or on the ground surface and is eventually broken down in surface water. RDX is not acutely toxic in trace amounts. RDX breaks down very quickly when exposed to ambient environmental conditions, but breaks down more slowly when in soils and waters.

The most likely route of exposure at or near hazardous waste sites is contaminated drinking water or through hand-to-mouth contact. RDX changes into other chemicals in the body, but it is not known which chemicals it changes to. Some of these other chemicals may be hazardous to human health. RDX will leave the body through respiration and urination within a few days.

RDX can cause allergic skin reaction and eye irritation based on direct contact or repeated or chronic contact. Systemically, RDX can cause seizures (a problem of the nervous system) in humans and animals when large amounts are inhaled or eaten.

Pentaerythritol tetranitrate (PETN) is the white crystalline powder used in Primacord with lead azide as an initiator. Direct exposure may result in eye irritation and tearing but has limited affects to the skin. Systemically, PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness. Repeated over-exposure may result in chest pains even in the absence of exposure.

Trinitrotoluene (TNT) - Appearance are yellow crystals at room temperature with what is described as a bitter almond odor. TNT is irritating to the eyes and skin. Prolonged skin contact can cause skin irritation, causing the skin to turn a bright yellow-orange color. TNT is poisonous systemically resulting in anemia and liver damage over prolonged period of contact or an acute exposure. Symptoms may include stomach gastrointestinal pain, jaundice, varying degress of CNS depression (headaches and dizziness), muscle pains, and cardiac irregularities.

Wastewater from munitions programs, including contamination of surface and subsurface waters may be colored pink because of the presence of TNT. Such contamination, called "pink water", may be difficult

and expensive to remedy. TNT is prone to exudation of dinitrotoluenes and other isomers of trinitrotoluene. This leads to an increased shock sensitivity.

Nitroglycerin Effects on Humans: Nitroglycerin is a vasodilator which affects the cardiovascular system, blood, and nervous system in humans. Workers exposed to between 0.03 and 0.11 ppm complained of headaches and irritation. Chronic exposure results in the development of tolerance to the cardiovascular effects of nitroglycerin. A break in chronic exposure of one to three days can result in malaise, severe chest pains, palpatations, and even sudden death. Monday morning headaches or angina have been reported to occur in chronically exposed workers as a result of a withdraw from exposure while not working over the weekend. Normally, if the individual is again exposed to nitroglycerin the symptoms will disappear.

Acute exposure to nitroglycerin can cause headaches, nausea, vomiting, occasionally diarrhea, sweating, and lightheadedness. High exposure can cause abdominal cramps, vomiting, depression or mania, mental confusion, delirium, convulsions, paresthesias or paralysis, aphasia, impaired vision, breathing difficulties, methemoglobinemia and blue skin (cyanosis), bradycardia, circulatory collapse, or death.

Lead azide is usually handled underwater and maintained in rubber drums. It is extremely shock sensitive and will actually crackle under your feet when spread over surface soils as a result of open burning/open detonation activities. This material is usually shipped wet with isopropyl alcohol.

Over exposure to this product usually results in health effects associated with the components such as lead. The signs and symptoms are generally non-specific. See Lead in Section 6.1.3.

Lead Styphanate – This compound as lead azide is an initiating explosive. Dust or fume can cause irritation consisting of redness, swelling, and pain associated with the eyes possibly leading to conjunctivitis with repeated exposures. Direct contact with the skin dust may cause irritation consisting of redness and/or swelling. Potential skin absorption contribution to systemic exposure exists. Inhalation of high concentrations may cause respiratory and nasal irritation, coughing, and difficulty breathing. Ingestion may cause nausea, vomiting, constipation, cramps, and or stomach pain.

Prolonged or repeated skin contact may cause more severe irritation or dermatitis. Prolonged or repeated inhalation may cause more severe irritation and possibly lung damage. Chronic exposure to lead can cause kidney damage, anemia, reproductive effects, developmental effects and permanent nervous system damage in humans including changes in cognitive function.

Acute or repeated prolonged exposure may aggravate an existing dermatitis, blood condition, asthma, kidney disease, emphysema, or other respiratory disease.

6.1.3 Component Toxicity

The following information is based on some of the component toxicity versus the initial parent compounds. These are associated with those chemicals listed in Table 6-1.

Arsenic – Arsenic is odorless, white or transparent, lumps or crystals. It is irritating to the eyes, skin, and respiratory tract. Acute toxicity results in all routes of exposure including peripheral nervous system (tingling or burning sensation) damage, and anemia. Possible skin sensitizations may result. Ingestion will be marked by a metallic or garlic like taste. Nausea, vomiting and abdominal pain will follow. Intense thirst, severe hypotension. A human fatal dose is 1 to 2.5 mg/kg. As this material is a solid our concerns are directed at inhalation and ingestion of particulates through direct contribution or hand-to-mouth activities.

Chromium VI Oxide – Chromic acid is a powerful irritant to the skin, eyes and respiratory tract. Affects may include irritation or burning of the nose, throat and air passages. Possible pulmonary edema may result leading to wheezing and difficulty breathing. Skin contact may result in a skin rash characterized by burning itching and redness and possible ulceration. These conditions result from chromic acid or chromates. These conditions may result in permanent damage. If swallowed may cause severe and permanent damage to the digestive tract. Causes gastrointestinal tract burns.

Lead - Lead poisoning usually does not cause symptoms until the level of lead in your blood reaches a toxic concentration that can be different for different age groups and ocerall health. Most lead poisoning comes from low levels of exposure over a long period of time. The major organ systems affected are the central nervous system, digestive tract, and the renal system (urinary tract).

General physical symptoms (usually seen when lead poisoning levels are severe):

- Stomachaches, cramping, constipation, or diarrhea
- Nausea, vomiting
- Persistent, unexplained fatigue
- Headache
- Muscle weakness

6.1.4 Potential Routes of Exposure

Inhalation: Based on the data from previous investigations at this worksite worker exposure to airborne concentrations that could represent a health concern is not considered likely. It is also important to keep in mind that the planned work area is outdoors, with ample natural ventilation that will reduce any airborne

particulates through dilution, dispersion, and heavy particulates will settle out and fall to the ground. In addition area wetting may be employed to control some dust emissions or use an air & water flushing medium to control airborne dusts. Initial assessment indicates dusts concentrations would not have to be excessively high to reach the TLV or PEL for silica dust during air rotary drilling operations. This remains unknown as no bulk samples from the bedrock are available to determine % silica and type.

As a result of this, it is very unlikely that workers participating in these activities will encounter any airborne concentrations of the above COPCs that would represent an occupational exposure concern but silica dusts remain a challenge. Examples of onsite practices that are to be observed that will protect workers from exposure via inhalation include:

- Proper PPE use and hygiene care

Note: This is a concern during the employment of the air rotary rig that the airstream employed to remove cuttings may also result in mobilizing contaminants. Protective measures will include:

- Employment of a shroud and trunk line to contain particulates and dusts and to discharge them away from the work area.

- Based on visible dust levels the use of dust masks and HEPA vacuums are to be employed to control the removal of dust from clothing and tools. There is no scenario in which compressed air or high pressure water that blasts the silica dusts into the air be employed.

Ingestion and Skin Contact: Potential exposure concerns to COPC may also occur through ingesting or coming into direct skin contact with contaminated soils. However, the likelihood of worker exposure concerns through these two routes is also considered low based on reported source concentrations. This maybe further minimized through good personal hygiene and standard good sample collection/sample handling practices, and wearing appropriate PPE as specified in this HASP and diligent decontamination. Examples of onsite practices that are to be observed that will protect workers from exposure via ingestion or skin contact include the following:

- No hand-to-mouth activities on site (eating, drinking, smoking, etc.)
- Washing hands upon leaving the work area and prior to performing any hand to mouth activities
- Wearing proper gloves whenever handling potentially-contaminated media, including soils, hand tools, and sample containers.
- Use D-Lead or similar wipes to remove metals and metalloids from the hands.
- Removing silica dusts using HEPA vacuums to control incidental transfer and exposure.

6.2 PHYSICAL HAZARDS

The following is a list of physical hazards that may be encountered at the site or may be present during the performance of site activities.

- Slip, trips, and falls (See Section 4.1 of the HSGM for additional safe work practices)
- Contact with underground utilities (electric lines, gas lines, water lines, etc.) (See Section 7.0 of the HSGM for additional information concerning Utility Locating and Excavation Clearance)
- Strain/muscle pulls from heavy lifting (See Section 4.4 of the HSGM for additional safe work practices)
- Ambient temperature extremes (heat/cold stress) (See Section 4.6 of the HSGM for additional information concerning detecting, monitoring, and the prevention of heat related injuries)
- Pinch/compression points (See Section 4.5 of the HSGM for additional safe work practices)
- Vehicular and equipment traffic (See Section 4.3 of the HSGM for additional safe work practices)
- Inclement weather (See Section 4.6 of the HSGM for additional information)
- Heavy equipment hazards (pinch/compression points, rotating equipment, etc.) (See Section 4.2 of the HSGM for additional information)
- Noise in excess of 85 decibels (dBA) (See Section 6.0 of the HSGM for additional information)
- Compressed Gases – Cylinder Safe Work Practices (Section 5.4 and 5.4.1). To assist in ensuring the safe work practices are addressed a Compressed Gas Cylinder Safety Checklist has been included with the groundwater AHA provided in Attachment IV.
- Natural hazards (snakes, ticks, poisonous plants, etc.) (See Section 4.0, subsection 5.1 of the HSGM for additional information). Mites and ticks are prevalent at this worksite. While the work will be conducted in and around improved areas and emphasis to these hazards cannot be stressed enough.
- Water hazards – When sampling along water tributaries near this site. See Section 4.10, regarding water hazards and associated safe work practices to be employed to combat these hazards.

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These hazards are discussed in more detail in the Activity Hazard Analysis (AHAs) and additional information may be obtained in the HSGM in the identified sections.

6.3 HOT WORK PROCEDURES

The following defines specific procedures to be employed at NSA Crane to conduct Hot work. This includes any spark producing tools (grinders), open flames (oxy/acetylene units), or elevated temperature applications.

Specific Responsibilities:

SSO

- The SSO is responsible for the safe operations of hot work activity under their supervision. These duties include:
  - Establish permissible areas for hot work.
  - Ensure that only approved apparatus, such as torches, manifolds, regulators and pressure reducing valves, are used.
  - Ensure that all individuals involved in the hot work operations are familiar with NSA Crane Hot Flame Permit.
  - Ensure that all individuals involved in the hot work operations are trained in the safe operation of their equipment and the safe use of the process. These individuals must have an awareness of the risks involved and understand the emergency procedures in the event of a fire.
  - Determine site-specific flammable materials, hazardous processes, or other potential fire hazards present or likely to be present in the work location.
  - Ensure combustibles are protected from ignition by the following means:
  - Move all combustible materials at least 35 feet from the hot work area. Where this is not possible, provide heat shielding protection.
  - Ensure hot work is scheduled such that operations that could expose flammables or combustibles to ignition do not occur during hot work operations.

If any of these conditions cannot be met, then hot work must not be performed.

- Determine that fire protection and extinguishing equipment are properly located and readily available.
- Ensure that a fire watch is posted at the site when:
  - Hot work is performed in a location where other than a minor fire might develop.
  - Combustible materials are closer than 35 ft to the point of hot work.
- Where a fire watch is required, the Fire Watch shall make a final inspection $^1/_2$ hour after the completion of hot work operations to detect and extinguish possible smoldering fires.

Permit Holder (Person actually doing the Hot Work):

- The Permit Holder shall handle the equipment safely and perform work so as not to endanger lives and property. Specific duties include:
  - No hot work shall be conducted without specific written authorization from the Fire Prevention via completion of the Hot Flame Permit.
  - The operator must cease hot work operations if conditions under which the permit were issued changes. Hot work may resume after conditions have been reassessed.

Fire Watch:

- The function of the fire watch is to observe the hot work and monitor conditions to ensure that a fire or explosion does not occur as a result of the work performed. The fire watch is authorized to stop any unsafe operation or activity. Specific duties and responsibilities include:
  - Watch for fires, smoldering material or other signs of combustion.
  - Be aware of the inherent hazards of the work site and of the hot work.
  - Ensure that safe conditions are maintained during hot work operations and stop the hot work operations if conditions under which the permit was issued change.
  - Have fire-extinguishing equipment readily available and be trained in its use.
  - Extinguish fires when the fires are obviously within the capacity of the equipment available. If the fire is beyond the capacity of the equipment, sound the alarm immediately.
  - Be familiar with the facilities and procedures for sounding an alarm in the event of a fire.
  - A fire watch shall be maintained for at least $^{1}/_{2}$ hour after completion of hot work operations.
  - More than one fire watch may be required if combustible materials that could be ignited by the hot work operation cannot be directly observed by a single fire watch (e.g. in adjacent rooms where hot work is done on a common wall).

Hot Work Operational Requirements – Hot Work Permit Issuance

- Please note that when requesting a Hot Flame Permit, the area supervisor, permit holder, Contractor etc, will dial x-1235/1458 and give the following minimal information:
  - Name of caller, with call back number.
  - Name of trade, contractor, or tenant activity performing the hot work.
  - Type of work to be performed, such as welding, grinding, acetylene torch, etc.
  - Building/Magazine number or area where permit is to be issued.
- Finally, each permit is to be requested on the day needed. Also, the individual who will be doing the actual hot work (also called the “Permit Holder”) must be present to receive instructions from the Fire Inspector, and to actually sign for the permit. If the permit is requested in an explosive area, the building supervisor (or designated representative) must be present in order to sign the permit.
- It should be noted that each permit is unique in its own way. A permit could be issued for one to fourteen (14) days in duration (max limit inspectors are authorized to approve). Longer duration permits (up to twenty-eight (28) day duration) require the Fire Prevention Chiefs’ approval. Permit renewals must be called into the Fire Department before the last day of approval is reached.

Work Closeout:

- A fire watch shall be maintained for at least 30 minutes after completion of hot work operations in order to detect and extinguish smoldering fires.

- The SSO shall inspect the job site 30 minutes following completion of hot work and close out the permit with the time and date of the final check.
- The completed Hot Work Permit shall be retained in the project files following completion of the project.

7.0 AIR MONITORING

It is the intent of this section to present the air sampling and monitoring approach to be utilized at the NSA Crane, SWMU 22 Lead Azide Pond during air rotary drilling. It is the objective of this section to define hazard monitoring/hazard sampling approach as it relates to the tasks to be conducted to ascertain the exposure potential of contaminants of concern and for those materials (α-silica dust) that are generated through the process.

7.1 AIR ROTARY DRILLING

One of the primary tasks to be conducted includes the installation of bedrock wells utilizing air rotary drilling. In this application, a pressurized air stream clears the borehole as the hardened bit cuts the rock. Particulates of various sizes are then driven out of the borehole where they can be removed using shovels or captured in screens for borehole logging and analysis.

As is discussed in the AHA, an engineering control that may be employed to control the exposure potential to particulates, is through the use of a shroud that extends over the drill string down over the borehole and a trunk line from the shroud. A shroud can be placed surrounding the drill string and from this a trunk line can be extended to capture and direct the dust and particulate burden discharge away from the workers through the trunk line to a downwind location. This trunk line can be extended, and a blower assist can be used to move the material further from the work area. Additionally, these trunk lines can be discharged into cyclones in which the heavy particles slow and drop out. For this to be affective, the shroud must be kept close to the ground, and the vacuum assist must be used to increase capture ability.

To monitor the effectiveness of this engineering control, real time dust monitoring will be performed to qualify size distribution and to quantify total dust airborne particulates using a HAZ IV Dust monitor.

Because the containment shroud will not control 100% of the dust emissions, a real-time air sample for respirable silica dusts will be collected during concurrent monitoring. This approach will permit some correlation to monitoring results.

7.1.1 HAZ IV Real Time Aerosol Monitor

The HAZ-DUST IV personal real-time aerosol monitor, with new infrared detector, provides you with immediate breathing zone measurements of aerosol and dust for industrial hygiene and environmental air investigations. The small, lightweight unit attaches to a worker's belt while the miniature sensor easily clips

to a worker's collar. The HAZ IV in this application will be equipped with a respirable dust sampling heads to target a specific fraction or size.

The driller in this case will represent the worst case scenario as he/she cannot leave the controls during drilling which puts him/her near the borehole and dust release point. Monitoring and sampling conducted for the driller will represent the highest exposure concentration and will be suitable to for ascertaining exposure potential for all other job classifications.

7.2 SITE DESCRIPTION/EXPOSURE POTENTIAL

During drilling, the potential for exposure exists through:

- Inhalation – The rock fragments are carried up out of the borehole as a flushing media of compressed air is applied. The fragments will be of various sizes relative to the competency of the rock. For particulates to be flushed they will be ground to small sizes ranging from a particle of sand to a fine powder resulting from repeated grinding. These fine particles are of primary concern as they can become airborne through minimal mechanical agitation. The larger particulates associated with the bedrock are not of concern as they do not become readily airborne due to their size and mass and quickly drop out. It is the intent of this air sampling/monitoring plan to qualify and quantify that impact to assess potential exposure to site personnel and nearby receptors not directly involved in the operation.

- Contact and ingestion – Ingestion exposure typically occurs through failure to observe good site work practices (such as proper use of dermal PPE, prohibiting hand-to mouth activities such as eating, smoking or use of other tobacco products) and personal decontamination practices, and also through poor personal hygiene practices such as hands washing after leaving the work area and before engaging in any hand-to-mouth activities.

- Skin and eye irritation – The particulates or other abrasive components may result in scratching and mechanical irritation of the skin and eyes.

7.2.1 Background Levels

In order to establish an understanding of general ambient air quality conditions for this location without the affect of this drilling action (e.g., determine “background” air quality conditions), area samples will also be collected for at least two days prior to the drilling activity to determine the amount of airborne contribution associated with the process area.

7.2.2 Representative Air Sample Collection

Personal air sampling is performed by affixing the air sampling equipment (Haz Dust IV) to a worker in a way that the sampling media (e.g., filters housed in plastic cassettes) are affixed in the breathing area of a worker (typically, clipped to a workers shirt collar or otherwise near the head and face). The Haz Dust IV will be affixed to the worker's belt, with flexible tygon tubing connecting the pump to the sampling apparatus and media (e.g., cyclone, cassette, etc.).

For personal sampling, it is not necessary to sample every worker or to sample every day. The intent of an air sampling plan is to design an approach to collect enough samples to evaluate air quality and worker exposure/no-exposure conditions during the work. This is commonly referred to as "representative sampling". In this approach, work activities will be segregated into the different types of personnel assignments that will be associated with the planned work and at least one sample will be taken for each onsite work assignment with the results considered as "representative" for all other workers performing similar assignments [e.g., drill rig (driller) and supporting ground personnel directing the excavation removal and loading). Air samples will be collected in accordance with NIOSH Method #7500. This method number is provided in Attachment V of this HASP. Within this method, directions are provided for the calibration and establishment of the flow rate for the Haz Dust IV with the sampling train in place. Also provided in Attachment V is the Tetra Tech Air Sample Log Sheet where calibration and environmental condition information will be recorded.

The instrument will be equipped with an in-line 37-mm cassette and cyclone behind the sensor allows the collection of a concurrent filter sample for gravimetric or chemical analysis [see Attachment V, (NIOSH Analytical Method #7500)]. Through this sample the percent, size, and type of silica can be determined. The instrument flow rate will be set at the desired flow rate 1.7 liters per minute (l/min) (nylon cyclone) or 2.2 l/min using an aluminum cyclone for the sampling methodology to be employed. Closely examine the cyclone interior to insure it is not scored or dirty. Assemble the sampling train and calibrate based on the type of equipment being used. This calibration will be recorded on the Tetra Tech Air Sample Log Sheet provided with the sample methodology in Attachment V. Calibration will be accomplished using a Bios Dry Cal Calibrator to set the flow rate. There are a couple of important considerations to keep in mind:

- Never overload the filter with more than 2 mg of dust. This is a subjective evaluation. If the filter appears to be getting dirty, collect that filter and continue sampling with a second in order to achieve minimum air volumes requirements.
- Stay within the required minimum and maximum volumes of 400 l (minimum volume) and 1000 L (maximum volume)
- The orientation of the cyclone is critical. Turning the cyclone to anything other orientation than vertical (such as inverting) will result in larger particles depositing on the filter and affecting your results.

As this is a Time Weighted Average the HazDust IV should continue to run even during periods of non-drilling. The results of the air sample will be compared to 0.025mg/m^3 as a TWA collected as a respirable fraction.

7.2.3 Area Air Sampling

It is critical in controlling the discharge of particulate matter from the trunk line to areas surrounding the drilling operation. If excessive dust is generated and not controlled additional area air sampling will be required to insure NSA Crane personnel and property are not affected by the drilling operations and the dust dispersal. This additional sampling will involve air sampling pumps and procedures as previously described, with the exception that the sampling devices will not be affixed to any workers. Instead, the sampling device and apparatus will be placed in open locations (removed from or protected from operating equipment or other site activities) around the work area to evaluate ambient air conditions during the work activities. Area sampling will be performed in three different aspects:

- **Work zone Perimeter Monitoring** – Area air sampling will be performed along what will be defined as the perimeter boundary of the work site, downwind during the drilling. This will be an area that separates the drilling area and downwind receptors. Three samplers are used to accommodate minor wind directional changes. Meteorological information will be obtained and recorded each morning from the closest airport or the facility if they are recording meteorological information. At least one wind socks will be placed within the drilling area. Sustained wind direction changes will require relocation of perimeter and downwind samplers.

- **Upwind and downwind locations** – During each day of sampling, an upwind sample will be collected to ensure the area is not being impacted from other potential sources. In addition, during each day of sampling a downwind sample will be collected at 100 feet from the discharge point of the trunk line. It is the intent of this sample to potentially capture emissions that may not have settled sufficiently to be captured at the exclusion zone boundary.

- **Nearest Off site Receptor Locations - Process building(s)** – The closest receptor to the operations will be the process buildings located south of the former lead azide pond. An air sample pump and collection media will be placed in that location to determine if there is any introduction of dusts and/or particulates into the air intake or over parked vehicles.

7.2.4 Air Sample(s) - Number and Frequency

The following will prescribe the frequency regarding the collection of air samples during air rotary drilling into bedrock. There are provisions to be considered in the collection of these samples, which are as follows:

- If the drilling subcontractor has already sampled personnel most importantly the driller during this drilling process (same or similar drilling machines and operating air pressures, environmental conditions, approved methods, etc.), the subcontractor will provide the results and any associated validation to the PHSO for evaluation. If the results are accepted, no additional air samples will be required during monitoring of dust levels.
- If there are no employer determinations, then the initial sample(s) will be collected at the beginning of the project in an effort to collect as much information as possible to permit the evaluation of protective levels selected and the necessity to modify these levels based on this information.
- Additional samples will be collected any time the process or engineering or administrative controls are altered in order to evaluate the success or failure of these changes.
- It is recommended that at least three air samples be collected through the course of drilling. It is not recommended that sampling be conducted during rain events or high winds as these results may be skewed by environmental conditions.
- The results associated with the dust monitoring and subsequent air samples results will be provided to the PHSO for evaluation. Additional air samples may be directed based on dust monitoring and air sample results correlation.

7.3 SAMPLE COLLECTION/SAMPLE PREPARATION

1. Apply the calibrator to the Haz Dust IV to determine post calibration flow rates. Record this information on your sampling log sheet.
2. The filter cassette will be removed from the sample train, and caps will be placed on the filter cassette.
3. The filter along with a method or field blank will be sent to an Industrial Hygiene laboratory for analysis utilizing NIOSH Method #7500. The method blank will utilize a cassette with filter and the caps. You will not draw air through the field blanks. You will collect at least two field or method blanks per ten air samples.
4. The cassette will be labeled concerning the sample identification and volume of air collected. See Section 7.3.1.
5. Samples will be wrapped in Bubble wrap and placed into ziplock bags and into a cooler that will be sealed with custody seals. They do not require chilling. Ambient temperature transport is sufficient.
6. The Chain of custody will have start and stop times and total volume of air sampled.

7. Results shall be directed to the PHSO for evaluation.

7.3.1 Sample Nomenclature

For Representative Personal Sampling, the following sample nomenclature will be employed

AAA	AA	AAAA	NN	NNNNNNNN
Site location 022	Matrix Code	Job Category Drlr	Persons Initials	Date in mmddyyyy

7.3.1.1 QC Sample Numbering

The QC code will consist of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AA	AA	NNNNNN	NN
QC type	Matrix Code	Date	Sequence number(per day)

The QC types are identified as:

- TB = Trip Blank
- FB = Field Blank
- AB = Ambient Blank
- FD = Field Duplicate

Valid matrix codes are:

- AS = Air sample

The sampling time recorded on the chain-of-custody form and labels for duplicate samples will be “0000” so that the samples are "blind" to the laboratory. Notes detailing the sample number, time, date, flow rate and total air volume will be recorded on the sample log sheet and in the field log bog to document the location of the samples and duplicate sample (sample log sheets are not provided to the laboratory).

7.3.1.2 Quality Control

Field Duplicates

Field duplicates will be collected during a single act of sampling to assess the overall precision of the sampling and analysis program. The frequency for duplicate sample collection is one duplicate sample per every 20 samples collected.

Selection of the locations for duplicate sampling will be left to the discretion of the Sampling Technician. At the conclusion of each daily monitoring event, the FOL will document all sampling activity in a daily log, on sample data sheets, download electronic data from the real-time dust samplers, and prepare and ship or transfer custody of all samples for analysis to the selected laboratory.

7.3.2 Hollow Stem Auger (HSA)/DPT Drilling/Multi-Media Sampling/Surveying

During these activities, no monitoring will be conducted. The drilling will occur in the overburden. The identified contaminants of concern are not anticipated to present an exposure threat. Area wetting will be performed to knock down and control any visible dust emissions of overburden materials.

The multi-media sampling and surveying due to their minimal intrusive nature, emissions are considered negligible or non applicable in the case of groundwater sampling. Therefore, monitoring will not be conducted during these activities.

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

This section specifies health and safety training and medical surveillance requirements for both Tetra Tech and subcontractor personnel participating in on-site activities.

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

Tetra Tech and subcontractor personnel must complete:

- 40 hours of introductory hazardous waste site training and 3 days of on-the-job training prior to performing work at the NSA Crane, SWMU 22.
- Persons who have had introductory training more than 12 months prior to site work must have completed 8 hours of Refresher Training within the past 12 months, before being cleared for site work.
- 8-hours Supervisory Training, in accordance with 29 CFR 1910.120(e)(4), will be required for site supervisory personnel.
- 8-Hour Supervisory Refresher Training must be completed for supervisors who have had their initial or most recent supervisory refresher training greater than 12 months ago.

Documentation of Tetra Tech introductory, supervisory, and refresher training, as well as, site-specific training will be maintained at the site. Copies of certificates or other official documentation will be used to fulfill this requirement.

8.2 SITE-SPECIFIC TRAINING

Tetra Tech FOL and the SSO will provide site-specific training to Tetra Tech employees and subcontractor personnel who will perform work on this project prior to those personnel's initiation of work activities at the site.

The FOL will be responsible for providing training concerning the work to be performed as stipulated in the scope of work and elements of the SOPs that will be employed. In this training SOP review, methods of sampling, etc. shall be reviewed in tandem with the safety and health measures as specified in this plan and in the identified elements of the HSGM as it relates to the scope of work and facility specific requirements.

Figure 8-1 will be used to document the provision and content of the project-specific and associated training. Site personnel will be required to sign this form prior to commencement of site activities. This training documentation will be employed to identify personnel who through record review and attendance

of the site-specific training who are cleared for participation in site activities and for what duration. This document shall be posted to maintain an active list of cleared site personnel.

Tetra Tech will conduct a pre-activities operations discussion prior to initiating site work. Additionally, a brief Tail Gate Safety meeting may be held daily to discuss operations planned for that day as well as a short meeting that may be held at the end of the day to discuss the operations completed and any problems encountered. This activity will be supported through the use of the AHA or Tail Gate Safety Meeting Attendance Form provided as Figure 8-2. Documentation of these efforts can also be recorded in the project logbook.

8.2.1 Other Training

In addition, on-site personnel will be required to provide proof of training, license or certification in:

- Driller License or Certification
- Surveyors License or Certification
- First Aid/CPR and Bloodborne Pathogen Training (two persons preferred)
- Any activity requiring the support of a Competent or Qualified Person as defined by OSHA. As it pertains to the activities to be conducted at SWMU 22, the Air monitoring/Air sampling would be an example of this requirement.
- Persons responsible for the implementation of Safety and Health programs including but not limited to
  - Hazard Communication
  - Hearing Conservation
  - Bloodborne Pathogens
  - Air monitoring and/or collection of air samples

Appropriate documentation of completed personnel training will be collected, reviewed, and maintained at the project worksite by the SSO.

8.3 MEDICAL SURVEILLANCE

Tetra Tech and subcontractor personnel participating in project field activities will have had a physical examination meeting the requirements of their respective company's medical surveillance program. The respective medical surveillance programs will meet the minimum contents identified in 29 CFR 1910.120(f).

Documentation for medical clearances will be maintained on the project site and made available, as necessary, and will be documented using Figure 8-1 for every employee participating in onsite work activities at this site.

FIGURE 8- 1

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing remedial investigation activities at NSA Crane, Crane, Indiana and that I have received site-specific training, which included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present at the sites
- Use of personal protective equipment
- Work practices to minimize tasks from hazards
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of the contents of relevant Material Safety Data Sheets
- Review of the use of the AHAs
- Review of Stop Work policy

I state that I have been given the opportunity to ask questions and that my questions have been answered to my satisfaction. The dates of my training (introductory, refresher, and supervisory, as applicable) and my medical surveillance requirements are accurate and correct to the best of my knowledge.

Name (Printed and Signature)	Site-Specific Training Date	40-Hour Training (Date)	8-Hour Refresher Training (Date)	8-Hour Supervisory Training (Date)	Medical Exam

Instructor(s): _____

_____

FIGURE 8-2

TAILGATE/SAFETY MEETING ATTENDANCE FORM

Facility Name: NSA Crane; SWMU 22, Lead Azide Pond Date:

Project Number:

Project/Task Order Manager: Tim Evans

Field Operations Leader/Superintendent:

Site Safety and Health Officer:

Type of Tasks Being Conducted Today:

Topics Discussed:

ATTENDEE'S NAME	JOB TITLE	AFFILIATION	SIGNATURE

Instructor(s):

Action Item	Due Date	Responsibility	Status	Comment

Documentation will be censored for private information (social security numbers, etc.) to support HIPAA requirements. This information will be removed or blackened to obscure.

8.4 MEDICAL DATA SHEETS

Medical Data Sheet Exception - Health Insurance Portability and Accountability (HIPAA) Requirements – The Privacy Rule

The HIPAA came into effect in 1996. The Privacy Rule was then amended April 14, 2003. Loosely interpreted, it establishes regulations for the use and disclosure of Protected Health Information (PHI) by the entity collecting that information. PHI is any information about health status (such as that you may report on your Medical Data Sheet Information), provision of health care, or payment for health care. This rule also requires Tetra Tech, in this case to insure the confidentiality of communication (Medical Data Sheets). This provision severely limits the ability of the Medical Data Sheet to convey information you would want the Doctor to know regarding PHI if you were incapacitated. This rule also limits the SSO ability to insure provisions are in place to provide timely response for instance to a severe allergic reaction. So before you complete the Medical Data Sheet understand that:

- The Medical Data Sheets will not be maintained in a secure location. They will be maintained in a file box or binder accessible to all members of the field crew. In addition, all personnel will carry a copy on their person. This is intended to make these documents quickly accessible so they can accompany the injured party to the hospital should there be an event.

- DO NOT include information that you do not wish others to know, only information that may be pertinent in an emergency situation or treatment such as allergic reaction to insects, drugs, or occupationally relevant information.

Each field team member, including visitors, entering the exclusion zone(s) will be requested to complete and submit a copy of the Medical Data Sheet (see Attachment II of this HASP). This shall be provided to the SSO, prior to participating in site activities. You may opt out, but should inform the SSO of any condition that may be relevant in your treatment.

9.0 SITE CONTROL

This section outlines the means to delineate work zones and use these work zones in conjunction with decontamination procedures to prevent the spread of contaminants into previously unaffected areas. It is anticipated that a three-zone approach will be used during work at this site. This approach will be comprised of an exclusion zone, a contamination reduction zone, and a support zone. It is also anticipated that this approach will control access to site work areas, restricting access by the general public, minimizing the potential for the spread of contaminants, and protecting individuals who are not cleared to enter work areas.

9.1 EXCLUSION ZONE

The exclusion zone will be considered those areas of active operations plus an established safety zone depending on the task. The following represent the exclusion zone boundaries for the following identified tasks:

- Surface soil, sediment and groundwater sampling – 5 feet surrounding the sample collection points
- Decontamination – 5 feet surrounding the point of operation, low pressure decontamination (DPT rig) or HEPA vacuum use.
- High pressure decontamination – Pressure washer – 35-feet surrounding the decon pad boundary.
- DPT drilling – 25 feet surrounding the point of operation
- HSA/Air Rotary Drilling operations – Minimum 35-feet + five feet surrounding the point of operation or discharge hose for the air rotary drill rig.
- Surveying – Signs indicating surveyors working ahead will be required on all approach routes. If traffic patterns are to be altered signage will be placed at least 400-feet from where the taper zone begins to the point will lane restrictions take place. Speed will be reduced to 25 mph. All Traffic control plans and signage will meet the Manual on Uniform Traffic Control Devices.(MUTCD 2009).

Previously, NSA Crane provided signage as was needed for traffic control. Exclusion zones will be delineated using barrier tape, cones and/or drive poles, and postings to inform and direct facility site personnel and visitors, as necessary.

9.2 CONTAMINATION REDUCTION ZONE

The contamination reduction zone (CRZ) will be a buffer area between the exclusion zone and any area of the site where contamination is not suspected. This area will also serve as a focal point in supporting exclusion zone activities. This area will be marked using barrier tape, cones, and postings to inform and

direct facility personnel. High pressure decontamination activities will be conducted at a central location. Equipment potentially contaminated will be bagged and taken to that location for decontamination.

9.3 SUPPORT ZONE

The support zone for this project will include a staging area where site vehicles will be parked, equipment will be unloaded, and where food and drink containers will be maintained. The support zones will be established at areas of the site where away from potential exposure to site contaminants during normal working conditions or foreseeable emergencies.

9.4 ACTIVITY HAZARD ANALYSES

Work conducted in support of this project will be performed using Activity Hazard Analyses (AHAs) to guide and direct field crews on a task by task basis. Partially completed AHAs for the work to be performed are included as Attachment IV of this HASP. These AHAs were completed to the extent possible as part of the development of this HASP. It is the SSO's responsibility to finalize and complete these documents based on current, existing conditions the day the task is to be performed, and then review that completed AHA with the task participants as part of a pre-task tail gate briefing session. This will ensure that site-specific considerations and changing conditions are appropriately incorporated into the AHA, and will provide the SSO with a structured format for conducting the tail gate sessions, as well will also give personnel an opportunity to ask questions and make suggestions. The AHAs require the signature of the FOL and/or SSO.

A pre-startup site visit will be conducted to identify proposed subsurface investigation locations, conduct utility clearances, and provide notices concerning scheduled activities.

Subsurface activities will proceed only when utility clearance has been obtained. In the event that a utility is struck during a subsurface investigative activity, the emergency numbers provided in Section 2.0, Table 2-1, will be notified.

9.5 SITE VISITORS

Site visitors for the purpose of this document are identified as representing the following groups of individuals:

- Personnel invited to observe or participate in operations by Tetra Tech
- Regulatory personnel (i.e., DoD, EPA, OSHA)
- Authorized Navy Personnel

- Other authorized visitors

Non-Tetra Tech personnel working on this project are required to gain initial access to the base by coordinating with the Tetra Tech FOL or designee and following established base access procedures.

Site visitors will be escorted and restricted from approaching any work areas where they could potentially be exposed to hazardous chemicals. If a visitor has authorization from the client and from the Tetra Tech Project Manager to approach our work areas, the FOL must assure that the visitor first provides documentation indicating that he/she/they have successfully completed the necessary OSHA introductory training, receive site-specific training from the SSO, and that they have been physically cleared to work on hazardous waste sites.

9.6 SITE SECURITY

Site security will be accomplished using Tetra Tech field personnel. Tetra Tech will retain complete control over active operational areas. As this activity takes place at a Navy facility open to public access by base personnel, the first line of security will take place using exclusive zone barriers, AHAs, and any existing barriers at the sites to restrict the general public. The second line of security will take place at the work site referring interested parties to the Base Contact. The Base Contact will serve as a focal point for base personnel, interested parties, and serve as the final line of security and the primary enforcement contact.

9.7 BUDDY SYSTEM

Personnel engaged in on-site activities will practice the "buddy system" to ensure the safety of personnel involved in this operation. Wherever possible, personnel will work with a Buddy to complete work activities. The Buddy system employs a mechanism in which personnel may account for one another through visible accounting or in some cases through periodic check-in procedures.

9.8 MATERIAL SAFETY DATA SHEET (MSDS) REQUIREMENTS

A chemical inventory of the chemicals brought and used on site will be developed using the Health and Safety Guidance Manual (Section 6.0). Tetra Tech and subcontractor personnel will provide MSDSs for chemicals brought onsite. The contents of these documents will be reviewed by the SSO with the user(s) of the chemical substances prior to any actual use or application of the substances on site. The MSDSs will then be maintained in a central location (i.e., temporary office) and will be available for anyone to review upon request.

It is required that during any transport of a hazardous material that the driver maintain MSDSs with the materials being transported. An example of this would be carrying the MSDS for the cylinder of nitrogen used to power bladder pumps during groundwater sampling.

9.9 COMMUNICATION

As personnel will be working in proximity to one another during field activities, a supported means (two-way radios or cell phones) of communication between field crew members will not be necessary.

External communication will be accomplished by using the cell phone. Workers should enter the emergency and important phone numbers from Table 2-1 into their cell phones prior to beginning work. The use of two way radios will be approved for the area in which they are used due to the potential to initiate charges through certain radio frequency use.

9.10 SANITATION AND BREAK AREAS

This section will address the following items:

- Toilets
- Potable water
- Showers and change rooms
- Break Areas

9.10.1 Toilets

One toilet will be provided for every 20 people. All toilets will be unisex and will have locking doors. The toilet provided will either be a chemical toilet and service provider or the flush toilet readily accessible at a predetermined approved location at the site where work is being conducted.

9.10.2 Potable Water/Electrolyte Balanced Drinks

Potable water as well as electrolyte balance sports drinks such as Gatorade will be provided to the field crews for fluid replacement, as it is necessary under conditions of ambient temperature extremes. Storage and dispensing will proceed as follows:

- All containers will be clean and replenished daily.

- All containers will clearly marked as to their contents (Potable Water – Drinking Water Only; Gatorade, etc.). It is also recommended that these flavored drinks be employed as they will stimulate consumption versus that of plain water. It is recommended that plain water be consumed at a 1 flavored to 3 water ratio.

- Dispensing locations will be placed in identified break areas within the support zone. The most likely location will be at a support vehicle staged near the work area. This will serve as an area for cooling or warming as well as an identified food and drink consumption area.

- If larger containers are used, dispensing cups will be provided.

- The coolers used for storage of potable drinks and cups will be stored in plastic bags away from potentially contaminating materials when not in use.

Note: Containers (drilling, decontamination fluids) containing non-potable water sources will also be marked/labeled to insure they do not get mixed up with potable water sources.

9.10.3 Showers and Change Rooms

Based on this scope and duration of this project shower facilities and locker rooms will not be required.

9.10.4 Break Areas

Given the location and the time of the year structured suitable locations for work breaks and cooling regimens will reflect the ambient conditions anticipated for that time of the year. Portable shelters such as canopies can be provided for protection from the sun as well as to provide a suitable area to permit cooling in a hot environment. This may also be suitable for conducting certain field activities within a static position such as monitoring well installation, monitoring well sampling, and/or traffic control.

10.0 SPILL CONTAINMENT PROGRAM

10.1 SCOPE AND APPLICATION

This spill containment program will apply to the following scenarios:

- Resource Deployment – This includes resource storage areas for fuels (petroleum products)
- Point of Investigation – This includes an area surrounding the drill rigs. As it is known that many of the components of the drill rigs operate based on hydraulic pressure, the potential for release and spill response should be recognized.
- IDW Management Area – This is the area in which drums of soil cuttings; purge and decontamination waters are stored.

It is not anticipated that quantities of bulk, potentially hazardous, materials will be handled during some of the site activities conducted as part of the scope of work (including IDW). It is also not anticipated that spillage of these materials would constitute a significant danger to human health or the environment. It is, however, recognize that the potential for accumulation of these materials exists, and therefore, preparation for a spill or a release is necessary. Further, it is possible that as the job progresses disposable PPE and other non-reusable items will be generated. These items will be washed or flushed of residual materials and disposed of as normal refuse.

10.2 POTENTIAL SPILL AREAS/PREVENTION METHODS

To establish an early detection of potential spills or leaks, the following measures will be employed

Resource Deployment

Fuels will be dispensed from safety cans to minimize the potential for spills.

Flammable and Combustible Liquids Safety Cans

OSHA defines a safety can as:

> "An approved container, of not more than 5 gallons capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure" [1910.106(a)(29)]."

Approved safety cans have several basic design qualities:

- They have a spring loaded cap that closes the spout automatically when released. Tension in the spring forces the cap closed and provides a leak proof seal.

- The spring tension is also designed to lift the cap slightly in the event of excessive internal vapor pressure inside the can. This automatically vents off vapors at approximately five psi internal pressure, to prevent the can from rupturing or exploding if it is exposed to excessive outside heat. Many plastic approved gasoline cans do not have this design characteristic and will rupture if overheated.

- The spout is also equipped with a flame arrester screen designed to prevent outside fire from reaching the gasoline inside the can. This is the same type of screen that is found in marine gasoline engine carburetors. With the screen in place, if the can is involved in a fire, the vapors will burn around the spout, but will not permit an internal fire or explosion. This screen must not be removed or damaged.

- Finally, it is extremely dangerous to carry gasoline--even in a safety can--in the trunk of a vehicle. If the trunk heats up from the sun, the contents of the can will expand and pressure will raise the springed cap. This permits vapors to accumulate in the trunk, and an explosion may result.

Products that meet the requirements are given either a UL product or FM approved. Both laboratories are also recognized by OSHA. In addition, 29 CFR 1910.106 limits the amount of liquid in a single safety can. The following chart shows the allowable amounts for each class of liquid.

MAXIMUM ALLOWABLE SIZE OF CONTAINERS AND METAL PORTABLE TANKS

	Flammable Liquids		**Combustible Liquids**		
Container Type	**Class IA**	**Class IB**	**Class IC**	**Class II**	**Class III**
Glass or approved plastic	1 pint	1 quart	1 gallon	1 gallon	1 gallon
Metal (other than DOT drums)	1 gallon	5 gallon	5 gallon	5 gallon	5 gallon
Safety Cans	2 gallon	5 gallon	5 gallon	5 gallon	5 gallon
Metal Drum (DOT spec.)	60 gallon	60 gallon	60 gallon	60 gallon	60 gallon
Approved Metal Portable Tanks	660 gallon	660 gallon	660 gallon	660 gallon	660 gallon

Source: Lab Safety Supply EZ Facts

This table is provided to illustrate the size of other types of containers. As is indicated above, approved plastic containers will have a permitted capacity of only one gallon.

Spill prevention besides the use of the safety cans will be through:

- The use of funnels to guide and direct fuels into the fuel tanks;
- The use of spill pads to capture incidental spills during fueling;
- DO NOT over fill the safety can. This makes it more difficult to handle during fueling operations.

Compressed Gas Cylinders

Cylinders of nitrogen will be employed to power the bladder pumps. These cylinders will be transported in site vehicles and hand carried where necessary to monitoring wells. The current storage location for these cylinders is in vehicles during use and in the tool section of the office trailer when not in use. Leaks associated with compressed gas cylinders are uncommon. However, should it be noted, the cylinder will be removed from where personnel are and allowed to discharge. Once discharged, the vendor will be notified for pick up or it may be delivered.

- Mark the cylinder “Empty” or “MT”, plus a note indicating the valve (cylinder) is leaking.
- Expired compressed air calibration gases will be taken outside and discharged, marked empty. These disposable cylinders, once disabled may be disposed of as general refuse.

DPT/HSA/Air Rotary Drill Rigs

Potential releases associated with these types of equipment are based on the rupture and/or release of a hydraulic line or storage reservoir. To combat these potential release points the following will be conducted:

- Equipment inspection – All leaks will be corrected before work is allowed to commence. All hydraulic lines will be examined for damage (structural) and those caused by overheating. Dried or peeling friction resistant covers are an indication of overheating.
- Maintain spill pads at the drill rigs for rapid response.
- While it is somewhat cumbersome the placement of plastic sheeting under the drill rig will provide protection from the released material reaching the environment. However, care must be exercised not to extend the plastic beyond the rig creating a slip, trip, and fall hazard.

IDW

The following measures will be employed to control and/or minimize spills associated with IDW management.

- A periodic walk-around by the personnel staging or disposing of drums area will be conducted during working hours to visually determine that storage vessels are not leaking. If a leak is detected, the contents will be transferred, using a hand pump, buckets, or similar device, into a new vessel. The leak will be collected and contained using absorbents such as Oil-Dry or sand, which will be maintained in vulnerable areas in a conspicuously marked drum. This used material, too, will be containerized for disposal pending analysis.

- The FOL and/or the SSO will identify potential transport routes (drainage swales and ditches) from the IDW Storage area. These routes will be blocked or otherwise controlled to minimize migration from this release location. This may include the placement of straw bales or silt fence leading from the IDW management area. The area for storage will not be selected along stream or other active conveyance routes.

- Drums and transport buckets will not be filled greater than 80%. Mortar tubs will be used as secondary containment for buckets at monitoring wells and for transport in vehicles. All containers will be covered to minimize spills.

- IDW Storage Areas Inspections will be documented in the project logbook.

Potential spill areas will be monitored in an ongoing attempt to prevent and control further potential contamination of the environment.

10.3 PERSONNEL TRAINING AND SPILL PREVENTION

Personnel will be instructed in the procedures for incipient spill prevention, containment, and collection of hazardous materials in the site-specific training. The FOL and the SSO will serve as the Spill Response Coordinators for this operation, should the need arise.

10.4 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

The following represents the types of equipment that may be maintained at the staging area for the purpose of supporting this Spill Prevention/Containment Program.

- Sand, clean fill, or other noncombustible absorbent (oil-dry);

- Drums (55-gallon U.S. Department of Transportation DOT 1A1 or 1A2)
- Shovels, rakes, and brooms
- Labels

10.5 SPILL CONTROL PLAN

This section describes the procedures the Tetra Tech field crew members will employ upon the detection of a spill or leak.

1. Employ incipient spill prevention/protection devices to control and contain released materials.
2. Notify the SSO or FOL immediately upon detection of a leak or spill if they are not onsite at the time of occurrence.
3. Employ the personal protective equipment stored at the staging area. Take immediate actions to stop the leak or spill by plugging or patching the container or raising the leak to the highest point in the vessel. Spread the absorbent material in the area of the spill, covering it completely.
4. Transfer the material to a new vessel; collect and containerize the absorbent material. Label the new container appropriately. Await analyses for treatment and disposal options.
5. Re-containerize spills, including 2-inch of top cover impacted by the spill. Await test results for treatment or disposal options.

Emergency Alerting - Activate emergency alerting procedures for that area to remove non-essential personnel if all measures to control the spill is unsuccessful. It is not anticipated that a spill will occur that the field crew cannot handle. Should this occur, notification of the appropriate Emergency Response agencies will be carried out by the FOL or SSO in accordance with the procedures discussed in Section 2.0 of this HASP.

11.0 CONFINED-SPACE ENTRY

It is not anticipated, under the proposed scope of work, that confined space and permit-required confined space activities will be conducted. **Therefore, personnel under the provisions of this HASP are not allowed, under any circumstances, to enter confined spaces**.

A confined space is defined as a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit (for example, tanks, manholes, sewers, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- Is not designed for continuous employee occupancy.

Additionally, a **Permit-Required Confined Space** is a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly caving walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized, serious, safety or health hazard.

For further information on confined spaces, or their potential application based on location in relationship to the work to be conducted, call the PHSO. If confined space operations are to be performed as part of the scope of work, detailed procedures and training requirements will have to be addressed.

12.0 MATERIALS AND DOCUMENTATION

The Tetra Tech FOL shall ensure the following materials/documents are taken to the project site and used when required.

- A complete (signed) copy of this HASP
- Health and Safety Guidance Manual (Most recent version)
- Incident Reports
- Medical Data Sheets
- Material Safety Data Sheets for chemicals brought on site, including decontamination solutions, fuels, sample preservatives, calibration gases, etc.
- A full-size OSHA Job Safety and Health Poster (Attachment VI)
- Training/Medical Surveillance Documentation Form (Figures 8-1 and 8-2)
- Emergency Contact Table 2-1
- Directions and map to the Hospital

12.1 MATERIALS TO BE POSTED AT THE SITE

The following documentation is to be posted or maintained at the site for quick reference purposes. In situations where posting these documents is not feasible (such as no office trailer), these documents should be separated and immediately accessible.

- **Chemical Inventory Listing (posted)** - This list represents the chemicals brought on-site, including decontamination solutions, sample preservations, fuel, etc. This list should be posted in a central area.

- **MSDSs (maintained)** - The MSDSs should also be in a central area accessible to the site personnel. These documents should match the listings on the chemical inventory list for the substances employed on-site. It is acceptable to have these documents within a central folder and the chemical inventory as the table of contents.

- **The OSHA Job Safety & Health Protection Poster (posted)** - This poster should be conspicuously posted in places where notices to employees are normally posted, as directed by 29 CFR 1903.2 (a)(1). Each FOL shall ensure that this poster is not defaced, altered, or covered by other material. The law also states that reproductions or facsimiles of the poster shall be at least 8½ by 14 inches with 10 point type.

- **Site Clearance (maintained)** - This list is found within the training section of the HASP (Figure 8-1). This list identifies the site personnel, dates of training (including site-specific training), and medical surveillance. The list indicates not only clearance, but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in activities.

- **Emergency Phone Numbers and Directions to the Hospital(s) (posted)** - This list of numbers and directions will be maintained at the phone communications points and in each site vehicle.

- **Medical Data Sheets/Cards (maintained)** - Medical Data Sheets will be filled out by on-site personnel and filed in a central location. The Medical Data Sheet will accompany any injury or illness requiring medical attention to the medical facility.

- **Personnel Monitoring (maintained)** - The results generated through personnel sampling (levels of airborne toxins, noise levels, etc.) will be posted to inform individuals of the results of that effort.

- **Placards and Labels (maintained)** - Where chemical inventories have been separated because of quantities and incompatibilities, these areas will be conspicuously marked using DOT placards and acceptable [Hazard Communication 29 CFR 1910.1200(f)] labels.

The purpose of maintaining or posting this information, as stated above, is to allow site personnel quick access. Variations concerning location and methods of presentation are acceptable providing the objective is accomplished.

13.0 ACRONYMS / ABBREVIATIONS

ACGIH	American Conference of Governmental and Industrial Hygienists
AHA	Activity Hazard Analysis
BBP	Blood Borne Pathogens
BG	Background
BZ	Breathing Zone
CAAA	Crane Army Ammunition Activity
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Contaminants of Concern
CPR	Cardio Pulmonary Resuscitation
CSP	Certified Safety Professional
CTO	Contract Task Order
dBA	decibels
DoD	Department of Defense
DOT	Department of Transportation
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
IDW	Investigation Derived Waste
mg/m^3	milligrams per cubic meter
N/A	Not Available
NSA	Naval Support Activity
NIOSH	National Institute for Occupational Safety and Health
OELs	Occupational Exposure Limits
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PEL	Personal Exposure Limit
PHSO	Project Health and Safety Officer
PPM	Parts per million
PM	Project Manager
PPE	Personal Protective Equipment
RPM	Remedial Project Manager
SOP	Standard Operating Procedure
SSO	Site Safety Officer

STEL	Short term exposure limit
TBD	To be determined
TLV	Threshold Limit Values
TWA	Time Weighted Average
SWMU	Solid Waste Management Unit
Tetra Tech	Tetra Tech NUS, Inc

ATTACHMENT I

INCIDENT REPORT FORM

TETRA TECH, INC.
Safety Excellence

Report Date	Report Prepared By	Incident Report Number

INSTRUCTIONS: IR

All incidents (including those involving subcontractors under direct supervision of Tetra Tech personnel) must be documented on the IR Form.

Complete any additional parts to this form as indicated below for the type of incident selected.

TYPE OF INCIDENT (Check all that apply)	Additional Form(s) Required for this type of incident
Near Miss (No losses, but could have resulted in injury, illness, or damage)	☐ Complete IR Form Only
Injury or Illness	☐ Complete Form IR-A; Injury or Illness
Property or Equipment Damage, Fire, Spill or Release	☐ Complete Form IR-B; Damage, Fire, Spill or Release
Motor Vehicle	☐ Complete Form IR-C; Motor Vehicle

INFORMATION ABOUT THE INCIDENT

Description of Incident

_____

_____

_____

Date of Incident	Time of Incident
	_____ AM ☐ PM ☐ *OR* Cannot be determined ☐
Weather conditions at the time of the incident	**Was there adequate lighting?**
	_____ Yes ☐ No ☐

Location of Incident

_____ Was location of incident within the employer's work environment? Yes ☐ No ☐

Street Address	City, State, Zip Code and Country
Project Name	**Client:**
Tetra Tech Supervisor or Project Manager	**Was supervisor on the scene?**
	Yes ☐ No ☐

WITNESS INFORMATION (attach additional sheets if necessary)

Name	Company
Street Address	**City, State and Zip Code**

Telephone Number(s)

CORRECTIVE ACTIONS

Corrective action(s) immediately taken by unit reporting the incident:

_____

_____

_____

Corrective action(s) still to be taken (by whom and when):

_____

_____

_____

ROOT CAUSE ANALYSIS LEVEL REQUIRED

Root Cause Analysis Level Required: Level - 1 ☐ Level - 2 ☐ None ☐

Root Cause Analysis Level Definitions

Level - 1	**Definition:** A Level 1 RCA is conducted by an individual(s) with experience or training in root cause analysis techniques and will conduct or direct documentation reviews, site investigation, witness and affected employee interviews, and identify corrective actions. Activating a Level 1 RCA and identifying RCA team members will be at the discretion of the Corporate Administration office. The following events may trigger a Level 1 RCA: ▪ Work related fatality ▪ Hospitalization of one or more employee where injuries result in total or partial permanent disability ▪ Property damage in excess of $75,000 ▪ When requested by senior management
Level - 2	**Definition:** A Level 2 RCA is self performed within the operating unit by supervisory personnel with assistance of the operating unit HSR. Level 2 RCA will utilize the 5 Why RCA methodology and document the findings on the tools provided. The following events will require a Level 2 RCA: ▪ OSHA recordable lost time incident ▪ Near miss incident that could have triggered a Level 1 RCA ▪ When requested by senior management

Complete the Root Cause Analysis Worksheet and Corrective Action form. Identify a corrective action(s) for each root cause identified within each area of inquiry.

NOTIFICATIONS

Title	Printed Name	Signature	Telephone Number	Date
Project Manager or Supervisor				
Site Safety Coordinator or Office H&S Representative				
Operating Unit H&S Representative				
Other: _____				

The signatures provided above indicate that appropriate personnel have been notified of the incident.

_____

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INCIDENT FORM IR-A

INSTRUCTIONS: IR-A

Complete all sections below for incidents involving injury or illness.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

EMPLOYEE INFORMATION

Company Affiliation

Tetra Tech Employee? ☐ TetraTech subcontractor employee (directly supervised by Tetra Tech personnel)? ☐

Full Name	**Company (if not Tetra Tech employee)**
Street Address, City, State and Zip Code	**Address Type**
_____ _____	Home address (for Tetra Tech employees) ☐ Business address (for subcontractors) ☐

Telephone Numbers

Work: _____ Home: _____ Cell: _____

Occupation (regular job title)	**Department**
Was the individual performing regular job duties?	**Time individual began work**
Yes ☐ No ☐	_____ AM ☐ PM ☐ *OR* Cannot be determined ☐

Safety equipment

Provided? Yes ☐ No ☐

Used? Yes ☐ No ☐ If no, explain why

_____
_____
_____

Type(s) provided:
☐ Hard hat ☐ Protective clothing
☐ Gloves ☐ High visibility vest
☐ Eye protection ☐ Fall protection
☐ Safety shoes ☐ Machine guarding
☐ Respirator ☐ Other (list)

_____

NOTIFICATIONS

Name of Tetra Tech employee to whom the injury or illness was first reported	**Was H&S notified within one hour of injury or illness?**
	Yes ☐ No ☐
Date of report	**H&S Personnel Notified**
Time of report	**Time of Report**

If subcontractor injury, did subcontractor's firm perform their own incident investigation?

Yes ☐ No ☐ If yes, request a copy of their completed investigation form/report and attach it to this report.

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INCIDENT FORM IR-A

INJURY / ILLNESS DETAILS

What was the individual doing just before the incident occurred? Describe the activity as well as the tools, equipment, or material the individual was using. Be specific. Examples: "Climbing a ladder while carrying roofing materials"; "Spraying chlorine from a hand sprayer"; "Daily computer key-entry"

What Happened? Describe how the injury occurred. Examples: "When ladder slipped on wet floor and worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; Worker developed soreness in wrist over time"

Describe the object or substance that directly harmed the individual: Examples: "Concrete floor"; "Chlorine"; "Radial Arm Saw". If this question does not apply to the incident, write "Not Applicable".

MEDICAL CARE PROVIDED

Was first aid provided at the site: Yes ☐ No ☐ If yes, describe the type of first aid administered and by whom?

Was treatment provided away from the site: Yes ☐ No ☐ If yes, provide the information below.

Name of physician or health care professional	**Facility Name**
Street Address, City State and Zip Code	**Type of Care?**
	Was individual treated in emergency room? Yes ☐ No ☐ Was individual hospitalized overnight as an in-patient? Yes ☐ No ☐ Did the individual die? Yes ☐ No ☐ If yes, date: _____ Will a worker's compensation claim be filed? Yes ☐ No ☐
Telephone Number	

NOTE: Attach any police reports or related diagrams to this report.

SIGNATURES

I have reviewed this report and agree that all the supplied information is accurate

Affected individual (print)	**Affected individual (signature)**	**Telephone Number**	**Date**

This form contains information relating to employee health and must be used in a manner that protects the confidentiality of the employee to the extent possible while the information is being used for occupational safety and health purposes.

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INCIDENT FORM IR-B

INSTRUCTIONS: IR-B

Complete all sections below for incidents involving property/equipment damage, fire, spill or release.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

TYPE OF INCIDENT (Check all that apply)

Property Damage ☐ Equipment Damage ☐ Fire or Explosion ☐ Spill or Release ☐

INCIDENT DETAILS

Results of Incident: Fully describe damages, losses, etc.

_____

_____

_____

Response Actions Taken:

_____

_____

_____

Responding Agency(s) (i.e. police, fire department, etc.)	**Agency(s) Contact Name(s)**

DAMAGED ITEMS (List all damaged items, extent of damage and estimated repair cost)

Item:	**Extent of damage:**	**Estimated repair cost**

SPILLS / RELEASES (Provide information for spilled/released materials)

Substance	**Estimated quantity and duration**	**Specify Reportable Quantity (RQ)**
		_____ Exceeded? Yes ☐ No ☐ NA ☐

FIRES / EXPLOSIONS (Provide information related to fires/explosions)

Fire fighting equipment used? Yes ☐ No ☐ If yes, type of equipment: _____

NOTIFICATIONS

Required notifications	**Name of person notified**	**By whom**	**Date / Time**
Client: _____ Yes ☐ No ☐			
Agency: _____ Yes ☐ No ☐			
Other: _____ Yes ☐ No ☐			

Who is responsible for reporting incident to outside agency(s)? Tetra Tech ☐ Client ☐ Other ☐ Name: _____

Was an additional written report on this incident generated? Yes ☐ No ☐ If yes, place in project file.

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INCIDENT FORM IR-C

INSTRUCTIONS:

Complete all sections below for incidents involving motor vehicle accidents. Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

INCIDENT DETAILS

Name of road, street, highway or location where accident occurred	**Name of intersecting road, street or highway if applicable**	
County	**City**	**State**

Did police respond to the accident?	**Did ambulance respond to the accident?**
Yes ☐ No ☐	Yes ☐ No ☐
Name and location of responding police department	**Ambulance company name and location**
Officer's name/badge #	

Did police complete an incident report? Yes ☐ No ☐ If yes, police report number: _____
Request a copy of completed investigation report and attach to this form.

VEHICLE INFORMATION

How many vehicles were involved in the accident? _____ (Attach additional sheets as applicable for accidents involving more than 2 vehicles.)

Vehicle Number 1 – Tetra Tech Vehicle		**Vehicle Number 2 – Other Vehicle**	
Vehicle Owner / Contact Information		**Vehicle Owner / Contact Information**	
Color		**Color**	
Make		**Make**	
Model		**Model**	
Year		**Year**	
License Plate #		**License Plate #**	
Identification #		**Identification #**	
Describe damage to vehicle number 1		**Describe damage to vehicle number 2**	
Insurance Company Name and Address		**Insurance Company Name and Address**	
Agent Name		**Agent Name**	
Agent Phone No.		**Agent Phone No.**	
Policy Number		**Policy Number**	

DRIVER INFORMATION

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INCIDENT FORM IR-C

Vehicle Number 1 – Tetra Tech Vehicle		Vehicle Number 2 – Other Vehicle	
Driver's Name		**Driver's Name**	
Driver's Address		**Driver's Address**	
Phone Number		**Phone Number**	
Date of Birth		**Date of Birth**	
Driver's License #		**Driver's License #**	
Licensing State		**Licensing State**	
Gender	Male ☐ Female ☐	**Gender**	Male ☐ Female ☐
Was traffic citation issued to Tetra Tech driver? Yes ☐ No ☐		Was traffic citation issued to driver of other vehicle? Yes ☐ No ☐	
Citation #		**Citation #**	
Citation Description		**Citation Description**	

PASSENGERS IN VEHICLES (NON-INJURED)

List all non-injured passengers (excluding driver) in each vehicle.
Driver information is captured in the preceding section.
Information related to persons injured in the accident (non-Tt employees) is captured in the section below on this form.
Injured Tt employee information is captured on FORM IR-A

Vehicle Number 1 – Tetra Tech Vehicle		Vehicle Number 2 – Other Vehicle	
How many passengers (excluding driver) in the vehicle? ___		How many passengers (excluding driver) in the vehicle? ___	
Non-Injured Passenger Name and Address		**Non-Injured Passenger Name and Address**	
Non-Injured Passenger Name and Address		**Non-Injured Passenger Name and Address**	
Non-Injured Passenger Name and Address		**Non-Injured Passenger Name and Address**	

INJURIES TO NON-TETRATECH EMPLOYEES

Name of injured person 1				Address of injured person 1		
Age	**Gender**	**Car No.**	**Location in Car**	**Seat Belt Used?**	**Ejected from car?**	**Injury or Fatality?**
	Male ☐ Female ☐			Yes ☐ No ☐	Yes ☐ No ☐	Injured ☐ Died ☐
Name of injured person 2				**Address of injured person 2**		
Age	**Gender**	**Car No.**	**Location in Car**	**Seat Belt Used?**	**Ejected from car?**	**Injury or Fatality?**
	Male ☐ Female ☐			Yes ☐ No ☐	Yes ☐ No ☐	Injured ☐ Died ☐

OTHER PROPERTY DAMAGE

Describe damage to property other than motor vehicles	
Property Owner's Name	**Property Owner's Address**

COMPLETE AND SUBMIT DIAGRAM DEPICTING WHAT HAPPENED

ATTACHMENT II

MEDICAL DATA SHEET

MEDICAL DATA SHEET

This Medical Data Sheet must be completed by on-site personnel. It is recommended that this completed document be kept in a centrealized location accessible to all or personnel carry them on their person. This Medical Data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

Project NSA Crane, SWMU 22 Lead Azide Pond

Name: _____ Cell or Home Phone _____ Occupation: _____

Address _____

Age _____ Height _____ Weight _____

Person to notify in the event of an emergency: Name: _____

Phone: _____

Drug or other Allergies: _____

Doctor Prescribed Antidotes: _____

Particular Sensitivities (Medical Conditions potentially aggravated): _____

_____

_____

Do You Wear Contacts? Yes or No _____

What medications are you presently using? _____

_____

Name of personal physician: _____ Phone Number: _____

Note: Health Insurance Portability and Accountability Act (HIPAA) Requirements

HIPAA took effect in 1996 and was amended April 14, 2003. Loosely interpreted, HIPAA regulates the disclosure of Protected Health Information (PHI) by the entity collecting that information. PHI is any information about health status (such as that you may report on this Medical Data Sheet), provision of health care, or other information. HIPAA also requires Tetra Tech to ensure the confidentiality of PHI. This Act can affect the ability of the Medical Data Sheet to contain and convey information you would want a Doctor to know if you were incapacitated. So before you complete the Medical Data Sheet understand that this form will not be maintained in a secure location. It will be maintained in a file box or binder accessible to other members of the field crew so that the can accompany an injured party to the hospital.

DO NOT include information that you do not wish others to know, only information that may be pertinent in an emergency situation or treatment.

_____ _____ _____

Name (Print clearly) Signature Date

ATTACHMENT III

DRILL RIG EQUIPMENT INSPECTION CHECKLIST

Equipment Inspection Checklist for Drill Rigs

Company: _____ **Unit/Serial No#:** _____

Inspection Date: ____/____/____ **Time:** _____:_____ **Equipment Type:** _____
(e.g., Drill Rigs Hollow Stem, Mud Rotary, Direct Push, HDD)

Project Name: _____ **Project No#:** _____

Yes	No	NA	Requirement	Comments
			Emergency Stop Devices	
☐	☐	☐	• Emergency Stop Devices (At points of operation)	
☐	☐	☐	• Have all emergency shut offs identified been communicated to the field crew?	
☐	☐	☐	• Has a person been designated as the Emergency Stop Device Operator?	
			Highway Use	
☐	☐	☐	• Cab, mirrors, safety glass?	
☐	☐	☐	• Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use?	
☐	☐	☐	• Seat Belts?	
☐	☐	☐	• Is the equipment equipped with audible back-up alarms and back-up lights?	
☐	☐	☐	• Horn and gauges	
☐	☐	☐	• Brake condition (dynamic, park, etc.)	
☐	☐	☐	• Tires (Tread) or tracks	
☐	☐	☐	• Windshield wipers	
☐	☐	☐	• Exhaust system	
☐	☐	☐	• Steering (standard and emergency)	
☐	☐	☐	• Wheel Chocks?	
☐	☐	☐	• Are tools and material secured to prevent movement during transport? Especially those within the cab?	
☐	☐	☐	• Are there flammables or solvents or other prohibited substances stored within the cab?	
☐	☐	☐	• Are tools or debris in the cab that may adversely influence operation of the vehicle (in and around brakes, clutch, gas pedals)	

Unit/Serial No#:_____ **Inspection Date:** ____/____/____

Yes	No	NA	Requirement	Comments
			Fluid Levels:	
☐	☐	☐	• Engine oil	
☐	☐	☐	• Transmission fluid	
☐	☐	☐	• Brake fluid	
☐	☐	☐	• Cooling system fluid	
☐	☐	☐	• Hoses and belts	
☐	☐	☐	• Hydraulic oil	
			High Pressure Hydraulic Lines	
☐	☐	☐	• Obvious damage	
☐	☐	☐	• Operator protected from accidental release	
☐	☐	☐	• Coupling devices, connectors, retention cables/pins are in good condition and in place	
			Mast Condition	
☐	☐	☐	• Structural components/tubing	
☐	☐	☐	• Connection points	
☐	☐	☐	• Pins	
☐	☐	☐	• Welds	
☐	☐	☐	• Outriggers	
☐	☐	☐	• Operational	
☐	☐	☐	• Plumb (when raised)	
			Hooks	
☐	☐	☐	• Are the hooks equipped with Safety Latches?	
☐	☐	☐	• Does it appear that the hook is showing signs of wear in excess of 10% original dimension?	
☐	☐	☐	• Is there a bend or twist exceeding 10% from the plane of an unbent hook?	
☐	☐	☐	• Increase in throat opening exceeding 15% from new condition	
☐	☐	☐	• Excessive nicks and/or gouges	
☐	☐	☐	• Clips	
☐	☐	☐	• Number of U-Type (Crosby) Clips (cable size 5/16 – 5/8 = 3 clips minimum) (cable size 3/4 – 1 inch = 4 clips minimum) (cable size 1 1/8 – 1 3/8 inch = 5 clips minimum)	

Unit/Serial No#:_____ **Inspection Date:** ____/____/____

Yes	No	NA	Requirement	Comments
☐	☐	☐	Power cable and/or hoist cable • Reduction in Rope diameter π (5/16 wire rope>1/64 reduction nominal size -replace) (3/8 to 1/2 wire rope>1/32 reduction nominal size-replace) (9/16 to 3/4 wire rope>3/64 reduction nominal size-replace)	
☐	☐	☐	• Number of broken wires (6 randomly broken wires in one rope lay) (3 broken wires in one strand)	
☐	☐	☐	• Number of wire rope wraps left on the Running Drum at nominal use (≥3 required)	
☐	☐	☐	- Lead (primary) sheave is centered on the running drum	
☐	☐	☐	• Lubrication of wire rope (adequate?)	
☐	☐	☐	• Kinks, bends – Flattened to > 50% diameter	
☐	☐	☐	Hemp/Fiber rope (Cathead/Split Spoon Hammer) • Minimum ¾; maximum 1 inch rope diameter (Inspect for physical damage)	
☐	☐	☐	• Rope to hammer is securely fastened	
☐	☐	☐	Safety Guards – • Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact?	
☐	☐	☐	• Hot pipes and surfaces exposed to accidental contact?	
☐	☐	☐	• High pressure lines	
☐	☐	☐	• Nip/pinch points	
☐	☐	☐	Operator Qualifications • Does the operator have proper licensing where applicable, (e.g., CDL)?	
☐	☐	☐	• Does the operator, understand the equipment's operating instructions?	
☐	☐	☐	• Is the operator experienced with this equipment?	
☐	☐	☐	• Is the operator 21 years of age or more?	

Unit/Serial No#:_____ **Inspection Date:** ____/____/____

Yes	No	NA	Requirement	Comments
			PPE Required for Drill Rig Exclusion Zone	
☐	☐	☐	• Hardhat	
☐	☐	☐	• Safety glasses	
☐	☐	☐	• Work gloves	
☐	☐	☐	• Chemical resistant gloves_____	
☐	☐	☐	• Safety toed Work Boots	
☐	☐	☐	• Chemical resistant Boot Covers	
☐	☐	☐	• Apron	
☐	☐	☐	• Coveralls Tyvek, Saranex, cotton)_____	
			Other Hazards	
☐	☐	☐	• Excessive Noise Levels? _____dBA	
☐	☐	☐	• Chemical hazards (Drilling supplies - Sand, bentonite, grout, fuel, etc.)	
☐	☐	☐	- MSDSs available?	
☐	☐	☐	• Will On-site fueling occur	
☐	☐	☐	- Safety cans available?	
☐	☐	☐	- Fire extinguisher (Type/Rating -_____ _ _____)	

Approved for Use ☐ Yes ☐ No ☐ See Comments

_____ _____

Site Health and Safety Officer Operator

ATTACHMENT IV
ACTIVITY HAZARD ANALYSES

ACTIVITY HAZARD ANALYSIS (AHA)

Site Name: NSA Crane, Crane, Indiana; SWMU 22 Lead Azide Pond

Task: Site Mobilization/Demobilization

Prepared by	T. Dickson	**Date**	09/2011	**FOL**	
Reviewed by	J. Carothers, Ph.D.	**Date**	09/2011	**SSO**	

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
1. All vehicle operations conducted while performing duties associated with the project or in a motor vehicle rented for such purpose.	1. Vehicle Accident - • Unauthorized drivers • Vehicle/equipment failure • Distracted driving • Struck by motor vehicles • Speeding • Unsecured loads	1. The following measures will be employed to minimize the potential for an accident **Before Driving** • Ensure driver is "authorized" per the Tetra Tech Vehicle Safety Program • Prior to use, walk around your vehicle make sure you have adequate tire pressure, no lights are broken, etc. Examine gauges to ensure operational fluids are at desired levels. • Preset radio stations, secure wires for auxiliary IPod or similar devices so this is not attempted while driving. • Attach hands free devices to cell phones, place devices where they are easily accessed. • Set address for GPS or similar devices so this does not have to occur while driving. **Driving** • Do not use cell phones, eat, play with the radio or engage in any activities that would distract you from your primary task of driving. Cell phone use while driving is only permitted when a hands-free device is used. If you receive a call, let it go to voice mail or pull over and answer it. • Ensure you have an Orange Vest and a Reflective Triangle in your vehicle at all times, a disposable camera, Tetra Tech Incident Form (IR-C). • Practice defensive driving whenever traveling in a vehicle. Always permit adequate room between you and the driver in front of your vehicle. Use the 4-second rule. • Follow the direction of posted signs (speed limits, etc.). You will be responsible for all moving and parking violations. • Exercise extra caution when moving through school and work zones. • All items in and on your vehicle should be secured to prevent movement or loss from the vehicle potential causing an accident. **If you are in an accident:** • Move you vehicle if possible from the travel lanes. • Turn on your emergency flashers. • Do not step into traffic when exiting your vehicle. • Place your warning triangle (100-feet behind your vehicle) and put on your Orange vest. • Contact the FOL and the SSO. • Be respectful to the Local authorities. • Do NOT attempt to argue whose fault. • DO NOT admit to fault.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		• Secure all valuables. Take the keys from the ignition if you leave your vehicle for any reason. (Be aware there will be a fee for towing, traffic citations, etc.). • Complete the IR-C form to make sure you have gathered all pertinent information
2. Preparatory tasks, such as: Assembling, packing, unpacking equipment and supplies.	2. Minor cuts, abrasions or contusions handling equipment and tools	2. Wear cut-resistant gloves when handling items with sharp or rough edges or when using knives to cut open packages. A cut resistant glove should at least be worn on the non-knife hand. • Exercise caution when unpacking boxes. Make sure you can see clearly into the box and do not reach in and contact broken glass (possibly damaged in shipment) or sharp articles. • Always cut away from yourself and others. • Do not place items to be cut on your hand and/or knee • Always use a sharp cutting instrument. Many accidents result from struggling with dull cutting implements. • Secure work pieces to be cut. • Carry and transport glassware in a hard sided container. That way if you fall, you will not fall on broken glass. • If there is broken glass place, it in a hardsided container for disposal. Placement in a soft sided container may result in cuts and lacerations if the bag is penetrated by shards of glass during carrying. See Section 4.13 of the HSGM for additional safe work practices as it pertains cuts/lacerations.
3. Unpacking; assembling; inspecting equipment before use	3. Strains or sprains during manual lifting and carrying activities	3. Practice safe lifting techniques (use mechanical lifting devices such as a dolly whenever possible), and plan each lift: • Inspect/clear the intended path of travel and areas where loads will be deposited, • test lift each object to ensure you can without injuring yourself, • ensure good grasp is obtainable on object, • keep back straight and lift with legs not back, • obtain help when needed to lift large, bulky, or heavy items. **Remember:** Your muscles, tendons, and ligaments are not as flexible in the early morning hours. Stretch before physical taxing activities. In the later afternoon, your muscles, tendons, and ligaments maybe stressed from fatigue. Take breaks as necessary to avoid injury. See Section 4.4 of the HSGM for additional safe lifting practices.
3A. Performing Equipment inspections of vehicles and equipment arriving/preparing to depart the site • Equipment Inspection Air	3A. The following potential hazards may be encountered during the equipment inspection process • Flying projectiles –	3A. The purpose of the following inspections is to prevent possible injury from faulty equipment. However, as the equipment has to operate to test personnel may also be exposed to inherent hazards such as those described. **HSA/Air Rotary/DPT Drill Rigs** • Complete Equipment Inspection Checklist for the Drill Rigs and associated

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
rotary DPT and HSA drill rigs and hand tools	Pressurized systems –High pressure hydraulics • Cuts and lacerations • Pinch/compressions • Struck by As part of this effort compressed nitrogen will be secured brought onto and most likely stored on base. The nitrogen will be employed for groundwater sampling. Injuries due to faulty equipment	drilling components using Attachment III. All emergency stop devices will be tested initially, then daily from that point on. • Do not place hands or fingers within pinch or compression points. If this is necessary (which it should never be) use blocking or tools intended for that purpose to secure potential energy sources. • Wear leather work gloves when handling hoisting cables to avoid sticks and lacerations. See hoisting cable inspection requirements (included in the Equipment Inspection Checklist). Inspector or selected Qualified person should employ hardhat, safety glasses, and leather work gloves during the inspection activity. All potential and kinetic energy sources will be secured or controlled during inspection. **Sampling devices** • Threads of sampling devices will be examined. If they are washed out difficult to assemble and disassembled have them replaced. • Connectors, pins, associated attachments will not show signs of excessive wear. This will also pertain to wrenches employed to construct/disassemble pump assemblies. Check teeth and gripping surfaces to minimize the potential for slip. • Exercise caution when handling machine (drive tubes, drive rods, cutting shoes, etc.) components due to the potential for sharp edges
Equipment Inspection (continued)	3B. High pressure air lines – Struck by hazards	3B. Struck by hazards – To prevent hazards of this nature the following measures will be employed All high pressure air lines that do not have mechanical threaded connections will have connections pinned and will be equipped with a whip check to minimize the lines thrashing should they become disconnected.
Equipment Inspection (continued)	3C. Spills Prevention – • Hydraulic fluid release – A hydraulic line that ruptures can release hydraulic fluid • Thermal Burns	3C. During the Equipment Inspection additional attention will be focused to the condition of the hydraulic lines to avoid a potential rupture and/or release. This will include • Attention will be focused on connection points • Condition of the hoses o Damaged steel braids o Areas of friction wear patterns o Damage or deterioration to the rubber protective outer coating (indicative of overheating) In all cases, suspect hoses will be replaced. It is recommended where possible, that plastic be placed on the ground in the area under the rig to capture incidental spills and releases should they occur. Care should be taken not to extend the plastic beyond the rig proper as such creating a slip trip and fall hazard.
Equipment Inspection	3D. Hoisting and Rigging –	3D. Hoisting and Rigging – Structural failure, struck by – To control hazards of this

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
(continued)	Structural failure, struck by	nature • Hardware inspection will occur initially, then daily prior to use. • Periodic inspections will occur at a frequency not to exceed 1 year. The Driller will provide such certification upon request • Removal criteria o Missing or illegible identification or markings o Heat or environmental damage o Bent, twisted, distorted, elongated, cracked load bearing components o Any other condition that causes doubt in the continued use of the rigging hardware. o Rigging (running rope and slings) employed will meet requirements set for broken strands (specified on the Equipment Inspection Checklist). o Hoisting wire rope will be sized for the drum and sheeve and capacity. o Connections will be examined for damage; means of connection; necessary number of wire rope clamps appropriately placed. o Minimal number of wraps (3) on the drum when extending rope and hooks and appliances meet specifications as identified.
4. Hazard Communication - Receiving chemicals, storing chemicals, preparing to use chemicals, collecting Material Safety Data Sheets completing chemical Inventory;	4. Chemical Exposure	4. Chemical hazards – It is not anticipated that site personnel will encounter chemical hazards as it pertains to mobilization as no direct encounter is planned. However, it will be the responsibility of the FOL and/or the SSO to implement the Onsite Hazard Communication Program (See Section 5.0 of the HSGM). In this effort all chemicals brought onsite (compressed gases (calibration gases), decontamination fluids; sample preservatives, well construction supplies, etc.) will • All chemicals will have an accompanying Materials Safety Data Sheet (MSDS) that has been reviewed and approved for use by the SSO. o The SSO will review the HASP to ensure emergency equipment and/or associated PPE necessary to ensure the safety of the workers are equal or better than that listed in the MSDS. • All incoming containers will be properly labeled, will be in English and not defaced. If the materials will be transferred to temporary containers, these too will be appropriately labeled by the SSO or the person using the materials. • All materials received onsite will be added to the Chemical Inventory List. Included in this information is the volume and location stored and primary hazards. • All materials will be stored as prescribed with compatible chemicals. • As necessary employ spill prevention pans or like equipment to capture or contain spills within the storage area.
5. Initial Site Surveys - Access/egress into Controlled areas	5. Coordinate efforts with facility personnel • Inherent hazards or restrictions	5. In order to address the potential hazards associated with the initial entry • The FOL and/or the SSO will meet with the restricted area personnel/operators to ensure they are aware of planned activities. • As part of these discussions Inquire of the potential hazard in the area and areas to avoid.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Initial site survey of the intended work areas		• Inquire as to what the facilities Emergency Action Requirements are should there be an emergency and where you should go as an assembly point. • What security measures are required • PPE requirements for location (such as flame retardant clothing) • Restriction boundaries • If persons must enter the restricted area local requirements will prevail. These include o Signing in o PPE minimum requirements for the location • The FOL and/or the SSO will survey the area to ensure areas prone to slip, trip, and fall hazards are flagged or removed. o Entry/access routes will be determined as well as schedules. All workers are to wear sturdy work shoes that are outfitted with slip resistant aggressive tread and steel toe and shank when foot hazards exist.
	Emergency Prevention – This component will be critical in identifying potential emergencies that may be task associated. These are as follows: • Utility strike – Overhead power lines; buried utilities; gas, sewage, and/or water. • Physical hazards – Steep embankments, sink holes; poisonous vegetation.	All exits and selected access pathways will be maintained free of obstructions to allow free movement of site personnel, equipment, and if necessary emergency equipment. **Utility strikes** – • Overhead power lines – In the areas in which the mast will be raised will be examined for the existence of overhead power lines or obstructions. • Personnel will perform walkovers to examine the surface for surface monuments including: o Valve or meter boxes o Manhole covers o Direction cable boxes o Utilities entering or exiting buildings.
	Determining site control boundaries:	The FOL/SSO will determine the necessary boundary at each work location: • HSA/Air rotary/DPT drilling operations – 35-feet or the height of the mast, whichever is greater. During this time, the FOL and/or the SSO will determine if physical hazards exists, terrain challenges and the necessary amount of vegetation to be removed (where applicable) to allow access and a sufficient size work area. • Groundwater measurements; well development; groundwater measurements, and groundwater sampling – 10-feet surrounding the point of operation • High pressure decontamination 35-feet surrounding the point of operation. • Low pressure decontamination 10-feet surrounding point of operation.
	Emergency preparation • Selecting evacuation routes and assembly points; determining emergency	The Emergency Evacuation point will be selected as part of the initial site survey. Tentatively this location is at the driveway intersection where emergency response crews will approach from. Dependent on the location of the hazard escape may have to occur

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
	equipment requirements	in the opposite direction. A secondary point will be determined in the field and communicated as part of the Daily Tail Gate meeting.
6. Preparing the site for work activities.	6. Site set up hazards • Struck By • Tip Over • Backing • Electrocution / Explosion • Slips, Trips, Falls	6. **Struck by/ Tip Over** • All equipment, augers, rods and tools will be properly secured during transport. • All vehicles and equipment to be employed on roads and highways will comply with DOT requirements. • Never move the drilling rig with the mast upright. Set hydraulic leveling jacks before raising the mast. Ensure the drilling site foundation is stable and as level as possible. • Use a ground guide along with a functioning back-up alarm during equipment backing to avoid striking objects or backing into pits and/or ditches. This is especially critical as this is within a process area and movement is tight. **Utility damage prevention** • Inspect for buried and overhead utilities in the vicinity of the drilling location. A drilling clearance permit shall be obtained from base personnel or utility companies prior to initiating intrusive operations. **Slip, trips, and falls** • Practice good housekeeping to keep the ground around the drilling site clear of obstructions, equipment and other tripping hazards. • Wear appropriate foot protection to prevent slips and trips. • Use caution when working on uneven and wet ground surfaces.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Hand tools (dollies, hand carts, hand knives, carpenter tools, fixed and portable ladders, etc.)	Visual inspection of hand and power tools will be performed by the SSO. Tools will be tagged with colored electrical tape. Green tape ok for use. Red tape do not use. All red taped items should be repaired or removed from the site. Each time a tool is used it will undergo a cursory inspection by the user. Noted damage (mushroomed head, splintered handle, etc.) will require removal from service. FOL and SSO to perform regular (e.g., daily) inspections for	All personnel • 40-Hour General Site Worker Training [OSHA 29 CFR 1910.120 (e)] • 8-Hour General Site Worker Refresher Training [OSHA 29 CFR 1910.120 (e)(8)] • Site Specific Training – All personnel shall review this Abbreviated Health and Safety Plan prior to the commencement of on-site activity. • Participate in a Medical Clearance/Surveillance Program as described in OSHA 29 CFR 1910.120 (f). • Complete a Medical Data Sheet • Review applicable MSDSs if you are unaware of the hazards and recommended control measures for diesel fuel and grout. Supervisory personnel: 8-Hour General Site Worker Supervisory Training [OSHA 29 CFR 1910.120 (e)(4)]

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
	housekeeping issues. The results of these efforts will be documented in the Field Logbook	
Personal Protective Equipment: <u>Minimum</u>: Steel toed work boots; hardhats, safety glasses, work gloves; suitable work attire (long pants; sleeved shirts. <u>Optional items:</u> High visibility vest, Hearing protection and flame retardant protective clothing; may be required in the area the work will be conducted. **<u>HTRW</u>**: None anticipated for this task. Note: Personnel maybe require to meet location specific PPE requirements.	Initial PPE inspection performed by SSO. Ongoing (prior to each use) inspections responsibilities of PPE users.	PPE training in proper use, care, storage, and limitations. It is anticipated that this has been covered in employees 40 hour HAZWOPER training, which is to be verified by the SSO through initial training documentation and review prior to permitting personnel to participate in site activities, and will be confirmed by visual observations of worker activities. The SSO will be responsible for the implementation of the following Site Specific Health and Safety Programs: • Hazard Communication • Hearing Conservation **AHA Assessment** - During the initial walk through the FOL and/or the SSO shall review the AHA to determine applicability or information that will need added given site specific conditions.

All persons working within the operational will sign this AHA indicating that they have reviewed the document and are aware of their responsibilities as stated in the AHA.

Name (Printed)	Signature	Occupation	Date Reviewed/Training

FIELD CHEMICAL INVENTORY LIST

This chemical inventory is to be completed for hazardous chemicals known to be present at project sites. Chemical inventories may be maintained separately (Tetra Tech NUS, Inc. and Subcontractors) or they may be maintained separately.

Site Name: NSA Crane, Crane, Indiana; SWMU 22 Lead Azide Pond Project: _____

Tetra Tech Hazard Communication On-site Program Administrator: _____ (SSO)

Subcontractor Hazard Communication On-site Program Administrator/Point of Contact: _____

Chemical/Product Name/Synonym	**Owner**	**Quantity**	**Location**	Hazards	**Supplier/Manufacturer**
Alconox/Liquinox Synonym: Anionic Detergent	Tetra Tech NUS, Inc.	1-gallon	Field Office Support Trailer **Note:** Smaller amounts are maintained at work sites.	- Irritating to the eyes. - May cause drying of the skin.	Alconox, Inc. 215 Park Avenue South new York, New York 10003 (212) 473-1300
Isobutylene/Air Synonym: Isobutene Methylpropene	Tetra Tech NUS, Inc.	( )Cylinders	Field Office Support Trailer	Inhalation hazard – May act as a simple asphyxiant in closed or confined spaces. Pressurized cylinder hazard – Containers may rupture in a fire	Scott Specialty Gases 6141 Easton Road Plumstaedville, PA 18949 (215) 766-8861 Liquid Carbonic 135 South LaSalle Street Chicago Illinois 80603-4282 (504) 673-8831 Chemtrec (800) 424-9300
2- Propanol Synonym: Isopropanol	Tetra Tech NUS, Inc.	4-liters (1.05 gallons)	Field Office Support Trailer **Note:** Smaller amounts are maintained at work sites.	- Flammable - Eyes, skin, and respiratory irritant	Fisher Scientific 1 Reagent Lane Fairlawn, New Jersey 07410 Emergency #: (201)796-7100

FIELD CHEMICAL INVENTORY LIST

This chemical inventory is to be completed for hazardous chemicals known to be present at project sites. Chemical inventories may be maintained separately (Tetra Tech NUS, Inc. and Subcontractors) or they may be maintained separately.

Site Name: NSA Crane, Crane, Indiana; SWMU 22 Lead Azide Pond Project: _____

Tetra Tech Hazard Communication On-site Program Administrator: _____ (SSO)

Subcontractor Hazard Communication On-site Program Administrator/Point of Contact: _____

Chemical/Product Name/Synonym	**Owner**	**Quantity**	**Location**	Hazards	**Supplier/Manufacturer**

ACTIVITY HAZARD ANALYSIS (AHA)

Site Name: NSA Crane, Crane, Indiana; SWMU 22 Lead Azide Pond

Task: Hollow Stem Augering (HSA) Drilling; Air Rotary Drilling, DPT Drilling Operations

Prepared by	T. Dickson	**Date**	09/2011	**FOL**	
Reviewed by	J. Carothers, Ph.D.	**Date**	09-2011	**SSO**	

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
1. Drill rig (HSA /Air Rotary Unit Mobilization / Site Set Up) Tetra Tech personnel vehicle operation and mobilization.	• Accidents and injuries resulting from the transport of the drill rig and associated equipment to the site. • Materials falling from the drill rig during transport. • Equipment failure – leading to a potential accident or hazardous situation. • Improper operation • Unqualified operator Vehicle accidents	1. The vehicle operator will perform a walk around inspection to insure • All equipment, augers, rods and tools will be properly secured for/during transport. • Vehicle components – Turn signals brake lights, etc. all function properly. • There are no materials carried or stored in the cab that will interfere with the safe operation of this motor vehicle on the highways (garbage in and around the pedals). • All critical fluid levels (brake fluid, motor oil, anti-freeze) are at their recommended levels. • Seat belts are functioning properly. • Mirrors are properly adjusted. • Cell phone use during driving is prohibited unless a hands free device is used. • If the vehicle GVWR is greater than 26,001 pounds, the operator will have a Commercial Driver's License (CDL). • If the vehicle has air brakes, the CDL will have an air brake endorsement. • The vehicle will be operated within DOT or facility specific guidelines including adhering to the speed limit obeying all posted signs. • Where necessary, use escort vehicles with flashing lights to warn and control local traffic when moving large equipment to support area. • Practice defensive driving whenever traveling in a vehicle • Ensure you have an Orange Vest and a Reflective Triangle in your vehicle at all times along with an Incident Reporting Form IR-C and a disposable camera (phone cameras are acceptable). • Keep a safe distance between cars (Use the 4-second rule). • Always carry the AR-1 Incident Reporting form (IR-C) in your Vehicle should there be an accident • If you are in an accident o Visually Examine the area ensure the scene is safe to enter and provide assistance as necessary. o Move you vehicle if possible from the travel lanes. o Turn on your emergency flashers.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		o Do not step into traffic when exiting your vehicle. o Secure your vehicle and all valuables. Be aware there will be a fee for towing, traffic citations, etc.) o Place your warning triangle (100-feet behind your vehicle) and put on your High Visibility Vest. o Provide assistance to injured persons as training permits and as necessary. o Contact the FOL and the SSO. o Be respectful to the Local authorities. o Do NOT attempt to argue who's fault. o Police Officers Name and Report Designation Take the Incident Form (Last section) and begin to complete the information. Take photos, record locations, get witness names and contact information where and as possible.
2. Preparing the Drill Rig for Use	2. Injury due to the failure of faulty equipment	2. **Injury due to the failure of faulty equipment** – To combat this hazard, the FOL, SSO, and/or a designated "Qualified Person" will determine the operating integrity of the drill rig through the completion of an Equipment Inspection Checklist for Drill Rigs provided in Attachment III. These checklists will be used to insure that back-up alarms are functional, that all moving parts are guarded if such parts are exposed, that all emergency stop controls on equipment have been tested and are functional. These checklists provide a consistent platform to examine these types of equipment. While not all lists cannot be all inclusive, expertise in these areas can add additional categories as needed.
3. Personnel qualifications/ equipment integrity	3. Injury due to Improper operation	**3. Injury due to control improper operation** - Ensure the driller or driller's helper responsible for the transport and/or operation are qualified to do so. This will be determined through the examination of • Licenses or certification indicating they are thoroughly trained and competent to perform their assigned task with the equipment used in investigation. • Oversight and monitoring of active operations. Where deficiencies are noted, these will be identified, and corrected immediately. If necessary these conditions will also be reviewed during the Tail-Gate Training sessions conducted periodically. • If consistent poor work habits are employed personnel will be removed and replaced as determined to be necessary to protect onsite personnel, property, and the environment.
4. Positioning Unit (engaging outriggers. etc.)	4. Struck by/ Rig stability	4. **Struck by** – When moving the drill rig into place, • Prior to committing personnel and/or resources the FOL and/or the SSO will examine the intended work area to select travel route, placement of the drill rig, and to insure any potential hazards within the designated work area are eliminated or at least demarcated.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		• The operator in concurrence with the FOL and/or the SSO should select the best possible approach vantages to move the unit up the slope or around physical obstructions to the selected boring location. • Preview travel paths and set up location for subsurface utilities, soft spots, curbs, etc. These items may affect the stability of the rig during operation. Use pads for outriggers to avoid potentially damaging subsurface utilities or to control subsidence during drilling. • Operate the unit at a suitable rpm for the terrain and conditions. Furthermore, • Ground spotters will be used to move the rig into place to avoid damaging subsurface process lines or overhead power lines. • During the time of directing equipment into place o Do not place yourself between the rig and an immovable object. o Stay within the operators line of sight. o Keep all non-essential personnel out of the area. o Do not create distractions when placing the rig by requesting information or the attention of the spotter. o Only one person will direct the actions of the operator. 5. The HSA/Air Rotary Drill Rig is equipped with outriggers to provide stability to the unit during drilling operations. There are a number of factors that can influence the outriggers ability to provide this stability including • Are the outriggers fully extended? • Are outrigger pads used to increase the area in which the outriggers are applying pressure? If not cribbing can be used to increase the foot print size. • Is the ground surface in the area of the outrigger placement adequately compacted to support the drill rig? If not materials can be haul in and compacted to add additional stability. • Ensure the drilling site foundation is stable and as level as possible. • The drill rig is never to be moved unless the mast is fully down and the outriggers are fully retracted.
5. Emergency Preparation - Assembling equipment and supplies	5. Emergency preparation - • Fire • Spill response • Injury response	5. A number of measures will be employed to prepare for potential emergency conditions. These include ***Fire*** • Portable Fire Extinguisher(s) – 2A:10B:C extinguisher will be made available for all general support activities. Travel distances greater than 50-feet will require additional fire extinguishers. If portable extinguishers are provided then training in their use must be provided for the employees who are to use them. Fire extinguishers will be initially inspected then monthly thereafter. Fire extinguishers will be immediately accessible. If they are stored in tool boxes, the box will be labeled as such.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		Spill Response • Spills – As we recognize the release of hydraulic lines associated with the drill rig operation can cause environmental damage, then rapid response through having spill kit provisions at the ready at the rig. Prophylactic measures such as placing plastic under the drill rig that would be effected by a spill and/or release but not extending into the work area in which it would create a slip, trip, and fall hazard. Additional measures include: o Having spill pads at the ready. o Using spill pads during incidental fueling operations. o Use of safety cans and o Periodic monitoring of potential spill or release areas such as IDW management marshaling areas. ***Injury Response*** • Responding to Injury – Per 1910.151 in the absence of an infirmary, clinic. Or hospital a person or persons will be made available and trained to provide first-aid. Adequate first aid supplies will be provided to render assistance. Within these provisions, additional supplies to support Blood Borne Pathogen Universal precaution (CPR Masks; surgeons gloves, safety glasses; dust masks to offer shielding against potentially contaminated body fluids. ***Eye Injuries/Skin Irritation*** • During well installation the use of Portland Cement which can be corrosive and injurious to the eyes suitable facilities will be made available for quick drenching or flushing of the eyes for immediate emergency use. Quick drench portable bottles will be made available and stored to maintain for use until a plumbed or self contained unit or medical attention may be obtained. • During well sampling, the potential exposure to preservatives also offers a potential exposure to a corrosive materials including nitric acid.
6. Pre – Drilling Excavation clearance	6. Utility Damage – Injury, property damage	**6. Utility Damage** - An excavation or dig permit will be required anytime the ground surface is broken using a mechanized piece of equipment. To obtain a Dig Permit • Mark the areas to be drilled in White Paint – Also identify it as the area for One-Call or whatever the clearance designation is for that state. • Contact the Indiana Underground Plant Protection Service at (800) 382 - 5544 or use 811 that is the National Clearinghouse contact point. • Where possible provide drawings and/or coordinates. • The typical timeline required is 2-3 days. • Upon receipt of your permit, make sure all utility owners in the area have responded back. If not, contact them. This is especially critical when dealing with electrical and

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		gas lines. • During site preparation the discussion was provided concerning the site walk over to inspect for surface monuments that would be indicative of buried utilities • During this site walk over you are also examining the area for overhead utilities. The dig permit has NOTHING to do with overhead power lines. DO NOT approach overhead power lines closer than 20-feet. • Follow NSA Crane Utility Clearance Procedures. The Tetra Tech SOP Utility Location and Excavation Clearance can be found in Section 7.0 of the HSGM.
7. Drilling - Drill Rod / Auger / Tool Handling	7. Entanglement/ Struck by Entanglement deaths have occurred due to clothing articles becoming entangled in spinning augers; geofabric ground cover becoming entangled in augers wrapping around the drillers feet dragging him into the spinning auger flights. Entanglements have also occurred when rotating equipment was insufficiently guarded. Struck by includes • Collapsing tooling improperly secured. • Tooling be handled in an area too small to complete the task. • Pressurized lines	**7. Entanglement/Struck by**- Drill rig will have undergone and passed an initial site acceptance prior to being set up and used at this site. The inspection must include ensuring that the rig is equipped with only manufacturer provided/accepted devices (such as, no "home-made" auger flight pins, all guards are in place, wire cables are not damaged, etc.). Also, test drill rig upon initial site acceptance inspection to ensure that the device(s) are operable, clearly and marked/accessible. Also, ensure that all workers know the location and how to activate kill switches. • Secure all loose clothing, PPE, long hair, and jewelry. Anything that can become snagged. • Cut and remove any geofabric ground cover in the area of the borehole. • Identify and remove all snag points on the drill rig where possible and remove or correct. • The driller will loudly announce he is preparing to engage the augers to insure all personnel are clear. • The driller will remain at the controls while the augers are engaged. • Shovels will be used to remove cutting from near the spinning augers. The soil cuttings will be placed in a 55-gallon drum. Diligent effort will be made to keep the work area clean. • During inspection the inspector will insure all guarding is in place to protect the driller from rotating equipment, high pressure items, high temperature items. • Entanglement during split spoon sampling – This may occur if the rope is too long and gets tangled around the driller feet. • Oily ropes versus clean ropes also increase friction increasing the potential for entanglement. ***Struck by*** • Drill rods and augers will be stored and transported in racks. The loads shall be blocked to prevent shifting. Unload drill rods and augers layer by layer. Be prepared for sudden shifting when tailing rod sections. Keep a wide base and

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		secure footing. Always leave yourself an escape route. • As items will be lifted above the head using cable assisted devices all personnel in the exclusion zone will o Wear hard hats to protect from incidental contact. o DO NOT lift the load over anyone. The helper will maintain control of the load either by hand or through the use of tag lines. o The lifting devices, appliance, attachments will be inspected using the equipment inspection checklist. During this initial inspection visual inspections for damage, performance inspection to insure the proper cable size and the number of clips per cable size are employed. o During this initial inspection measurements of hooks chains etc will be recorded to determine if these articles are stretching and could potentially fail. • All pressurized lines will be inspected to insure mechanical connections are not leaking and are securely attached. All lines that are not guarded or that could strike the driller if they became detached will be secured with whip checks. • Pressurized lines in which the metal braiding is exposed will be closely inspected to determine the need for replacement. Lose of the rubber friction covering is often due to abrasion or heat which results in the failure of these lines through repeated elevated heat cycles. Operating at insufficient rpms will result in overheating.
8. Tool and material handling (cont.)	8. Lifting – Due to the weights of the various drill tooling the potential for back related injuries are significant. Some common weights are as follows: Auger flight and drill rods = >100lbs Bags of Portland cement = 94 lbs Bags of sand = 80lbs	**8. Lifting hazards** – The auger flights weigh in excess of 100 lbs. Due to the physically demanding nature of handling these devices back injuries as well as smashed fingers often result. To control these hazards • Use proper lifting techniques when manually handling rods, augers and tools. Use mechanical equipment during lifting whenever possible (hoisting devices). Use the buddy system when lifting tools and supplies. Stretch in the morning to limber your muscles, tendons, and ligaments prior to engaging in heavy lifting activities. Take more breaks in the afternoon to guard against fatigue related injuries. • Review Section 4.4 of the HSGM for additional safe lifting practices.
9. Drill Rig Operation	9. Excessive Occupational Noise	9. Excessive Occupational Noise – Noise levels associated with HSA and Air Rotary drilling rigs have ranged from 82 to 94dBA. Due to the magnitude of these levels provisions for hearing protection is required. These measures are as follows: • Unit operator and helper(s) are to wear hearing protection. Other persons who must be nearby (within the 35-foot exclusion zone) to perform their job duties are to also

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		wear hearing protection. • Onsite personnel may use the general rule of thumb when determining if noise levels are excessive *If noise levels are such that they must raise their voice in order to communicate with someone who is within arm's reach (approx. 2') of them then noise levels are becoming excessive and hearing protection should be employed.* Based on accumulated data, operations requiring hearing protection will be specified in the site specific health and safety plan. • The SSO responsible for monitoring the use of hearing protection, ensuring the hearing protection selected have a sufficient noise reduction rating (at least 25 dB). • Implementing the site specific Hearing Conservation Program found in Section 6.0 and posting 29 CFR 1910.95 when hearing protection is required.
Drill Rig Operations (continued)	10. Exposure to site contaminants i. Inhalation ii. Skin contact/absorption, ingestion Arsenic Chromium (as Chromium VI) Lead Silica dust – Air rotary; well construction	10. The concentrations associated with arsenic, chromium, and lead are not anticipated to reach concentrations that could result in exposure based on source concentrations. Monitoring will be conducted during air rotary drilling to determine total and respirable dust fractions using the HAZ Dust IV. This concentration is based on general waste classification. In the use of air rotary drilling equipment the concern is greater as the cuttings are brought to the surface via air pressure. It is determined whether through the use of this drilling application will put site workers at additional risk to exposure to silica dust. To qualify and quantify the following measures will be conducted: • The driller will wear the HazDust IV to monitor airborne dust concentrations. This will provide information concerning Total Dust (must be maintained less than 10 mg/m^3). The HazaDust IV will also allow the collection of a sample through a cyclone to permit size differentiation as well as determining the silica type and percentage. Samples will be sent to an approved Industrial Hygiene Laboratory for analysis. Results will be provided to the PHSO for interpretation. • Action levels - If readings in worker BZ areas exceed: **Total dust** o HAZ Dust IV Total Dust 10mg/m^3 – Tape up leaks in the shroud and trunk line. o Minimize the time in which the shroud is elevated to collect samples. Keep the shroud as close to the ground as possible. o Extend the trunk line out of the work area downwind. **Respirable Dust** o HAZ Dust IV Total Dust utilizing the interchangeable head will be

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		employed for respirable fractions. Action level 3mg/m^3 for particulates not otherwise classified. o Monitoring will be conducted in the breathing zone of the Air Rotary Driller to collect data for the worst Case scenario in order to evaluate air emissions from this source point. o Air sampling – NIOSH method #7500 – Silica Dusts – Air sampling will be conducted using a 37mm cassette and GS-3 cyclone at the end of the sampling train. This will be used to confirm silica types and percentage during bedrock well installation. See Section 7.0 for a detailed description. To control exposure through skin contact, absorption, and/or ingestion personnel handling contaminated media will • Wear surgeons gloves when handling potentially-contaminated media and samples, avoid contact with potentially-contaminated media to the extent possible, follow good decontamination and practice good personal hygiene (hands and face washing) when exiting work area, hand-to-mouth activities in the work area will be prohibited (eating, drinking, smoking, etc.). • Practice good housekeeping to avoid the spread of contamination. • Work from the least contaminated toward the source to avoid potential cross contamination
	10A. Heat Stress - Regardless of the level of PPE employed recent high temperatures has brought the potential for heat stress to the forefront.	10A. To combat heat stress onsite personnel must be aware of the signs and symptoms of the onset of this condition. These are provided in Section 4.6 of the HSGM as well as biological monitoring protocol. Some easy tips • Drink water often, even if you are not thirsty. • Monitor your urine output and the color. If it is dark drink more. If you are not going to the bathroom at normal frequencies drink more. • Rest in the shade – Direct sunlight will raise your body core temperature. So when you are taking a break, do it in the shade. Portable pop-up canopies are good for this purpose. Umbrella and other shade providing devices should be placed over the sample screening station and other static positions. • Heat stress or the conditions associated with heat stress are not easy to determine by visual observation. Therefore, biological monitoring should be conducted in the morning to get baseline measurements. Subsequent measurements can be determined based on site specific conditions or if you suspect someone maybe experiencing heat stress. o Action levels are as follows: o Body Core body temperature >101.3˚F; stop work, initiate cooling o Recovery heart rate at one minute after peak work effort >120bpm o Weight loss over the shift is greater than 1.5%

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		• Report heat stress symptoms early. • SSO – Know your field crew – Certain medication (medical data sheets) will increase the potential for heat stress such as blood pressure medication; alcohol use and lifestyle • SSO – Use administrative controls such as altering work/rest(cooling regimens) • SSO – Take baseline readings so you have a starting point • If there are symptoms including sudden or severe fatigue, nausea, dizziness, or lightheadedness treat for heat stress immediately • Know what to do in an emergency o Move person to a shaded area o Lay then down or into a sitting position o Loosen clothing o Apply cool wraps or ice pillows at the base of the neck o Apply cool water wraps or ice pillows over the head and wrists, to promote cooling. o Lay down person, treat for shock by raising feet and legs above the heart call for medical assistance continue cooling regimen.
Monitoring Well Construction – Once drilled to the desired depth, the monitoring well will be inserted into the HSA auger flight or into the borehole for the bedrock wells. Centralizers maybe used to keep the well in the center. Strings of PVC NSF Well grade materials are threaded together and lowered in to the borehole. Once in place a filter sand pack is placed around the well. The geologist will tag the depth to the sand periodically t insure bridging is not occurring. Sand will be extended to at least two feet over the screen interval, then a two foot interval of bentonite will be applied in the same manner.	11A. Lifting – Common weights ▪ Bag of sand 80lbs ▪ Grout 94lbs ▪ Bentonite 80lbs	11A. These lifting hazards are exacerbated due to the fact getting and maintaining good hand holds are very difficult. Where possible • Use the hoisting device to hold the bags of sand • Use multiple persons to move and handle bags of sand and grout • Take breaks as often as necessary to guard against fatigue and injury • See Section 4.4 for additional tips on controlling lifting hazards

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
The final step is the mixing and placement of the grout to seal and stabilize the well string.		
Monitoring well construction (continued)	11B. Total Dust; respirable fraction and Silica Dust	11B. During mixing of the grout or dumping the sand into the borehole the potential exists for exposure to silica dusts or chromates associated with the cement. To minimize potential exposure the following measures will be employed: • Add grout to the water slowly to minimize dust. Adding under a light spray will knock down airborne dusts and minimize exposure. • The sand used in well construction are washed and graded. Dust generation should be minimal. However, stand back from any dust released to avoid inhalation. • Dump slowly into the borehole to minimize dust generation. This will also aid in avoiding sand bridging in the well.
Monitoring well construction (continued)	11C. Eye and skin irritation – Chromates – component of the cement. This is more pronounce in persons who exhibit allergic reactions to chromates. This is most predominant when handing wet cement or grout	11C. To minimize hazards • Have the MSDS onsite for review • Grout mixture should have the lowest possible water soluble chromate contribution. As a general rule of thumb concentrations over 20ppm will present skin irritation and possible dermatitis. • Grout mixing machines are preferred as this mixing and tremie system minimize the amount of direct skin contact. • Wear rubber gloves (nitrile) and safety glasses to prevent eye contact. Periodically evaluate your gloves and glasses replace as necessary. • If wet grout gets on your skin flush it off. • Wear coveralls to avoid saturating your work clothes as this may hold these materials gainst your skin for extended periods of time • Mild irritation of the skin may be neutralized using a 10% vinegar and water solution. The use of moisturizers when your hands are still wet will aid in the prevention of your skin drying out. • Grout in the eyes should be immediately flushed and examined by a Doctor to ensure no permanent damage has occurred.
Drill rig maintenance activities	1. Struck by/entanglement/crushed	1. **Struck by/entanglement/crushed** – In order to control these types of hazards associated with periodic maintenance activities. • The drill rig and associated equipment must be maintained in a proper functioning condition. All equipment must be visually inspected daily prior to use. • All motors must be shut off and electrical, mechanical and hydraulic components locked out of service when making repairs. All components where work will be conducted or associated with will be reduced to a zero mechanical state (NO POTENTIAL or KINETIC energy). Bleed off pressure on hydraulic lines before

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
	2. Fire	undoing fittings. Do not leave tools or parts loose on the unit after maintenance has been performed. • Equipment must be operated and maintained in accordance manufacturer's guidelines. Safety shutoff system must be tested daily and not disabled. 2. **Fire** - Maintenance activities may include mechanical repair, hot work, refueling/greasing machine components, etc. To support these activities the following measures will be incorporated • All motors must be shut off during refueling. Smoking in the vicinity of the drill rig, within the exclusion zones are not permitted. Smoking will only be permitted in designated areas. • Fuel containers will not be stored within 10' of the unit motor or other elevated temperature application. Fuel will be stored in UL approved safety containers with contents clearly labeled. • The performance of hot work will require the acquisition of a facility hot work permit. All hot work conducted by Tetra Tech personnel or associated subcontractors will be supported through the completion of a Hot Work Permit. • Fire suppression devices including o Water source o Portable fire extinguisher(s) - A-B-C fire extinguisher must be maintained onsite and on associated motorized equipment. The number of fire extinguishers will be determined by the SSO. o Fire watches will be required to be maintained for at least 30-minutes after the cessation of activities. o All combustible materials will be removed from the intended work area. o All hot work will be performed in an area suitable and approved for these application such as a laydown area.
Site specific Conditions –		

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Drill Unit	Drill Rig Inspection • Inspect unit as part of site	SSO or designated "Qualified Person" must be sufficiently experienced and familiar with units to conduct a detailed inspection concerning the units operating integrity.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Work Areas	mobilization, after maintenance/repair. • Visual examination daily. • Test all Kill switches initially and then at least weekly thereafter, or more frequently if recommended by manufacturer. FOL and/or the SSO will conduct initial site surveys of all work areas prior to committing personnel and/or equipment. Hazards will be eliminated or demarcated. All hazards identified will be discussed at the Tail Gate training session prior to entering the work site.	The Driller will carry the necessary certification or licensing as required by the Commonwealth of Pennsylvania. This license/certification will be maintained onsite. For drilling activities employed to determine levels of contamination in the soils and/or groundwater • 40-Hour General Site Worker Hazardous Waste Operations Training • 8-Hour General Site Worker Refresher Training - If it has been greater than 12 months since receiving the 40-hour training or last refresher training. • 8-Hour Supervisory Training [29 CFR 1910.120 (e)(4)] for all personnel operating within the supervisory capacity. • Site-Specific Training – All personnel performing work within designated exclusion zones will have gone through site specific training including o Reviewing the contents of the site specific Health and Safety Plan o Applicable sections of the HSGM. o Work Plan • Tail Gate Training Sessions
Hand tools (dollies, hand carts, hand knives, shovels, etc.) Emergency Equipment – Fire Extinguishers First Aid (with Bloodborne Pathogen provisions) Eye wash units	Visual inspection prior to use by user. Upon receipt then monthly thereafter The SSO will be responsible for insuring the first aid kits are fully stocked and replenished as supplies are used. The SSO will be responsible for inspecting the onsite Emergency Eyewash units upon receipt then weekly thereafter.	None required All personnel will have received fire extinguisher training for the types of extinguishers to be employed. This will be through their respective companies or as part of the site-specific training. All personnel designated as first aid providers will have had formal training in first aid and CPR as well as in Bloodborne Pathogen (BBP) control and program elements.
Personal Protective Equipment: <u>Minimum</u>: Steel toe boots, safety glasses, hardhat, hearing protection cotton or leather gloves when	Initial PPE inspection will be performed by the user (prior to each use). The SSO will monitor use/ application of PPE by the users.	PPE training in proper use, care, storage, and limitations. It is anticipated that this has been covered in employees 40 hour HAZWOPER training, which is to be verified by the SSO through initial training documentation and review prior to permitting personnel to participate in site activities, and will be confirmed by visual observations of worker activities.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
handling drill tooling; Nitrile with grip support for handing contaminated tooling. **HTRW**: Nitrile gloves when handling samples or other potentially-contaminated media.	The SSO will address any deficiencies noted at the occurrence then at Tail Gate Safety Meetings. HAZDust IV to be subjected to calibration and operational checks in accordance with manufacturer's recommendations (but not less than daily)	SSO trained in proper calibration, use, and care of air monitoring devices used (Haz Dust IV). This is a general component of 40 hour HAZWOPER training, and SSO must become very familiar with the Operator's Manual for any instrument used.

All persons working within the operational will sign this AHA indicating that they have reviewed the document and are aware of their responsibilities as stated in the AHA.

Name (Printed)	Signature	Occupation	Date Reviewed/Training

ACTIVITY HAZARD ANALYSIS (AHA)

Site Name: NSA Crane, Crane, Indiana; SWMU 22 Lead Azide Pond

Task: Monitoring Well Groundwater Sampling Using Bladder Pumps

Prepared by	T. Dickson	**Date:**	09/2011	**FOL**	
Reviewed by		**Date**		**SSO**	

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
1. Groundwater sampling - Site preparation and set up.	1. Biological hazards Terrain challenges Free space for travel	1. Initial site preparations were critical during the mobilization phase in the identification, barricading or removal of hazards that may exist and hence the protection of site personnel and resources. Personnel moving to their sample locations will repeat this process to ensure they are aware of hazards within their immediate work area • Perform a site walk over The hazards types include o Terrain challenges – Paths for vehicle and pedestrian movement will travel, process line restricts, fence physical barriers, etc. • Once the site is set up provisions for adequate Emergency Access/Egress shall be maintained to allow emergency vehicles passage if required. • The work area should be sufficient size to permit the completion of assigned tasks without creating hazards. o The primary objective is to establish a safe work zone and to minimize potential vehicle hazards. These shall include ▪ Be extremely cautious around heavy and/or fast-moving vehicles. ▪ DO NOT place obstructions along the sides of the road that may cause pedestrians or yourself to move into the flow of traffic to avoid your activities or equipment. **Provide a required Free Space of Travel!** Required "Free Space": Maintain at least 6-feet of space between you and moving traffic. Where this is not possible, use flaggers and/or signs to warn oncoming traffic of activities near or within the travel lanes, and safety cones. ▪ Face Traffic: Whenever feasible, if you must move within the 6-feet of required space, or into traffic attempt to face moving traffic at all times. Always leave yourself an escape route. ▪ Wear High Visibility Vests to increase visual recognition by motorist equipment. ▪ Do not rely on the operator's visibility, judgment, or ability. Make eye contact with the driver. Carefully and deliberately use hand signals so they will not startle or confuse motorists or be mistaken for a flagger's direction before moving into

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		traffic. ▪ Move Deliberately: Do not make sudden movements that might confuse a motorist or operators. ▪ Avoid where possible interrupting Traffic Flow: Minimize crossing traffic lanes. ▪ People can't stand it they have to look to see what is going on, what you are doing. As a result many fender benders occur within work areas. Where possible move traffic through the work area but keep them separated to the extent possible that they do not collide with the car in front of them. ▪ Maintain clear walking/working areas and good housekeeping to the extent possible.
2. Groundwater sampling • Well purging and development • Collection of groundwater samples (via small nitrogen gas powered bladder pumps. Water is pumped from the well at a low flow rate through groundwater quality instruments and placement into sample containers	2. Minor cuts, abrasions or contusions handling equipment and tools 2A. Slips, Trips, Falls	2. Use hand tools that are in good condition. Hand tool users must be familiar with their proper use and must use them only in a manner that is consistent with their intended operation. As indicated earlier, the users will be responsible for inspecting tools prior to use. Additional measures include: • When cutting tubing cut away from yourself and not towards others • It is recommended that scissors be used to cut tubing versus knives. Where this is not possible, wear a leather glove on your non-knife hand. • Sample glassware should be transported in hard sided containers such as coolers, that way if you fall the likelihood of falling onto glassware causing lacerations and punctures are greatly minimized. • Do not throw broken glass directly into the trash. Place it into a hard sided container such as a cardboard box. That way when you are transporting the garbage bag to the waste receptacle it will not cut through the bag and potentially cause lacerations. • Do not arbitrarily reach into the trash to retrieve something. Dump it out onto a flat surface. This will minimize potential punctures if someone else has thrown sharp articles into the trash. 2A. Clear intended work areas and walking paths of roots, weeds, limbs and other ground hazards. Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Use caution when working on uneven and wet ground. Mark or flag obstructions such as overhead process lines that present head strike hazards. Use orange or yellow marking paint to increase visual recognition of trip hazards. See Section 6.1 of this HASP as it pertains to chemical hazards associated with well sampling.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Groundwater sampling (cont.) The bladder pump operates on compressed nitrogen fed to the pump through a an airline connected to a compressed gas cylinder.	2B. Compressed Gas hazards	2B. The following measures will be employed to minimized the compressed gas hazards. • Secure the cylinder during transport. • Carry the MSDSs with you for any chemicals you are carrying in your sampling vehicle. • Follow the preventative measures indicated in the Compressed Gases Safe Work Practices (Section 5.4.1) and complete the Cylinder Safety Awareness checklist provided at the end of this AHA to minimize hazards associated with working with compressed gases.
Groundwater sampling cont)	2C. Lifting	2C. Depending on the size of the cylinders you are able to obtain the compressed gas cylinder could be in excess of 175lbs. Practice safe lifting techniques (use mechanical lifting devices such as a dolly whenever possible, ensure clear path of travel, good grasp on object, lift with legs not back, and obtain help when needed to lift large, bulky, or heavy items). Fill buckets and drums only to 80% which is manageable. Place lids on during transport. Remember if you must carry articles to the sample locations because vehicle access is not possible a cart or wagon is recommended for transport.
Groundwater sampling (cont)	2D. Knee injuries	2D. Knee injuries – Much of the sampling activities will require the sampler to get on the ground (flush mounts). When monitoring wells are installed as flush mounts this requires personnel to kneel to open wells, take groundwater level measurements, etc. This could result in knee injuries from kneeling on stones/foreign objects and general damage due to stress on the joints. To combat this hazard, personnel will wear hard sided knee pads. Where possible the PM will request Stick ups to minimize this hazard.
Groundwater sampling (cont)	2E. Over pressurization of the Well	2E. During groundwater sampling or well development, the following measures should be conducted to minimize contaminant exposure: • At arm's length, open the well and remove the J-Plug and retreat. During this time, the well may off gas, but it will also allow the water levels to reach equilibrium once pressure is removed. • Prepare your equipment. • Set up your sampling station from an upwind position. • The lid on the discharge bucket or drum should be placed loosely to allow the collection of the water but to contain any volatiles during discharge. • Wear nitrile surgeon's gloves during sample equipment deployment, sample collection, and removal as applicable.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		• Use good work hygiene practices including o Minimizing hand to mouth contact during this sample collection period. o Flushing disposable tubing out and wiping down the exterior as it is extracted prior to disposal. • Sample collection buckets and flow through cells should be placed in a mortar tub or similar secondary containment to minimize incidental release during collection and transportation to the disposal area • Wrap or bag all contaminated pumps and tubing for transport. Decontaminate as soon as possible. DO NOT allow contaminated equipment or tubing to off gas in your vehicle. Keep the bag sealed and get it cleaned.
Groundwater sampling (cont)	2F. Contaminant Exposure Arsenic Chromium Lead RDX	2F. It has been identified in Section 6.1, when exposure potential would be at its greatest and the routes of that exposure. For these contaminants of concern it is through hand to mouth transfer and ingestion. To combat this hazard Employ good work hygiene practices. See Groundwater sampling safe work practices provided in Section 5.4.
3. Sampler preservatives	3.Sample preservatives; Corrosives - These substances are used to minimize microbial degradation while not impacting the sample quality. The problem with these substances is that they are corrosive and will degrade steel and human tissue.	3. Hydrochloric acid is used as a sample preservative for volatile organic compound groundwater samples. Others that maybe encountered include • Nitric Acid – Metals By following the guidelines provided in the Mobilization/demobilization AHA including • Completing the onsite Hazard Communication Program – Know the hazards and how to prevent them. Review the MSDS; • Provide and prepare for the emergency even if it is using drinking water to flush a contact point; • Wear proper PPE – When opening sample bottles wear nitrile surgeons gloves and safety glasses • Store containers in the upright position. • Hold over your secondary containment when opening. You can minimize if not eliminate these hazards. In addition to the use of PPE to serve as a barrier, provisions for flushing the eyes and skin will be available. It is the intent that through the use of the small 1-liter eyewash solutions, to offer immediate aid during removal and transport to the medical provider. Drinking water may also be used when additional solution is needed until medical support is achieved. The eyewash units onsite will be • Immediately accessible during sampling.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		• Inspected once/week • Replaced when expired Maintain these solutions accessible but out of direct sunlight – No one wants to flush their eyes with hot or cold solutions.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Bladder pumps; dedicated or disposable tubing Groundwater quality measurement devices; turbidity.	Electrical connections, wiring, tubing connections; pressurized connections; compressed gas cylinder safety awareness	The FOL will direct personnel on the procedure to be employed to collect groundwater samples. General operating/demonstrated skill of the sampling technician per the SOP for groundwater sampling and/or well development should be assessed by the FOL. Instruction should be provided as necessary.
Personal Protective Equipment: **Minimum**: Safety Glasses; steel toed/shank footwear; hard hat; leather/canvas work gloves for site set up. Nitrile surgeons or nitrile outer gloves will be utilized when handling clean and contaminated tubing or sampling equipment. **Optional items**: High visibility vests are recommended for these activities in high traffic areas.	None required	All personnel • 40-Hour General Site Worker Training [OSHA 29 CFR 1910.120 (e)] • 8-Hour General Site Worker Refresher Training [OSHA 29 CFR 1910.120 (e)(8)] • Site Specific Training – All personnel shall be instructed and attest to the review and understanding of this HASP prior to the commencement of on-site activity. • Periodically, Tailgate Training Sessions will be conducted to review activities in progress, results of site surveys, and upcoming tasks. It is recommended that AHAs be reviewed prior to conducting the identified task. • Participate in a Medical Clearance/Surveillance Program as described in OSHA 29 CFR 1910.120 (f). • Complete a Medical Data Sheet • Review applicable MSDSs if you are unaware of the hazards and recommended control measures for sample preservatives. Supervisory personnel: 8-Hour General Site Worker Supervisory Training [OSHA 29 CFR 1910.120 (e)(4)] Documentation attesting to applicable training and medical clearance will be collected by the FOL and/or the SSO and maintained on site.

All persons working within the operational will sign this AHA indicating that they have reviewed the document and are aware of their responsibilities as stated in the AHA.

Name (Printed)	Signature	Occupation	Date Reviewed/Training

COMPRESSED GAS CYLINDER SAFETY AWARENESS CHECKLIST

The following checklist is intended to provided field personnel direction concerning the selection of a storage/operation location for groundwater sampling using compressed nitrogen; inspection of the cylinders, gauges associated hoses and connections. It is not intended to provide direction in the servicing and maintenance of cylinders which will be provided by the owner/vendor. It is also not intended to provide direction and qualification for the delivery of the nitrogen cylinders this will be the primary responsibility of the selected vendor.

Warning

Compressed nitrogen is considered an inert gas as it does not react with other materials at ordinary temperature and pressure. Nitrogen is colorless, odorless, nonflammable and nontoxic. The primary hazards associated with the use of this gas is the pressure. Damage to the valve or valve assembly can cause the cylinder to rocket through the release of the over pressurized gas. Significant injury, property damage, and death may result through this action. A secondary but no less important fact is this gas is a simple asphyxiant. If this gas is released within an enclosed spaced, it will displace oxygen, you will suffocate if the concentration is high enough. READ AND UNDERSTAND THE WARNINGS OF THE MSDS AND THIS AWARENESS CHECKLIST. IF NOT ASK QUESTIONS!

1.0 Training

_____1.1 Are all personnel assigned to utilize the compressed gas cylinders adequately trained in the operation, potential hazards, and control measures? The FOL and/or the SSO will review the procedure to be employed to ensure persons are adequately aware of the hazards.

_____1.2 Are all personnel adequately trained to conduct a site inspection including an evaluation of the compressed gas cylinders?

_____1.3 Are Material Safety Data Sheets onsite and available to all personnel? Have the nitrogen cylinders been added to the Site-Specific Chemical Inventory List? It is recommended that MSDSs accompany each cylinder.

_____1.4 Do personnel handling the cylinders have the proper PPE including Safety Glasses or goggles, work gloves for handling and moving the cylinder and steel toed boots?

2.0 Receiving Cylinders

_____2.1 Does the shipment invoice identify the correct type of gas and purity grade?

_____2.2 Does the labels on the cylinders match the shipment invoice regarding gas type and description?

_____2.3 Does the cylinder show signs of physical damage or imperfections (gouges, dents, does it wobble when rolled on a flat surface?)

_____2.4 Are the threads damaged? Does the regulator thread on easily?

_____2.5 Does each cylinder have a valve protection cap? (Note: Cylinders less than 30ibs water weight do not require a valve protection cap.)

If any of these conditions exist, the cylinder should not be accepted and should be returned to the vendor for a replacement. Make sure you examine these items upon receipt or pick up.

Labeling/Placards

_____2.3 Are cylinders properly labeled including

_____Chemical Identification

_____Hazard Warning

_____Manufacturer Name

Preferred labeling includes the identity of the material, statement of hazard and the associated signal word. For example, the preferred label for nitrogen would be:

NITROGEN
Caution High Pressure Gas can cause rapid suffocation in enclosed areas

_____Are the labels legible and free from physical damage?

_____Are there location specific labeling/placarding requirements (NFPA versus HMIS) at NSA Crane required?

_____2.4 Is the cylinder Hydrostatic Inspection up to date?

The cylinder inspection certification is up to date (Steel cylinders every 10-years; date stamped into the shoulder of the cylinder). See cylinder markings at the end of this checklist to determine.

_____2.5 Never remove identification. Add additional information as necessary.

Note: This cylinder can be left on its side within the site vehicle. It still must be secured but can be left on its side. When not in use or during transport, the valve protective cap must be in place.

3.0 Handling Cylinders

_____3.1 Always wear safety glasses when working with compressed gas cylinders

_____3.2 Are all cylinders equipped with a valve protection cap? Does it turn freely using only hand pressure to tighten of remove?

_____3.3 Where cylinders must be moved is a cylinder truck (with the appropriate wheels/tires for the terrain) available for use?

_____3.4 Do NOT tamper with safely devices.

_____3.5 Always handle cylinders as if they were full.

4.0 Storing Cylinders

_____4.1 Is the selected cylinder storage area at least 25-feet from established congested/populated areas (Lunch rooms, break areas, offices, etc.)?

_____4.2 Is the structure adequately vented to permit convective/radiant cooling of containers as well as permit dispersal of gas resulting from a leaking container?

_____4.3 Are these storage locations readily accessible to delivery/authorized/emergency personnel?

_____4.4 Is the storage area permanently posted with the names of the gases stored in the cylinders? [CGA 3.3.2 and 29 CFR 1910.101(b)]

_____4.5 Are full and empty cylinders stored separately?

_____4.6 Are cylinders stored out of heavily travelled vehicle or equipment routes making them vulnerable to potential vehicle movement accident?

_____4.7 Are cylinders always maintained at temperatures below 125ºF? [CGA 3.1.12]

Note: A flame should never come in contact with any part of a compressed gas cylinder. The storage of these portable cylinders in site vehicles is discouraged. Excessive heat may cause softening of the rubber rupture pressure relief plug resulting in the immediate discharge of the contents.

5.0 Using Compressed Gas Cylinders (Nitrogen)

_____5.1 With the cylinder opening facing away from you, have you slightly cracked the valve before hooking up the cylinder to the gauge to blow any debris out of the cylinder? (DO NOT DO THIS WITH HYDROGEN CYLINDERS!!!!)

_____5.2 Are the cylinders connected through a pressure reduction regulator before being hooked into the equipment and/or system?

_____5.3 Are those cylinders containing a liquid phase stored/used in an upright position?

_____5.4 Are the cylinder(s) adequately secured to prevent them from falling over during storage and use?

_____5.5 Are the cylinder(s) threads compatible with the threads on the regulator? (DO NOT MODIFY FITTINGS – CONTACT THE CYLINDER PROVIDER)

_____5.6 Have gloves, rags, or other materials containing lubricants been removed from the area?

_____5.7 Are the use of wrenches or other tools for opening and closing valves prohibited? [CGA 3.4.9]

Note: Hammering or using cheater pipes and bars on valve wheels or valve caps to open them is strictly prohibited. For valves and valve protective caps that are hard to open, contact the supplier for replacement.

_____5.8 Open the regulator – Is there any indication of a leak (audible – Air hissing)? [29 CFR 1910.101(a)], if so quickly locate the leak, recheck the fitting.

_____5.9 Are all compressed gas cylinders regularly subjected to leak detection (initial hook-up then as needed using an approved leak detecting liquid? [29 CFR 1910.101(a)] Ensure the leak detection fluid is compatible with the materials employed.

_____5.10 Are the safety devices intact (pressure relief plug)? (Is it holding pressure? Is the rubber plug protruding into the hole of the brass plug?

_____5.11 Never use nitrogen as a substitute for compressed air.

_____5.12 Have cylinders been removed from the system before complete depressurization? (Cylinders should not be emptied below 25 psig to prevent potential suck back).

_____5.13 Are above ground delivery tubing/piping protected from physical damage of affects of the environment?

_____5.14 Does the delivery hoses leak? If so replace. Are the hose connections equipped with quick connects? This type of connection will stop the flow of gases and not whip if accidentally disconnected.

_____5.15 Are Operating Instructions of the pump system, most importantly the nitrogen cylinder(s) posted with each unit?

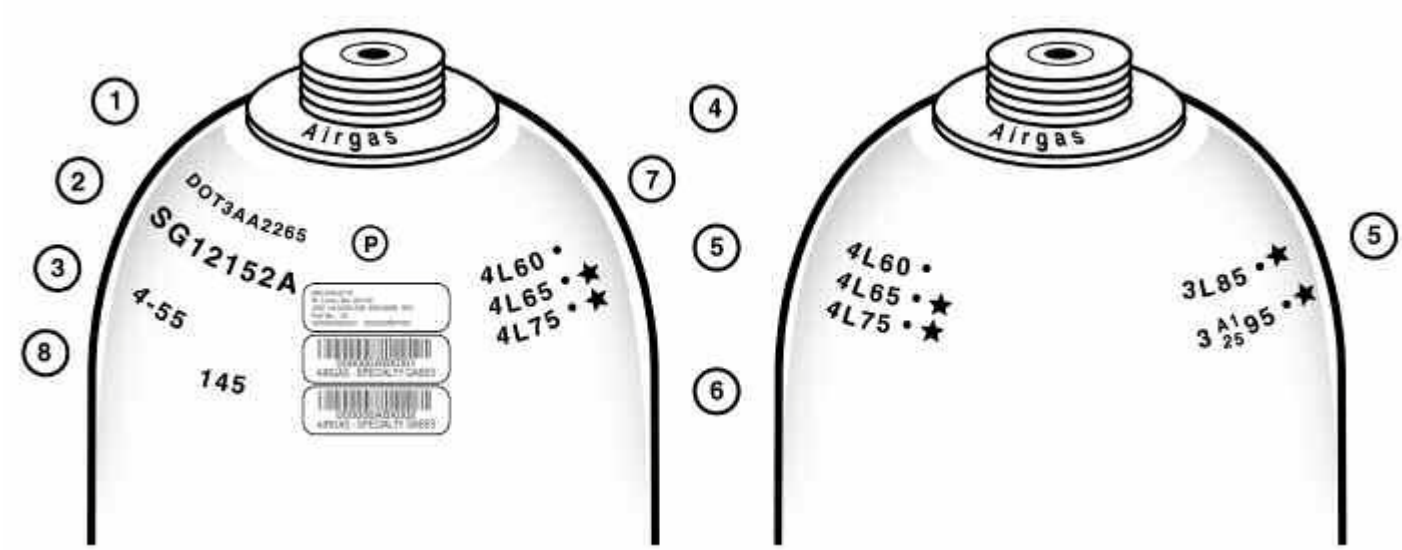
Cylinder Identification and Marketing's Packaging and Color

Colors of cylinders are not to be trusted to identify compressed gas cylinder content!!!

The following information was obtained from the Airgas website, while some elements maybe manufacturer specific, the markings to be discussed are universal.

1st, Please read the contents label.

A shoulder label indicates the product's shipping name and identification number. On pure products, a grade label is also applied to the cylinder shoulder. The shoulder label identifies cylinder contents.



Markings

Airgas specialty gas cylinders are stamped with markings designed to indicate ownership, specifications, pressure ratings, and other important data. Airgas also utilizes a bar code label for product identification and tracking.

1. Cylinder Specification:

DOT—Department of Transportation (previously ICC – Interstate Commerce Commission), which is the regulatory body that governs the use of cylinders.

Specification of the cylinder type of material of construction (e.g., 3AA).

Service or working pressure in pounds per square inch (e.g., 2,265 psig).

2. Cylinder Serial Number

3. Date of Manufacture:

This date (month-year) also indicates the original hydrostatic test.

4. Neck Ring Identification:

The cylinder neck ring displays the name of the original owner of the cylinder.

5. Retest Markings:

The format for a retest marking is: Month – Facility – Year – Plus Rating – Star Stamp. • The + symbol (Plus Rating) indicates that the cylinder qualifies for 10% overfill. • The H symbol (Star Stamp) indicates that the cylinder meets the requirements for 10-year retest, instead of a 5-year retest.

6. Bar Code Label:

The bar code label provides a unique cylinder identifier and is used by computer systems to track cylinders throughout the fill process. As an optional service, that gas suppliers utilize to track cylinders to and from customers.

7. Cylinder Manufacturer's Inspection Marking

8. Cylinder Tare (Empty) Weight:

This value may be preceded by the letters TW.

D.O.T. Classifications

Your compressed gas cylinders will have one or more of the hazardous materials placards shown at right. The United States Department of Transportation (US DOT) in Title 49 Section 173 of the United States Code of Federal Regulations (49 CFR 173) requires the use of hazardous materials placards when shipping compressed gases. These hazardous materials placards are intended to indicate the general hazards associated with the contents of the gas in the cylinder. For complete hazardous material information, refer to the Material Data Safety Sheet (MSDS).

For the nitrogen gas the DOT label will be nonflammable gas, Hazard Classification 2.

Information courtesy of Airgas

ACTIVITY HAZARD ANALYSIS (AHA)

Site Name: NSA Crane, Crane, Indiana; SWMU 22 Lead Azide Pond

Task: Decontamination – Hand tools and associated equipment. This is a low pressure application.
High Pressure Application – Heavy Equipment

Prepared by	T. Dickson	**Date**	09/2011	**FOL**	
Reviewed by	J. Carothers, Ph.D.	**Date**	09/2011	**SSO**	

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
1. Site set up Decontamination of non-dedicated hand tools and equipment can take place onsite or at a centralized location.	1. Slips trips and fall	1. Slips trips and falls – To prevent these types of hazards the following measures will be incorporated: • Station placement – Keep the decon station far enough back from the operation to allow room to work. • Practice Good housekeeping – Keep tubing and tools gathered and organized to prevent a tripping hazard. • Do not lay items around on the floor or ground where someone could step on them and go down. • Clear other obstructions in the area that may present trip hazards.
2. Washing and rinsing process	2. Contaminant accumulation - Contaminant exposure • Particulates – metals, metalloids, and energetics	2. Based on reported source concentrations the contaminant levels are not anticipated to be extremely elevated. To minimize exposure • Wear nitrile gloves, safety glasses, and an impermeable apron to prevent saturation of clothing. • Change out the wash water frequently to insure adequate decontamination but also protect from overloading contaminants. • Personnel involved in the decontamination process will themselves wash reusable garments (impermeable aprons); Follow good decontamination practices (work from top down and outside in). Surgeon's gloves are to be the last item of PPE removed; change gloves regularly and wash hands and face before any hand to mouth activities. • Keep decon areas orderly, maintain good housekeeping.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
4. Decon procedure Decontamination will include: a) Flushing tubing using a soap/water solution prior to disposal as general refuse.	4. Hazard Communication a., b. - Incidental spills - Slips, Trips, Falls c. Contaminant exposure	4. The SSO will complete the Site Specific Hazard Communication Program. This includes • Recording chemicals employed onsite for decontamination onto a Chemical Inventory List • MSDSs are available to all personnel and they are aware of the hazards associated with each. • The SSO has reviewed the documents for completeness and have also determined if there are additional equipment (PPE and/or Emergency equipment) that is needed. a., b. - Incidental spills - Slips, Trips, Falls - The decontamination will employ 5 gallon buckets with soap and water and rinse water contained in mortar tubs to serve as secondary containment to control incidental spills. Wash waters, as well as, purge waters will be containerized in buckets with the lids on to control spills and off gassing into the transport vehicles.
Decontamination – High Presssure		
Decontamination of heavy equipment and large tooling (e.g., vehicles, etc.) using pressure washer	1. Noise	1. Pressure washer operator must wear hearing protection (muffs or plugs with NRR of at least 25 dB)
	2. Flying projectiles/water lacerations	2. Control measures include • Restrict other personnel from decon pad during pressure washing operations. • Pressure washer operator must exercise care when directing the wand so that it is not pointing at himself/herself or at any other worker. • Restrict pressure washer to 3000psi with not less than 15˚ deflection tip • Pressure washer operator must wear full face shield over safety glasses with side shields and brow protection. • At SSO discretion, additional PPE consisting of hardhat, rainsuit, apron, and or boot covers may be required during heavy equipment decon operations Depending on observations indicating that significant contact with decon overspray and/or windy conditions during washing activities.

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
	3. Falling objects	3. Control measures include: • Place items to be decontaminated on ground or on washing/drying racks in a manner that they are secure and will not fall. • Wear safety toe safety footwear.
	4. Slips, trips, and falls	4. To control slips , trips, and falls • Keep hoses gathered when not in use. • Configure decon pad so the hoses maybe be run in an area not employed by pedestrian (employee) traffic. • As a tarp or plastic containment will be placed on the ground to serve as a containment, this may become slippery. Where necessary apply a light coating of sand to enhance traction. • Keep waters collected in the pad pumped to a minimal level as not to disguise trip hazards.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Hand tools (hand brushes, garden sprayers, hoses, etc.) Pressure washer	When decontaminating equipment check equipment for deficiencies report to the SSO. After decontamination is complete, scan with the PID to determine if there remains any contaminants, repeated as necessary.	All personnel participating in this activity must be current with HAZWOPER training requirements as specified in Mobilization/Demobilization.
Personal Protective Equipment: <u>Minimum</u>: • Nitrile gloves. • Safety glasses • Rain suit or moisture-repellant disposable coveralls or impermeable apron, When there is a	Initial PPE inspection performed by SSO. Ongoing (prior to each use) inspections responsibilities of PPE users.	PPE training in proper use, care, storage, and limitations. It is anticipated that this has been covered in employees 40 hour HAZWOPER training, which is to be verified by the SSO through initial training documentation and review prior to permitting personnel to participate in site activities, and will be confirmed by visual observations of worker activities.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
potential for the saturation of work clothing. **Optional items**: As determined by the SSO based on site specific conditions.		

All persons working within the operational will sign this AHA indicating that they have reviewed the document and are aware of their responsibilities as stated in the AHA.

Name (Printed)	Signature	Occupation	Date Reviewed/Training

ACTIVITY HAZARD ANALYSIS (AHA)

Site Name: NSA Crane, Crane, Indiana; SWMU 22 Lead Azide Pond

Task: IDW Management

Prepared by	T. Dickson	**Date**	09/2011	**FOL**	
Reviewed by	J. Carothers, Ph.D.	**Date**	09/2011	**SSO**	

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
1. Storage Area set up	1. Traffic hazards; Material handling hazards	1. Traffic hazards/Material Handling hazards – This area should be easily accessible in order to place and remove the drums accumulated. To further reduce material handling hazards, support spill containment and control, and sampling when necessary, the IDW storage area should be structured as follows: • Maximum 4-drums to a pallet with retaining ring bolt and label on the outside for easy access/reference. • Maintain a minimum of 4-feet between each row of pallets. This is the minimum distance necessary to wheel drums on a drum dolly. • If the site is not secured, the satellite storage area shall be fenced and signs placed indicating the following: a. Primary Point of Contact (make sure they know they been identified as the primary point of contact). b. Phone Number c. Emergency Contact (If different from the primary) • Provide a Drum/Container Inventory to the Primary Point of Contact and to Emergency Services, if they deem it necessary. The inventory should contain: a. Each drum shall be assigned a unique identification number. This number shall be placed on the label and drum shell using a paint marker (Note: Do not paint the number on the lid as these have a tendency to get exchanged from time to time.) b. Types of waste materials (decontamination waters; purge waters, etc.) c. Volumes (Full or level associated with the container after completion of the project location) d. Where it was derived from (The site and/or wells)

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		e. Dates (When filling began) f. Contact – For more information Ensure all lids are secured.
2. Material Handling	2. Lifting (strain/muscle pulls)	2. Lifting (strain/muscle pulls) • Use mechanical means (i.e. dollies, etc.) to move and handle containers. Use proper lifting techniques described in Section 4.4 of the Health and Safety Guidance Manual (HSGM). • Fill drums and buckets only to 80% to minimize some of the weight and incidental spill issues. • Use help to move and place drums **Reminder:** The drums you are attempting to move, lift and/or relocate may weigh on the average of • 55-Gallon container of purge or decontamination waters = ~500 lbs. (including the container)
3. Placing the drums	3. Pinches and compressions	3. Pinches and compressions – During placement of drums/containers on pallets use machinery or assistance from another person where possible. Keeps hand out of the area between drums during placement. It is best to place the drums and pallets then transport buckets to fill the drums already placed. Wear steel toed shoes with adequate lug to support traction when moving heavy containers. Use machinery where possible to place drums.
4. Spill prevention and protection • Staging and Labeling Containers.	4. Chemical contaminants exposure	**4) Chemical hazards** – Generally encountering contaminants during this activity is low unless the contents of a container must be transferred due to a faulty container [leak(s)]. The outside of containers should be cleaned of residual waters (e.g. splashes, etc.) to avoid potentially exposing all who come in contact. The FOL and/or the SSO will • Insure the outsides of all drums moved to the staging area are washed/wiped clean.
Spill Containment - Within this scope of work the primary area of concern regarding spills and/or releases are associated with • Collection point – This is being addressed through using mortar tubs as secondary containment.		

- Moving/Handling the drums/containers of waste materials. This can be minimized based on the method of picking these drums up and the method of transport.
  - o Use the proper lifting appliances such as drum grapplers, drum dollies, etc,. Secure containers for movement over long distances.
  - o Care should also be exercised when using a backhoe or similar device to lift the drums. This sometimes results in a bucket tooth into the drum again resulting in a release.
  - o Place the drums onto a lift gate and flat bed with removable sides for transport to the staging area.

This section describes the procedures the Tetra Tech NUS field personnel will employ upon the detection of a spill or leak.

- Initiate incidental response measures, including
  - o Employ the personal protective equipment (see below). Take immediate actions to stop the leak or spill by plugging or patching the container or raising the leak to the highest point in the vessel (for containers). Spread the absorbent material in the area of the spill, covering it completely.
  - o Transfer the material to a new vessel; collect and containerize the absorbent material. Label the new container appropriately. Await analyses for treatment and disposal options.
- Re-containerize spills, including 2-inch of top cover (if over soils) impacted by the spill. Await test results for treatment or disposal options.
- Notify the SSO or FOL immediately upon detection of a leak or spill and actions taken or employed.
  - Personal Protective Equipment
  - Nitrile outer gloves
  - Splash Shield
  - Impermeable over-boots
  - Rain suits

Hazard Monitoring Required:	**Decontamination Procedures:**	**Permits/Requirements:**
Visual observation of work practices by the FOL and/or the SSO to minimize potential physical hazards (i.e., improper lifting, unsecured loads, cutting practices, etc.). Monitoring will only be employed if Spill Containment is implemented. Periodic visual inspection for leaks when filling drums or those at the staging area.	Not required, unless spill containment protocol is implemented. Then the following will apply • Once the spill is secured and all of the spill equipment has been through a soap and water wash and rinse. • Personnel will wash/rinse outer protective garment with soap and water. • Remove outer protective garments. • Wash hands and face.	• Complete IDW Inventory List

Training Required	**Emergency Equipment**	**H&S Supporting Program Requirements**
• 29 CFR 1910.120 (e) Site Specific Training, See Figure 8-1 • Tail Gate Meeting Attendance, AHA review, See Figure 8-2 **Medical Clearance/Surveillance Required** • Completed a Medical Data Sheet (See Attachment II)	- First Aid Kit - Fire Extinguisher - Map to Hospital and Emergency Contact List (Posted and a copy placed in your First-Aid Kit. - Spill Kit (Oil dry, wood shavings, or other absorbent materials, Shovels, brooms, Oil absorbent pads	None required.

All persons upon review will sign off on this AHA prior to participating in these activities.

Name (Printed)	Signature	Occupation	Date of Review or Training

Drum/ Container Number #	Drum/ Container Type	Media (Contents)	Location (SWMU and Well #, etc.)	Estimated Volume	Date Filling Began	Comments
1	5-Gallon Bucket 55-Gallon Drum (UN1A2)	Purge/Development Water Decontamination Wash Waters		( )-Gallons	/ /	
2				( )-Gallons	/ /	
3				( )-Gallons	/ /	
4				( )-Gallons	/ /	

Drum/ Container Number #	Drum/ Container Type	Media (Contents)	Location (SWMU and Well #, etc.)	Estimated Volume	Date Filling Began	Comments

Field Operations Leader:_____ Phone Number: _____

NSA CRANE POINT OF CONTACT:_____ Phone Number: _____

ACTIVITY HAZARD ANALYSIS (AHA)

Site Name: NSA Crane, Crane, Indiana; SWMU 22

Task: Surveying

Prepared by	T. Dickson	**Date**	09/2011	**FOL**	
Reviewed by	J. Carothers, Ph.D.	**Date**	09/2011	**SSO**	

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Geographical Surveying will utilize Handheld GPS to mark the final coordinates on each sample location. In this practice, the handheld GPS will also annotate a fixed known survey position such as a monitoring well or similar point as a reference. Professional Surveyors will survey the horizontal position and vertical elevations of the monitoring wells tying to established benchmarks/control points. Steps include Mobilization to the site. Parking/placement of the vehicle. Location of control points Incidental vegetation removal to obtain line of sight. Shooting points. Carry control to benchmarks or control points.	1) Flying projectiles/Struck by 2) Slips/Trips/Falls 3) Poisonous Plants/Insect Bites	1**) Flying projectiles/Struck by** • When hammering wooden hubs into the ground there is a possibility that shards may break off. To protect from potential eye injury during this activity personnel will wear safety glasses. • Crack or damage hubs will not be used. • Use a suitable hammer to drive the hubs. The hammer shouldn't be so heavy that and additional person must hold the hub while you drive it into the ground. • Inspect the hammer to insure the head is attached tightly and there are no indication of mushrooming head that could also become a flying projectile should it break off. • Use a hub cover to eliminate this hazard while also removing hands and fingers from the potential strike area. **2) Slips, trips, and falls** • Remove/identify trip hazards from the work area so they may be avoided. • Maintain good housekeeping within the work area. • Place the hubs in a bucket or similar device. That way should you fall you are less likely to impale yourself. **3) Poisonous plants/Insect Bites** – There are areas that are not well maintained (Grass is cut, etc.) and therefore poisonous plants and insects may be encountered. The following measures should take place when this hazard is imminent:

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		• Poisonous Plants – Within the work area we have Poison Ivy, Poison Oak, and Poison Sumac. An irritating, allergic reaction can occur after direct contact with the plant or indirect contact through some piece of equipment or clothing article. Oils are transferred from the plant to exposed skin, clothing, or piece of equipment. The degree of the irritation or allergic reaction can vary significantly from one person to the next. To control exposure to these plants o Know the plants. Avoid if at all possible. If not wear protective clothing that maybe thrown away when the task is complete. o Wear barrier creams or PPE, prior to entry into heavy brush. o Wash with cool water and soap or an over the counter solutions to remove these oils from the skin. Wash your contaminated clothes separate from your other clothes. • Insects – Use repellants applied liberally to skin and clothing per the Manufacturers requirements. o Wear light colored clothing – This will assist in controlling heat stress as well as seeing crawling insects on your body easier to detect. o Tape pant legs to boots to control insect (Ticks) access into clothing. o See Section 4.0 of the HSGM regarding biological hazards and the removal of ticks as well as conducting close body inspection. • Snake chaps should be worn in heavy vegetation or areas of reported stings.
4. Removal of Vegetation – Cutting site lines	4. Cuts/lacerations; Struck by	4. Cuts/lacerations; Struck by • See Hand tool use for removal of vegetation – Cutting site lines • Wear Hard hat, safety glasses, and leather gloves when cutting and removing vegetation. • Keep cutting tools within their sheath during periods of travel or non-use. • Keep a 15-foot boundary during vegetation removal (by hand).

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
5. Traffic hazards	5. Traffic hazards – Struck by	5. To minimize potential Vehicle Traffic Hazards • Be extremely cautious around heavy and/or fast-moving equipment. • DO NOT place obstructions along the sides of the service or access roads that may cause personnel to move into the flow of traffic. **Provide a required Free Space of Travel.** • Required "Free Space": Maintain at least 6-feet of space between you and moving traffic. • Where this is not possible, use flaggers and/or signs to warn oncoming traffic of activities near or within the travel lanes. • Face Traffic: Whenever feasible, if you must move within the 6-feet of required space, or into traffic attempt to face moving traffic at all times. Always leave yourself an escape route. • Wear High Visibility Vests to increase visual recognition by motorist. • Do not rely on the operator's visibility, judgment, or ability. Make eye contact with the driver. • Carefully and deliberately use hand signals so they will not startle or confuse motorists or be mistaken for a flagger's direction before moving into traffic. • Move Deliberately: Do not make sudden movements that might confuse a motorist. • Avoid where possible interrupting Traffic Flow: Minimize crossing traffic lanes. • People can't stand it they have to look to see what is going on, what you are doing. As a result many fender benders occur within work areas. Where possible move traffic through the work area but keep them separated to the extent possible that they do not collide with the car in front of them. • Warning signs shall be placed indicating surveyors working from all approach venues where applicable. Distraction – One of the most hazardous conditions persons will encounter during this activity is distraction. They take their off of the task or hazard at hand and they take their mind off of the task or

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
		hazard at hand. When these conditions exist they place themselves into traffic in some instances by mistake they become wrapped in their job. In situations due to the complexity of the task; multiple concurrent information points utilize traffic control to protect those individuals involved. Restrict flow and speed associated with traffic. Minimize activities during high traffic periods or when visibility maybe affected such as early morning and near dusk.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Machetes; brush axes; sledge hammers; Survey equipment.	Inspect handles; heads; cutting implements	General operating/demonstrated skill of the survey personnel.
Personal Protective Equipment: <u>Minimum</u>: Safety Glasses; footwear with adequate Lug and ankle support; leather/canvas work gloves. **<u>Optional items</u>**: High visibility vests are recommended for these activities in high traffic areas. **Emergency Equipment** - First Aid Kit - Fire Extinguisher - Map to Hospital - Emergency Contact List	Inspect PPE to insure it is in adequate condition	All personnel • Site Specific Training – All personnel shall be instructed and attest to the review and understanding of this SSHP prior to the commencement of on-site activity. • Periodically, Tailgate Training Sessions will be conducted to review activities in progress, results of site surveys, and upcoming tasks. It is recommended that AHAs be reviewed prior to conducting the identified task. • Complete a Medical Data Sheet Survey License and/or Certification Proof **Decontamination Procedures:** Not required. Good personal hygiene practices are to be employed prior to breaks lunch or other period when hand to mouth contact occurs. This will minimize potential ingestion exposures. **Inclement Weather** – Use the 30/30 Rule – If there is 30 seconds or less between thunder and lightning go inside for 30 minutes or more since the last thunder.

All persons working within the operational will sign this AHA indicating that they have reviewed the document and are aware of their responsibilities as stated in the AHA.

Name (Printed)	Signature	Occupation	Date Reviewed/Training

ATTACHMENT V

NIOSH ANALYTICAL METHOD #7500

TETRA TECH NUS, INC.
AIR SAMPLE LOG SHEET

Project Name: NSA Crane, Crane, Indiana **Project Number:** 112G

Sample Date: _____/_____/_____ **Sampler:**

Instrument Type: HazDust IV **ID No.**

Tetra Tech Sample No.: **Client Sample No.:**

Analytical Method No.: NIOSH #7500 **Analytical Technique:**

Analyte(s):

TLV of Single Compound: 0.025mg/m3 **TLV of Mixture:** NA

Sample Media: PVC filter (Tubes) (Cassettes) XXX

Average Flow Rate **Average Flow Rate**

Before Sampling: 1.7 L/min Nylon cyclone; 2.2L/min aluminum cyclone After Sampling: l/min.

Average Flow Rate over Sampling Period: ml/min.

Pump Status Checked at: NA

Sample Type: (TWA) XXX (STEL)

Time On: **Time Off:** **Total Time:** **Air Volume (L)Sampled:**

Worker or Area Sampled: Social Security No.:

Plant Location or Process: Air Rotary Drill rig operation; silica dust

Job Description: Driller – High risk classification; will represent all categories – Driller helper, sample team, supervisory personnel

Filter Cassettes/Tubes Labeled and Sealed: Yes No N/A (Circle One)

Storage/Handling/Transportation Replace and secure cassette caps; ziplock bags; Chain of Custody sample ID and volume pumped; custody seals; shipped to Industrial Hygiene laboratory for analysis

Comments:

PRE AND POST PUMP CALIBRATION DATA
ELECTRONIC PRIMARY FLOW CALIBRATION

Calibrator Type: NA Serial Number: Primary Calibration Date:

Date	Media	Flow Cell Volume	Flow Rate 1	Flow Rate 2	Flow Rate 3	Avg. Flow	Initials.

PRE AND POST PUMP CALIBRATION DATA
DIGITAL STOP WATCH AND BUBBLE TUBE

Date	Media	(ml) Volume	Time 1	Time 2	Time 3	Avg. Time	Avg. Flow	Initials

SILICA, CRYSTALLINE, by XRD (filter redeposition) 7500

SiO_2 MW: 60.08 CAS: 14808-60-7 (quartz) RTECS: VV7330000 (quartz)
14464-46-1 (cristobalite) VV7325000 (cristobalite)
15468-32-3 (tridymite) VV7335000 (tridymite)

METHOD: 7500, Issue 4 **EVALUATION: FULL** **Issue 1: 15 August 1990**
Issue 4: 15 March 2003

OSHA : quartz (respirable) 10 mg/m³/(%SiO_2+2); cristobalite and tridymite (respirable) ½ the above
NIOSH: 0.05 mg/m³; carcinogen
ACGIH: quartz (respirable) 0.1 mg/m³
cristobalite (respirable) 0.05 mg/m³
tridymite (respirable) 0.05 mg/m³

PROPERTIES: solid; d 2.65 g/cm³ @ 0 °C; crystalline transformations: quartz to tridymite @ 867 °C; tridymite to cristobalite @ 1470 °C; α-quartz to ß-quartz @ 573 °C

SYNONYMS: free crystalline silica; silicon dioxide

SAMPLING

SAMPLER: CYCLONE + FILTER (10-mm nylon cyclone, Higgins-Dewell (HD) cyclone, or aluminum cyclone + 5-µm PVC membrane) *see sampling section

FLOW RATE: Nylon cyclone: 1.7 L/min; HD cyclone: 2.2 L/min; aluminum cyclone: 2.5 L/min

VOL-MIN: 400 L
-MAX: 1000 L

SHIPMENT: Routine

SAMPLE STABILITY: Stable

BLANKS: 2 to 10 per set (see step 13.g.)

BULK SAMPLE: High-volume or settled dust; to identify interferences

ACCURACY

RANGE STUDIED: 25 to 2500 µg/m³ [1] (800-L sample)

BIAS: None known

OVERALL PRECISION ($\hat{S}_{rT}$): 0.09 (50 to 200 µg) [1]

ACCURACY: ± 18%

MEASUREMENT

TECHNIQUE: X-RAY POWDER DIFFRACTION

ANALYTE: Crystalline SiO_2

ASH: Muffle furnace or RF plasma asher or dissolve in tetrahydrofuran

REDEPOSIT: On 0.45-µm Ag membrane filter

XRD: Cu target X-ray tube, graphite monochromator
Optimize for intensity; 1° slit
Slow step scan, 0.02°/10 sec
Integrated intensity with background subtraction

CALIBRATION: NIST SRM 1878a quartz, NIST SRM 1879a cristobalite, USGS 210-75-0043 tridymite suspensions in 2-propanol.

RANGE: 0.02 to 2 mg SiO_2 per sample [2]

ESTIMATED LOD: 0.005 mg SiO_2 per sample [2]

PRECISION ($\bar{S}_r$): 0.08 @ 0.05 to 0.2 mg per sample [1]

APPLICABILITY: The working range is 0.025 to 2.5 mg/m³ for an 800-L air sample.

INTERFERENCES: Micas, potash, feldspars, zircon, graphite, and aluminosilicates. See APPENDIX.

OTHER METHODS: This is similar to the method in the Criteria Document [3] and P&CAM 259 [4] which has been collaboratively tested [1]. This method is similar, except for sample collection, to S315 [5,6]. Method P&CAM 109 [7,8,9], which incorporates an internal standard, has been dropped. XRD can distinguish the three silica polymorphs and silica interferences can be eliminated by phosphoric acid treatment. IR (methods 7602 and 7603) can also quantify quartz, cristobalite and tridymite if amorphorous silica and silicates are not present in large amounts. However sensitivity is reduced if multiple polymorphs are present and secondary peaks must be used. Crystalline silica can also be determined by visible absorption spectrophotometry (e.g., Method 7601), but polymorphs can not be distinguished. Visible absorption methods also have larger laboratory-to-laboratory variabilty than XRD and IR methods and therefore are recommended for research use only [10].

REAGENTS:

1. Silica Standards.
   a. Quartz* (SRMs 1878a, 2950, 2951, 2958) and Cristobalite* (SRMs 1879a, 2960, 2957), available from Standard Reference Materials Program, Rm. 204, Bldg. 202, National Institute of Standards and Technology (NIST), Gaithersburg, MD 20899; www.nist.gov.
   b. Tridymite* (210-75-0043) available from U.S. Geological Survey, Box 25046, MS 973, Denver, CO 80225.
2. 2-Propanol*, reagent grade.
3. Desiccant.
4. Glue or tape for securing Ag filters to XRD holders.
5. Optional: tetrahydrofuran (THF)* (if LTA or muffle furnace are unavailable).
6. 1.5 % parlodion solution. (Dissolve 1.5 g of parlodion* in isopentyl acetate* and dilute to 100 mL with isopentyl acetate.)
7. Optional (if calcite present): 25% v/v concentrated hydrochloric acid* (ACS reagent grade) in distilled water and 25-mm filters of PVC or cellulose ester with pore size of 1 µm or less.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler:
   a. Filter: Polyvinyl chloride (PVC) filter, 37-mm, 5.0-µm pore size supported with backup pad in a two-piece, 37-mm cassette filter holder (preferably, conductive) held together by tape or cellulose shrink band.
      NOTE: Check each new lot of PVC filters by analyzing one or more by this method. For example, Gelman VM-1 filters (all lots) were found to be unacceptable because of high ash and background. If THF is used, check for complete dissolution by dissolving a blank PVC filter and following steps 5c through 8.
   b. Cyclone: 10-mm nylon, Higgins-Dewell (HD), Aluminum (Al), or equivalent [11].
2. Area air sampler: PVC membrane filter, 37-mm diameter, 5-µm pore size; three-piece filter cassette.
3. Sampling pumps with flexible connecting tubing, capable of the following flow rates: nylon cyclone, 1.7 L/min; HD cyclone, 2.2 L/min; Al cyclone, 2.5 L/min; and bulk sampler, 3 L/min.
4. Silver membrane filters, 25-mm diameter, 0.45-µm pore size, available from Sterlitech Corp., 22027 70th Ave S, Kent, WA 98032-1911; www.sterlitech.com.
5. X-ray powder diffractometer (XRD) equipped with copper target X-ray tube, graphite monochromator, and scintillation detector.
6. Reference specimen (mica, Arkansas stone, or other stable standard) for data normalization.
7. Low-temperature radio-frequency plasma asher (LTA) or muffle furnace, or ultrasonic bath ($\geq$150 W), for filter preparation.
8. Vacuum filtration assembly and side-arm vacuum flask with a 25-mm filter holder.
9. Sieve, 10-µm, for wet sieving.
10. Analytical balance (0.001 mg); magnetic stirrer with thermally insulated top; ultrasonic bath or probe; volumetric pipettes and flasks; Pyrex crucibles with covers (muffle furnace); 40-mL wide-mouth or 50-mL centrifuge tubes (THF method); desiccator; reagent bottles with ground glass stoppers; drying oven; polyethylene wash bottle.
11. Explosion-resistant hot plate.
12. Teflon sheet, 0.3 to 1 mm thick.

SPECIAL PRECAUTIONS: Avoid inhaling silica dust [3]. THF is extremely flammable and should be used in a fume hood. 2-Propanol, parlodion and isopentyl acetate are flammable. Hydrochloric acid is corrosive and should be used in a fume hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Sample at 1.7 ± 5% L/min with nylon cyclone or 2.2 ± 5% L/min with HD cyclone for a total sample size of 400 to 1000 L. Do not exceed 2 mg dust loading on the filter.
   NOTE 1: Do not allow the sampler assembly to be inverted at any time when using a cyclone. Turning the cyclone to anything other than a horizontal orientation may deposit oversized material from the cyclone body onto the filter.
   NOTE 2: A single sampler/flow rate should be used for a given application. Sampling for both crystalline silica and coal mine dust should be done in accordance with the ISO/CEN/ACGIH/ASTM respirable aerosol sampling convention. Flow rates of 1.7 L/min for the Dorr-Oliver nylon cyclone and 2.2 L/min for the Higgins-Dewell cyclone have been found to be optimal for this purpose. Outside of coal mine dust sampling, the regulatory agencies currently use these flow rates with the Dorr-Oliver cyclone in the United States and the Higgins-Dewell sampler in the United Kingdom. Though the sampling recommendations presented in a NIOSH Criteria Document have been formally accepted by MSHA for coal mine dust sampling, the Dorr-Oliver cyclone at 2.0 L/min with 1.38 conversion factor is currently used in the United States for the purpose of matching an earlier sampling convention [12]. In any case, a single sampler/flow rate should be used in any given application so as to eliminate bias introduced by differences between sampler types and sampler conventions [11].
3. Take an area air sample or collect a settled dust sample, if dust in the work environment has not been previously characterized.

SAMPLE PREPARATION:

4. Samples may be characterized by one of the following methods, as appropriate.
   a. **Interference check.** Prepare area dust sample or settled dust bulk sample for XRD analysis by mounting the collection sample directly on an XRD sample holder, or by depositing or redepositing the dust on another filter for mounting, or by packing an XRD powder holder. Proceed to step 11.
   b. **Qualitative Analysis.** Prepare the area air sample or settled dust sample for qualitative analysis by grinding and/or wet sieving to best match the airborne dust particle size. Wet sieve with a 10-µm sieve, 2-propanol, and an ultrasonic bath [13], followed by evaporation of excess alcohol, drying in an oven for 2 hours, and overnight storage in a desiccator. Deposit the end product on a filter (steps 7-8) or pack in a conventional XRD powder holder.
      NOTE 1: For quantitative determination of % SiO_2, weigh out, in triplicate, 2 mg sieved dust, transfer to a 50-mL beaker, add 10 mL 2-propanol, and continue with step 6.
      NOTE 2: In a bulk sample, if there is an interfering compound(s) that renders the identification and quantitation of quartz very difficult, the sample will need to be carefully treated in hot phosphoric acid [14] to dissolve the interfering compound(s) and avoid the loss of quartz. This treatment can be used to dissolve several 50-mg sample aliquots in order to concentrate the quartz content for the purpose of lowering the LOD.
5. Use one of the following methods to prepare filter samples and blanks:
   a. **Low Temperature Ashing:** Place the filters in 50-mL beakers within the low temperature asher so that the sample exposure to the plasma is optimized. Ash according to manufacturer's instructions. After ashing, carefully add 15 mL 2-propanol to each beaker; or
   b. **Muffle Furnace Ashing:**
      i. If the samples contain a significant amount of calcite (>20% of total dust loading), silica may be lost due to formation of $CaSiO_3$. Remove the calcite by the following procedure: Place a 0.5-µm, 25-mm PVC filter in the filtration apparatus and clamp the filter funnel over it. Remove the sample filter from the cassette, fold, and drop it on the 25-mm filter. Add 10 mL 25% v/v HCl and

5 mL 2-propanol to the filter funnel and allow to stand for 5 min. Apply vacuum and slowly aspirate the acid and alcohol in the funnel, washing with three successive 10-mL portions of distilled water. Release the vacuum. Carry both filters through the ashing step together.

ii. Place the filter samples in porcelain crucibles, loosely cover and ash in muffle furnace for 2 h at 600 °C (800 °C if graphite is present). Add several mL 2-propanol to the ash, scrape the crucible with a glass rod to loosen all particles and transfer the residue to a 50-mL beaker. Wash the crucible several more times and add wash to beaker. Add 2-propanol to the beaker to bring the volume to about 15 mL; or

c. **Filter Dissolution:** Using forceps and a spatula, remove the filter from the cassette, fold the filter three times, and place in the bottom of a 40- or 50-mL centrifuge tube. Add 10 mL THF and allow to stand for at least 5 min. Cap the centrifuge tube with aluminum foil to prevent contamination. Gently agitate the centrifuge tube by hand or with a vortex mixer making sure the THF does not go near the top of the tube. Place the tube in an ultrasonic bath (water level 2.5 cm from top) for at least 10 min. (The filter should be totally dissolved.) Just prior to filtering, agitate the sample for 10 to 20 sec on a vortex mixer. Continue with step 6, substituting THF for 2-propanol and centrifuge tube for beaker.

6. Cover the beaker with a watchglass and agitate in an ultrasonic bath for at least 3 min. Observe the suspension to make sure that the agglomerated particles are broken up. Wash the underside of the watchglass with 2-propanol, collecting the washings in the beaker.
7. Place a silver filter in the filtration apparatus. Attach the funnel securely over the entire filter circumference. With no vacuum, pour 2 to 3 mL 2-propanol onto the filter. Pour the sample suspension from the beaker into the funnel. After the transfer, rinse the beaker several times and add rinsings to the funnel for a total volume of 20 mL. In order to minimize feathering of the sample outside the deposition area, allow the suspension to settle for a few minutes prior to applying vacuum. Do not rinse the chimney after the material has been deposited on the silver filter. Rinsing the chimney can disturb the thin layer deposition.
8. Leave the vacuum on after filtration to produce a dry filter. Place 2 drops of 1.5% parlodion solution on a glass slide. Remove the silver filter with forceps and fix the material to the filter by placing the bottom side of the filter in the parlodion solution. Place the saturated filter on top of the Teflon sheet which has been heated on the hot plate at a low temperature setting. When thoroughly dry, mount the silver filter in the XRD sample holder.

CALIBRATION AND QUALITY CONTROL:

9. Prepare and analyze at least 6 levels of standard filters.

NOTE 1: Calibration standards are limited to NIST and USGS certified standards of known purity, particle size, and sample-to-sample homogeneity. At least 12 materials, including 5-µm Min-U-Sil, previously used by laboratories throughout the United States and Canada, have been evaluated, and none have been found to be acceptable alternatives to the certified standards cited within this method [10]. Standard reference materials should be corrected for phase purity.

NOTE 2: Crystalline silica methods require calibration standards of known purity, specific particle size and distribution, and sample-to-sample homogeneity. Establishing traceability of secondary calibration standards to the specified NIST and USGS primary standards requires the use of measurement methods with better precision and accuracy than the XRD, IR and visible absorption spectrophotometry methods commonly used in the industrial hygiene field can provide. In addition, particle size distribution measurements have considerable error. Therefore, the use of secondary calibration standards that are traceable to NIST and USGS certified standards is not appropriate.

NOTE 3: NIST SRM 2950 calibration set (α-quartz) and NIST SRM 2960 calibration set (cristobalite) may be useful for preparing working standards at known concentrations.

a. Prepare two suspensions of each analyte in 2-propanol by weighing 10 and 50 mg of the standard material to the nearest 0.01 mg. Quantitatively transfer each to a 1-L glass-stoppered bottle using 1.00 L of 2-propanol.

b. Suspend the powder in 2-propanol with an ultrasonic probe or bath for 20 min. Immediately move the bottle to a magnetic stirrer with thermally insulated top and add a stirring bar. Allow the solution to return to room temperature before withdrawing aliquots.

c. Mount a silver filter on the filtration apparatus. Place several mL of 2-propanol on the filter. Turn off the stirrer and shake vigorously by hand. Immediately remove the stopper and withdraw an aliquot from the center at half-height of the 10 mg/L or 50 mg/L suspension. Do not adjust the volume in the pipet by expelling part of the suspension. If more than the desired aliquot is withdrawn, discard the aliquot in a beaker, rinse and dry the pipet, and take a new aliquot. Transfer the aliquot from the pipet to the silver filter, keeping the tip of the pipet near the surface but not submerged in the delivered suspension.

d. Rinse the pipet with several mL 2-propanol, draining the rinse into the funnel. Repeat the rinse several times.

e. Allow the suspension to settle for a few minutes prior to applying vacuum. Apply vacuum and rapidly filter the suspension. Do not wash down the sides of the funnel after the deposit is in place since this will rearrange the material on the silver filter. Leave vacuum on until filter is dry. Place 2 drops of 1.5% parlodion solution on a glass slide. Remove the silver filter with forceps and fix the material to the filter by placing the bottom side of the filter in the parlodion solution. Place the saturated filter on top of the heated Teflon sheet. When thoroughly dry, mount the silver filter in the XRD sample holder. Prepare working standard filters, in triplicate, at e.g., 10, 20, 50, 100, 250, and 500 µg.

f. Analyze the working standards together with samples and blanks (step 12). The XRD intensities for the working standards (step 12.d) are designated I_x^o and are then normalized (step 12.e) to obtain $\hat{I}_x^o$. Correct the intensities of working standards >200 µg for matrix absorption (steps 12.f and 13).

g. Prepare a calibration graph ($\hat{I}_x^o$, vs µg of each standard).
NOTE: Poor repeatability (>10% above 0.04 mg silica) at any given level indicates that new standards should be made. The data should lie along a straight line. A weighted least squares ($1/\sigma^2$ weighting) is preferable.

h. Determine the slope, m, of the calibration graph in counts/µg. The intercept, b, on the abscissa should be within ± 5 µg of zero.
NOTE: A large intercept indicates an error in determining the background, i.e., an incorrect baseline or interference by another phase.

10. NOTE: The following procedure for absorption correction is not necessary in situations that have been previously documented as requiring no corrections.
Select six silver membrane filters as media blanks randomly from the same box of filters to be used for depositing the samples. These will be used to test for sample self-absorption. Mount each of the media blanks on the filtration apparatus and apply vacuum to draw 5 to 10 mL 2-propanol through the filter. Remove, let dry, and mount on XRD holders. Determine the net normalized count for the silver peak, $\hat{i}_{Ag}$, for each media blank (step 12.g). Obtain an average value for the six media blanks, $\hat{I}_{Ag}^o$.

NOTE: The analyst is a critical part of this analytical procedure [12]. A high level of analyst expertise is required to optimize instrument parameters and correct for matrix interferences either during the sample preparation phase or the data analysis and interpretation phase [15]. The analyst should have some training (university or short course) in mineralogy or crystallography in order to have a background in crystal structure, diffraction patterns and mineral transformation. In addition, an intensive short course in the fundamentals of X-ray diffraction can be useful.

MEASUREMENT:

11. Obtain a qualitative X-ray diffraction scan (e.g., 10 to 80 °2θ) of the area air sample (or bulk settled dust) to determine the presence of free silica polymorphs and interferences (see APPENDIX). The diffraction peaks are:

Mineral	Peak (2-Theta Degrees)		
	Primary	Secondary	Tertiary
Quartz	26.66	20.85	50.16
Cristobalite	21.93	36.11	31.46
Tridymite	21.62	20.50	23.28
Silver	38.12	44.28	77.47

NOTE: There is an alternative to scanning an area air sample, settled dust sample, or ground bulk sample to prove lack of contamination. A slow scan of the three main peaks of quartz (also cristobalite and tridymite if their absence has not been previously confirmed) on a personal air sample, with verification that their intensity ratios are within 15% of pure quartz, is sufficient evidence that other materials are not interfering in the silica determination.

12. Perform the following for each sample, working standard, and blank filter:
    a. Mount the reference specimen. Determine the net intensity, I_r, of the reference specimen before and after each filter is scanned. Use a diffraction peak of high intensity that can be rapidly but reproducibly (S_r <0.01) measured.
    b. Mount the sample, working standard, or blank filter. Measure the diffraction peak area for each silica polymorph. Scan times must be long, e.g., 15 min (longer scan times will lower the limit of detection).
    c. Measure the background on each side of the peak for one-half the time used for peak scanning. The sum of these two counts is the average background. Determine the position of the background for each sample.
    d. Calculate the net intensity, I_x, (the difference between the peak integrated count and the total background count).
    e. Calculate and record the normalized intensity, $\hat{I}_x$, for each peak:

$$\hat{I}_x = \frac{I_x}{I_r} \cdot N$$

NOTE: Select a convenient normalization scale factor, N, which is approximately equivalent to the net count for the reference specimen peak, and use this value of N for all analyses. Normalizing to the reference specimen intensity compensates for long-term drift in X-ray tube intensity. If intensity measurements are stable, the reference specimen may be run less frequently and the net intensities should be normalized to the most recently-measured reference intensity.

    f. Determine the normalized count, $\hat{I}_{Ag}$, of an interference-free silver peak on the sample filter following the same procedure. Use a short scan time for the silver peak (e.g., 5% of scan time for analyte peaks) throughout the method.
    g. Field blanks may be analyzed by scanning the 2-theta range used for the analyte and silver peaks to verify that contamination of the filters has not occurred. The analyte peak should be absent. The normalized intensity of the silver peak should match that of the media blank. Each laboratory should determine the specifics of field blank use for its application. When contamination does occur, the reason should be investigated and appropriate action taken. In practice, contamination of field blanks is extremely rare and usually is not consistent across filters. The analysis of blanks may be abbreviated if experience indicates that contamination is not likely with current field and laboratory operations; however, occasional confirmation of non-contamination is prudent.

CALCULATIONS:

13. Calculate the concentration of crystalline silica, C (mg/m^3), in the air volume sampled, V (L):

$$C = \frac{\hat{I}_x \cdot f(t) - b}{m \cdot V}, mg / m^3$$

$\hat{I}_x$ = normalized intensity for sample peak
b = intercept of calibration graph ($\hat{I}_x^o$ vs. µg)
m = slope of calibration graph, counts/µg
f(t) = $-R \ln T/(1 - T^R)$ = absorption correction factor (Table 1)

R = $\sin(\Theta_{Ag})/\sin(\Theta_x)$
T = $\hat{I}_{Ag}/(\text{average } \hat{I}^o_{Ag})$ = transmittance of sample
$\hat{I}_{Ag}$ = normalized silver peak intensity from sample
$\hat{I}^o_{Ag}$ = normalized silver peak intensity from media blanks (average of six values)

EVALUATION OF METHOD:

This method is based on P&CAM 259 which was collaboratively tested [1]. The testing included a ruggedization step to test the effects of the use of muffle furnace or plasma asher (but not the use of THF), shipment of samples, ashing time, and ultrasonication time. None of these factors was found to have an effect. The method was shown to have no bias when referenced to the Talvitie spectrophotometric method [14] and when all standards and samples were Min-U-Sil 5. The relative standard deviations (S_r) for intralaboratory, total measurement and overall (including sampling) variability are:

	Analyte Level (µg)	Measurement Precision (S_r)	Overall Precision (S_{rT})
Intralaboratory	50-200	0.08 [1]	
	20	0.20 [5]	
	10	0.28 [9]	
Total (intra- and interlaboratory)	50-200	0.17 [1]	0.29 [1]

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METHOD REVISED BY:

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APPENDIX: INTERFERENCES

Interferences include barite, micas (muscovite, biotite), potash, feldspars (microcline, plagioclase), montmorillonite, sillimanite, zircon, graphite, iron carbide, clinoferrosillite, wollastonite, sanidine, leucite, orthoclase, and lead sulfide.

The patterns for three forms of aluminum phosphate [JCPDS 10-423, 11-500, 20-44] are practically identical to those of quartz, cristobalite and tridymite, respectively. The quartz secondary and cristobalite primary peaks are close; cristobalite secondary peak is overlapped by a quartz peak; tridymite, if present in sufficient quantity, will interfere with all of the main (primary, secondary and tertiary) quartz and cristobalite peaks. Silver chloride, if present on the silver filter, interferes slightly with the primary quartz peak. Many of these interferences occur in the presence of quartz; however, in a study of samples collected in 11 different industries, Altree-Williams [20] found no significant interferences.

The presence of elements such as iron can result in appreciable X-ray fluorescence which leads to high background intensity. A diffracted-beam monochromator will minimize this problem.

If calcite is present, loss of quartz will occur when samples are ashed in a muffle furnace. See SAMPLE PREPARATION (step 5.b) for procedure to remove calcite.

If interferences with the primary silica peak are present, use a less sensitive peak. When overlaps are not severe, a smaller receiving slit or chromium radiation may be used; however, a new calibration curve will be necessary.

Table 1. Absorption correction factor as a function of transmittance for some silica-silver peak combinations [16-21].

		f(T) (at indicated degrees 2-θ)							
Transmittance	Silica	26.66	26.66	20.83	20.83	21.93	21.93	21.62	21.62
T	Silver	38.12	44.28	38.12	44.28	38.12	44.28	38.12	44.28
1.00		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.99		1.0071	1.0082	1.0091	1.0105	1.0087	1.0100	1.0088	1.0101
0.98		1.0144	1.0166	1.0184	1.0212	1.0174	1.0201	1.0177	1.0204
0.97		1.0217	1.0251	1.0278	1.0321	1.0264	1.0305	1.0268	1.0309
0.96		1.0292	1.0337	1.0373	1.0432	1.0355	1.0410	1.0360	1.0416
0.95		1.0368	1.0425	1.0470	1.0544	1.0447	1.0517	1.0453	1.0524
0.94		1.0445	1.0514	1.0569	1.0659	1.0541	1.0625	1.0548	1.0635
0.93		1.0523	1.0605	1.0670	1.0776	1.0636	1.0736	1.0645	1.0747
0.92		1.0602	1.0697	1.0772	1.0894	1.0733	1.0849	1.0743	1.0861
0.91		1.0683	1.0791	1.0876	1.1015	1.0831	1.0963	1.0844	1.0977
0.90		1.0765	1.0886	1.0982	1.1138	1.0932	1.1080	1.0945	1.1096
0.89		1.0848	1.0983	1.1089	1.1264	1.1034	1.1199	1.1049	1.1216
0.88		1.0933	1.1081	1.1199	1.1392	1.1137	1.1320	1.1154	1.1339
0.87		1.1019	1.1181	1.1311	1.1522	1.1243	1.1443	1.1261	1.1464
0.86		1.1106	1.1283	1.1424	1.1654	1.1350	1.1568	1.1370	1.1592
0.85		1.1195	1.1387	1.1540	1.1790	1.1460	1.1696	1.1481	1.1722
0.84		1.1286	1.1493	1.1657	1.1927	1.1571	1.1827	1.1595	1.1854
0.83		1.1378	1.1600	1.1777	1.2068	1.1685	1.1959	1.1710	1.1989
0.82		1.1471	1.1709	1.1899	1.2211	1.1800	1.2095	1.1827	1.2126
0.81		1.1566	1.1821	1.2024	1.2357	1.1918	1.2232	1.1946	1.2266
0.80		1.1663	1.1934	1.2150	1.2506	1.2038	1.2373	1.2068	1.2409
0.79		1.1762	1.2050	1.2280	1.2658	1.2160	1.2516	1.2192	1.2555
0.78		1.1863	1.2168	1.2411	1.2812	1.2284	1.2663	1.2319	1.2703
0.77		1.1965	1.2288	1.2546	1.2971	1.2411	1.2812	1.2447	1.2855
0.76		1.2069	1.2410	1.2683	1.3132	1.2540	1.2964	1.2579	1.3009
0.75		1.2175	1.2535	1.2822	1.3297	1.2672	1.3119	1.2713	1.3167
0.74		1.2283	1.2662	1.2965	1.3456	1.2806	1.3278	1.2849	1.3328
0.73		1.2394	1.2792	1.3110	1.3637	1.2944	1.3440	1.2989	1.3493
0.72		1.2506	1.2924	1.3259	1.3812	1.3084	1.3605	1.3131	1.3661
0.71		1.2621	1.3059	1.3410	1.3991	1.3226	1.3774	1.3276	1.3883
0.70		1.2738	1.3197	1.3565	1.4174	1.3372	1.3946	1.3424	1.4008
0.69		1.2857	1.3337	1.3723	1.4362	1.3521	1.4122	1.3576	1.4187
0.68		1.2979	1.3481	1.3885	1.4553	1.3673	1.4303	1.3730	1.4370
0.67		1.3103	1.3682	1.4050	1.4749	1.3829	1.4487	1.3888	1.4558
0.66		1.3230	1.3777	1.4218	1.4949	1.3987	1.4675	1.4050	1.4749
0.65		1.3359	1.3931	1.4390	1.5154	1.4150	1.4868	1.4215	1.4945
0.64		1.3491	1.4087	1.4567	1.5363	1.4316	1.5064	1.4383	1.5145
0.63		1.3626	1.4247	1.4747	1.5578	1.4485	1.5266	1.4556	1.5350
0.62		1.3765	1.4411	1.4931	1.5797	1.4659	1.5472	1.4732	1.5560
0.61		1.3906	1.4578	1.5120	1.6022	1.4836	1.5684	1.4913	1.5775
0.60		1.4050	1.4749	1.5314	1.6252	1.5018	1.5900	1.5098	1.5995
0.59		1.4198	1.4925	1.5511	1.6488	1.5204	1.6122	1.5287	1.6221
0.58		1.4349	1.5104	1.5714	1.6730	1.5394	1.6349	1.5481	1.6452
0.57		1.4504	1.5288	1.5922	1.6978	1.5590	1.6582	1.5679	1.6689
0.56		1.4662	1.5476	1.6135	1.7233	1.5790	1.6820	1.5883	1.6932
0.55		1.4824	1.5670	1.6353	1.7494	1.5995	1.7065	1.6092	1.7181
0.54		1.4991	1.6858	1.6577	1.7762	1.6205	1.7317	1.6306	1.7437
0.53		1.5161	1.6071	1.6807	1.8037	1.6421	1.7575	1.6525	1.7699
0.52		1.5336	1.6279	1.7043	1.8319	1.6642	1.7840	1.6751	1.7969
0.51		1.5515	1.6493	1.7285	1.8609	1.6870	1.8112	1.6982	1.8246
0.50		1.5699	1.6713	1.7534	1.8908	1.7103	1.8391	1.7220	1.8531

ATTACHMENT VI

OSHA POSTER

Job Safety and Health

It's the law!

OSHA

Occupational Safety and Health Administration
U.S. Department of Labor

EMPLOYEES:

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in that inspection.
- You can file a complaint with OSHA within 30 days of retaliation or discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have the right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violations.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records and records of your exposures to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.
- You must comply with all occupational safety and health standards issued under the *OSH Act* that apply to your own actions and conduct on the job.

EMPLOYERS:

- You must furnish your employees a place of employment free from recognized hazards.
- You must comply with the occupational safety and health standards issued under the *OSH Act*.

This free poster available from OSHA –
The Best Resource for Safety and Health

Free assistance in identifying and correcting hazards or complying with standards is available to employers, without citation or penalty, through OSHA-supported consultation programs in each state.

1-800-321-OSHA
www.osha.gov

OSHA 3165-12-06R