National Grid

# Pre-Design Investigation Work Plan

## North Albany Former MGP Site

## Albany, New York

## NYSDEC Site #401040

January 2026

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**North Albany Former MGP Site**

**Albany, New York**

**NYSDEC Site #401040**

January 2026

**Prepared By:**
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**Prepared For:**
National Grid

**Our Ref: 30003953**

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# Certification

I, John C. Brussel, P.E., as a Professional Engineer registered in the State of New York, to the best of my knowledge, and based on my inquiry of the persons involved in preparing this document under my direction, certify that this *Pre-Design Investigation Work Plan* for National Grid – North Albany former manufactured gas plant site in Albany, New York was completed in general accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).




John C. Brussel 1/29/26

John C. Brussel, P.E.
NYS PE License No. 075208

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# 1 Introduction

This pre-design investigation (PDI) work plan provides details for utility daylighting and surveying to be performed in support of the remedial designs for the final remedy that will be implemented in phases at National Grid's North Albany former manufactured gas plant (MGP) site (New York State Department of Environmental Conservation [NYSDEC] Site No. 401040). The remedy includes passive non-aqueous phase liquid (NAPL) barrier walls, NAPL recovery wells, soil excavation, in-situ soil solidification (ISS), a soil cover system, and institutional controls to address coal tar, purifier waste, and other residuals from the former MGP, located in the subsurface. The site location is shown on Figure 1.

Background information is presented below, followed by an overview of the proposed PDI work, description of the investigation report, and the anticipated schedule.

# 2 Background Information

Several subsurface utilities have been mapped within or adjacent to the remedial limits, but the burial depth, conduit/cable size, construction material, status (active or abandoned), and/or condition of certain gas mains or electric and communications cables is unknown. The utility locations, as currently shown on mapping, have been identified based on historical utility drawings, site reconnaissance, and previous geophysical survey work, but they have not been confirmed by direct observation (daylighting). The remedial contractors will need to work around, protect, and support the subsurface utilities that cannot be taken out of service, during the remedial construction.

Several overhead electric lines and utility poles are present in the vicinity of the proposed western passive NAPL barrier wall that will be constructed as part of the first phase of the final remedy. The heights of the overhead electric lines have not yet been measured. Construction equipment working beneath energized overhead electric lines will need to maintain minimum approach distances consistent with Occupational Safety and Health Administration (OSHA) regulations, for those lines that cannot be temporarily taken out of service/relocated.

# 3 Proposed PDI Field Activities

Soft-dig will be performed at up to 22 locations to uncover existing subsurface natural gas mains and electric and fiber optic cables, to confirm the subsurface utility location, burial depth, diameter, and construction material for these utilities. The proposed soft-dig locations are shown on Figure 2. These locations are subject to change in the field, based on the field preparation work outlined below and field conditions. An Arcadis of New York, Inc. (Arcadis) subcontractor (Parratt-Wolff, Inc. of East Syracuse, New York) will perform the soft-dig work using a vacuum truck and hand tools. An Arcadis field representative will oversee and document the soft-dig work by Parratt-Wolff and perform community air monitoring. As shown on Figure 2, each soft-dig location is within paved areas accessible to a vacuum truck. Details of the soft-dig and related survey activities are presented in the subsections below.

## 3.1 PDI Preparation

The following activities will be completed in preparation for the soft-dig work:

- Parratt Wolff will notify UDig NY, Inc., at least 3 business days before the start of work to comply with and complete the one-call process.
- National Grid will locate and mark underground electric, gas, water, and communications lines that extend through the proposed passive NAPL barrier wall and proposed ISS area shown on Figure 2.
- Arcadis and its survey subcontractor (Thew Associates of Marcy, New York) will field mark the location and ground surface elevation at the proposed 22 soft dig locations (i.e., the surveyor will identify the subsurface utility locations in the field based on coordinates from mapping provided by Arcadis and field observations from the mark-outs completed by National Grid). The soft-dig locations will be marked using white paint and/or survey nails with flagging. While Thew Associates is onsite, they will survey the utility pole locations and overhead electric line heights in the proposed western passive NAPL barrier wall construction area (approximately 18 locations, as shown on Figure 3).
- Parratt-Wolff will saw-cut the asphalt pavement at each proposed vacuum boring location to provide clean edges for subsequent restoration.

## 3.2 Soft-Dig Plan

At each proposed soft-dig location, Parratt-Wolff will use its vacuum truck and/or hand tools to excavate a boring at least 6 inches in diameter or a trench (as directed by National Grid/Arcadis) to uncover the underground utilities and obtain the construction information identified above. The subsurface utilities are anticipated to be encountered from 2 to 7 feet below ground surface (bgs). The vacuum boring depths will be determined in the field based on conditions and observations by National Grid, Arcadis, and the NYSDEC. Dry methods (e.g., air knife without water) are anticipated to be used to complete the 22 vacuum borings. We have assumed that groundwater will not be encountered in the vacuum borings.

The proposed soft-dig/vacuum boring IDs, locations, and anticipated depths are summarized in the table below.

| Vacuum Boring ID | Vacuum Boring Location | Anticipated Boring Depth (feet bgs) |
|---|---|---|
| VB-101 through VB-113 | Natural gas main alignments adjacent to or within the proposed western passive NAPL barrier wall alignment and excavation/ISS limits | 2 to 7 |
| VB-114 through VB-120 | Electric line alignments along or adjacent to the proposed western passive NAPL barrier wall alignment | 2 to 3 |
| VB-121 and VB-122 | Fiber optic line alignment within the proposed excavation limits | 2 to 3 |

Daylighting of additional subsurface utilities within or adjacent to the remedial limits is not proposed because sufficient information already exists for design purposes (e.g., the water main extending from Building 2 to the Fleet Building was uncovered to repair a break in May 2020, as summarized in a May 14, 2020 e-mail from Arcadis to the NYSDEC).

## 3.3 Boring Restoration

The vacuum borings will be backfilled with crushed stone to within 6 inches of the ground surface. In addition, for each vacuum boring that uncovers a gas main, the boring will be backfilled with sand placed below and around the main and extending to 1 foot above the main (the remainder of the boring will be backfilled with crushed stone to within 6 inches of the ground surface). After the crushed stone is placed at all locations, the ground surface will be restored with a minimum 6-inch thick concrete tinted black to match surrounding grade. The proposed sand and crushed stone will be supplied in bags commercially available to the public (e.g., from a local home improvement store such as Home Depot, Lowes). No sampling of the fill material is proposed, but a Request to Import form will be submitted to the NYSDEC (if requested).

Following restoration, the final location and ground surface elevation of each vacuum boring location will be surveyed to document any changes to locations from the work plan.

## 3.4 Equipment Decontamination and Waste Management

The vacuum truck and ground intrusive equipment will be decontaminated at the completion of work (and in-between vacuum boring locations, as needed) before demobilization. The vacuum truck and equipment will be decontaminated by brushing off adhered soil/debris over a decontamination pad and then hand washing and/or steam-cleaning with a non-phosphate detergent (e.g., Alconox) and clean water rinse, with water collected in a decontamination pad.

Investigation derived waste (IDW) will be transferred into new steel 55-gallon open-top Department of Transportation approved drums. IDW will be characterized for subsequent offsite treatment/disposal by National Grid's waste disposal vendor. Based on previous investigation activities, it is anticipated that solid waste will be transported to Clean Earth in Fort Edward, New York for disposal and liquid waste will be transported to Reworld in Oriskany, New York for treatment. Final waste disposal/treatment facilities will be based on waste characterization analytical results.

## 3.5 Community Air Monitoring

Community air monitoring will be performed by Arcadis during ground intrusive work in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan included in Appendix 1A to the NYSDEC's Program Policy Document titled, DER-10 / Technical Guidance for Site Investigation and Remediation, dated May 3, 2010 (Appendix A). This will involve monitoring for volatile organic vapors and particulates at one upwind and one downwind monitoring station. The air monitoring stations will be adjusted in the morning and afternoon, as needed, based on changes in prevailing wind direction. The monitoring equipment will calculate and record 15-minute running average concentrations. If a community air monitoring action level is exceeded, the NYSDEC will be notified within one business day. The notification will identify the activities that were taking place, the suspected cause of the exceedance, and corrective actions taken in response.

It is not anticipated that vapors/odors will be encountered during field work, due to the small size and shallow depth of the soil borings (impacts at the site are anticipated to be deeper, below the depth of the utilities). If vapor/odors are encountered and become a nuisance/issue, the Contractor will cover the vacuum boring and a vapor suppressant foam will be brought onsite and used, as needed.

## 3.6 Safety

Parratt-Wolff will install barriers (e.g., orange cones/cone bars, delineator posts/bars, barrels) to delineate the work zone, as the work will be completed in an active parking lot/driveways. Standard personal protective equipment (hard hat, safety glasses, hearing protection, reflective vest, and steel-toe boots) will be required for this work, as outlined in the Health and Safety Plan (Appendix B). Ground intrusive work will be implemented by a work crew with 40-hour OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training, including 8-hour annual refresher course updates, and medical clearance in accordance with Title 29 of the Code of Federal Regulations Part 1910.120.

# 4 PDI Documentation/Investigation Report

Arcadis will take photographs and prepare boring logs to document the soil recovered at each sampling location and the presence or absence of coal tar dense non-aqueous phase liquid (DNAPL) or obvious odors.

Daily progress reports will be prepared and submitted via e-mail to the NYSDEC and NYSDOH project managers during field work, within two business days. The daily reports will provide the following:

- A summary of the work completed.
- Overview of community air monitoring data and air monitoring exceedances and corrective actions (if any).
- Description of problems encountered or anticipated delays.
- Planned work activities for the following day.
- Photos of onsite work activities.
- A figure(s) showing work zones, community air monitoring station locations, and wind direction.
- Electronic attachment presenting the vapor and particulate data from each air monitoring station.

In addition, Arcadis will prepare a comprehensive PDI report summarizing the fieldwork and findings. The report will be supported by the following:

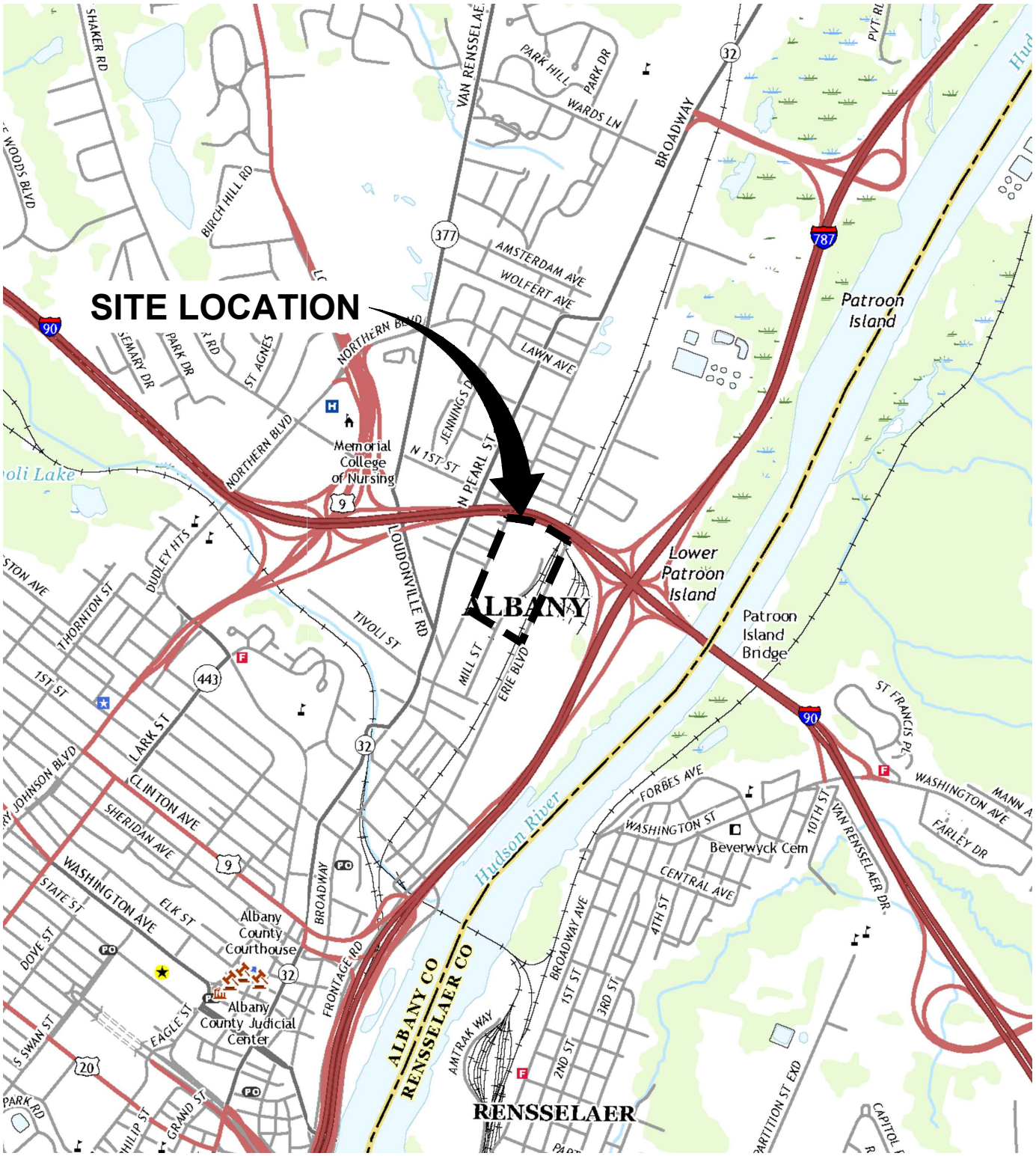
- Figures showing the site location, site layout, and PDI investigation area with soil boring locations.
- Soil boring logs.
- Waste disposal manifests.

The PDI report will be submitted to the NYSDEC for review/approval.

# 5 Schedule

The PDI work is scheduled to begin during the week of March 30, 2026 and anticipated to take one week to complete. The schedule for the fieldwork is subject to change based on weather conditions (e.g., heavy rain, snow) or unexpected field conditions during the vacuum excavation. The NYSDEC will be notified via e-mail a minimum of seven days prior to mobilizing for field work. We anticipate sending the investigation summary letter report to the NYSDEC within approximately four to five weeks following receipt of waste characterization laboratory analytical results (by end of May 2026).

# Figures




REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., ALBANY & TROY SOUTH, NY, 2019.

0 2000' 4000'

Approximate Scale: 1 in. = 2000 ft.




NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK

# SITE LOCATION MAP

ARCADIS

FIGURE 1

C:\Users\bdeclercq\DC\ACCDocs\Arcadis ACC USAUS-99999999-NATL GRID_N ALBANY FORMER MGP_ALBANY_NY\Project Files\10_WIP\10T_ARC_ENV\2024\01-DWG\N_ALB_Fig 1_Site Location Map.dwg SAVED: 3/13/2024 9:48 AM BY: DECLERCQ, BRIAN

XREFS:
IMAGES:
Arcadis Logo.png
NY_Albany_20190919_TM_geo.png
NY_Troy_South_20190919_TM_geo.png

RTE. 90 (EASTBOUND)

GENESEE ST.

MOHAWK ST

BROADWAY

GRAVEL

GENESEE STREET SUBSTATION

ASHER COOLER

250,000 C.F. RELIEF GAS HOLDER

CRUSHED STONE

EDUCATIONAL BLDG.

BOOSTER ROOM

GAS PUMP HOUSE

2,000,000 C.F. GAS HOLDER (CIRCA 1907)

GAS HOLDER

GAS HOLDER

BLOCK BIN

GARAGE

BARRELS

WAGON SHED

GENERATOR HOUSE

COAL HOUSE

PASSAGE

PAVEMENT

DYNAMO ROOM

BOILERS

WATER GAS

TAR PIT

MACHINE SHOP

CARRIAGE STORAGE

FLEET BUILDING

PURIFIER TYP. (TYP)

LIME HOUSE

OXIDE HOUSE

PURIFYING HOUSE

TAR TANK

METER HOUSE

BUILDING #2

16-INCH CARBON STEEL 24 PSI

12-INCH BLACK STEEL 99 PSI

4-INCH CARBON STEEL 24 PSI

VB-101

VB-102

VB-103

VB-104

VB-105

VB-106

VB-107

VB-108

VB-109

VB-110

VB-111

VB-112

VB-113

VB-114

VB-115

VB-116

VB-117

VB-118

VB-119

VB-120

VB-121

VB-122

TRUE NORTH

PLANT NORTH

**LEGEND:**

- PROPOSED PASSIVE NAPL BARRIER WALL ALIGNMENT
- PROPOSED SOIL EXCAVATION AREA
- PROPOSED IN-SITU SOIL SOLIDIFICATION LIMITS
- VB-101 PROPOSED NATURAL GAS MAIN VACUUM LOCATION
- VB-114 PROPOSED ELECTRIC LINE VACUUM LOCATION
- VB-121 PROPOSED FIBER OPTIC LINE VACUUM LOCATION
- FORMER MGP STRUCTURES
- FORMER RAILROAD
- OH — OVERHEAD WIRES
- E — UNDERGROUND ELECTRIC LINE
- E — UNDERGROUND ELECTRIC LINE (ABANDONED)
- W — UNDERGROUND WATER MAIN
- S — UNDERGROUND SANITARY SEWER MAIN
- D — UNDERGROUND STORM SEWER MAIN
- ? — UNDERGROUND UNKNOWN UTILITY
- G — UNDERGROUND NATURAL GAS MAIN
- G — UNDERGROUND ABANDONED NATURAL GAS MAIN (APPROXIMATE)
- // — // — ABOVE GRADE CONDUIT
- UTILITY POLE WITH LIGHT
- E — ELECTRIC MANHOLE
- CATCH BASIN
- D — DRAINAGE MANHOLE
- GD — GAS DRIP
- GAS MARKER
- G — G — GAS VALVE
- GAS BLOW-OFF PIPE
- GT — GAS TEST

0 30' 60'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK

# PROPOSED SOFT DIG LOCATIONS

ARCADIS

FIGURE 2

C:\Users\bdeclerq\DC\ACCDocs\Arcadis ACC US\AUS-99999999-NATL GRID_N ALBANY FORMER MGP_ALBANY_NY\Project Files\10_WIP\10T_ARC_ENV\2026\01-DWG\N Alb_Fig 2_Proposed Soft Dig Locations.dwg SAVED: 1/8/2026 5:04 PM BY: DECLERCQ, BRIAN

XREFS:
X_Remedial Design_Base
X_Former MGP Structures
X_Remedial Design_Utilities
N_ALB_Fig_Title Block

IMAGES:
Arcadis Logo.png

RTE. 90 (EASTBOUND)

GENESEE ST.

MOHAWK ST

BROADWAY

GENESEE STREET SUBSTATION

250,000 C.F. RELIEF GAS HOLDER

CRUSHED STONE

GRAVEL

BLOCK BIN

GARAGE

BARRELS

WAGON SHED

WASHER COOLER

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12-INCH BLACK STEEL 99 PSI

GENERATOR HOUSE

COAL HOUSE

PASSAGE

PAVEMENT

BOOSTER ROOM

EDUCATIONAL BLDG.

GAS PUMP HOUSE

DYNAMO ROOM

BOILERS

WATER GAS

TAR PIT

MACHINE SHOP

4-INCH CARBON STEEL 24 PSI

PURIFIER TANK (TYP)

2,000,000 C.F. GAS HOLDER (CIRCA 1907)

GAS HOLDER

GAS HOLDER

PURIFYING HOUSE

LIME HOUSE

OIL PUMP HOUSE

OXIDE HOUSE

TAR TANK

METER HOUSE

MW-20D

MW-2

MW-3

MW-26D

MW-26S

STOP

TRUE NORTH

PLANT NORTH

**LEGEND:**

- PROPOSED PASSIVE NAPL BARRIER WALL ALIGNMENT
- OVERHEAD ELECTRIC LINE/UTILITY POLE TO BE SURVEYED
- PROPOSED OVERHEAD ELECTRIC LINE/UTILITY POLE SURVEY LOCATION
- FORMER MGP STRUCTURES
- FORMER RAILROAD
- OH — OVERHEAD WIRES
- E — UNDERGROUND ELECTRIC LINE
- E — UNDERGROUND ELECTRIC LINE (ABANDONED)
- W — UNDERGROUND WATER MAIN
- S — UNDERGROUND SANITARY SEWER MAIN
- D — UNDERGROUND STORM SEWER MAIN
- ? — UNDERGROUND UNKNOWN UTILITY
- G — UNDERGROUND NATURAL GAS MAIN
- G — UNDERGROUND ABANDONED NATURAL GAS MAIN (APPROXIMATE)
- // — // — ABOVE GRADE CONDUIT
- UTILITY POLE WITH LIGHT
- (E) ELECTRIC MANHOLE
- CATCH BASIN
- (D) DRAINAGE MANHOLE
- GD GAS DRIP
- GAS MARKER
- G-G GAS VALVE
- GAS BLOW-OFF PIPE
- GT GAS TEST

0 20' 40'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK

# PROPOSED LOCATIONS OF OVERHEAD ELECTRIC LINES AND POLES TO SURVEY

ARCADIS

FIGURE 3

C:\Users\bdeclercq\DC\ACCDocs\Arcadis ACC US\AUS-99999999-NATL GRID_N ALBANY FORMER MGP_ALBANY_NY\Project Files\10_WIP\10T_ARC_ENV\2026\01-DWGIN Alb_Fig 3_OH Wires and Poles to Survey.dwg SAVED: 1/7/2026 2:40 PM BY: DECLERCQ, BRIAN

XREFS:
X_Remedial Design_Base
X_Former MGP Structures
X_Remedial Design_Utilities
N_ALB_Fig_Title Block

IMAGES:
Arcadis Logo.png

# Appendix A

## Generic Community Air Monitoring Plan (NYSDEC 2010)

## Appendix 1A
## New York State Department of Health
## Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

**Continuous monitoring** will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

**Periodic monitoring** for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. APeriodic@ monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/$m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/$m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/$m^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/$m^3$ of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Note:
CAMP exceedances and associated corrective measures shall be reported to the DEC and NYSDOH within 1 business day.

# Appendix B

## Health and Safety Plan (Arcadis 2025)

# Site Specific Health and Safety Plan

Template Revision: 21

| | |
|---|---|
| Project Name: | North Albany Service Center |
| Project Number: | 30003953.00011 |
| Client Name: | National Grid |
| Date: | 12/6/2024 |
| HASP Expires | 12/6/2025 |
| Revision: | 2/20/2025 |

Approvals:

HASP Developer: Matthew Hysell

Project Manager: John Brussel

HASP Reviewer: Elizabeth Hover

HASP Reviewer Name Typed



HASP Reviewer Signature (handwritten or digital signature)

**Arcadis Culture of Caring**

Arcadis is committed to a Culture of Caring that ensures each Arcadis employee, part time as needed employee (PTAN), temporary agency employee under Arcadis day to day control, Inexperienced Workers and contractor (cumulatively referred to here as "field staff") goes home at the end of the day free from injury or illness. I certify that the following has been performed with all Arcadis field staff on this project either in person or virtually through Teams:

☐ Reviewed the HASP including a discussion of hazard identification and controls.

- ☐ If conducting activities deemed by Arcadis to be "High Risk", frontline management has reviewed applicable H&S standards (Job Safety Analysis [JSA] when authorized by H&S) for these activities with field staff.
- ☐ If permit to work is required, frontline management has reviewed the permit(s) with field staff.

☐ Reviewed proactive H&S engagement expectations/injury prevention actions.
☐ Reviewed Stop Work Authority.
☐ Reviewed the incident reporting process and expectations including when WorkCare should be contacted by staff (WorkCare incident intervention for all minor, non-emergency injuries) and that the WorkCare phone number is programmed into field team cell phone.
☐ For Inexperienced Workers, a mentor has been assigned for the new task being performed.

For short service employees (SSEs), PTANS* and temporary agency employees* :

☐ Provided coaching and mentoring on Arcadis H&S expectations during project work. Reviewed in detail specific hazards and controls and provided a resource who can be contacted if individual has questions regarding planned or unplanned work tasks.

Mentor/Resource # _____ _____
Name Phone Number

Signed:

_____ Select

* Upon hiring/contracting for the first time.

# Emergency Information

**Site Address:** 1125 Broadway,
Menands, NY 12204

**Emergency Phone Numbers:**

| | | |
|---|---|---|
| Emergency (fire, police, ambulance) | | 911 |
| Emergency (facility specific, if applicable): | | |
| Emergency Other (specify): | Local Police | 518-462-8013 |
| | Mohawk Ambulance | 518-434-4151 |
| | Local Fire Department | 518-447-7879 |
| Primary Client Contact: | Gerald Cummins | 315-428-6073 |
| WorkCare (non-life-threatening injury/illness): | | 1-888-449-7787 |
| Project H&S: | Matt Hysell | 315-671-9189 |
| Task Manager: | Matt Hysell | 315-671-9189 |
| Project Manager: | John Brussel | 315-671-9441 |
| H&S Specialist: | Alec MacAdam | 720-454-0948 |
| Area H&S Director: | Aaron Svitana | 925-360-2313 |

**Hospital Name and Address:** Albany Memorial Hospital
600 Northern Boulevard
Albany, NY 12204

| | |
|---|---|
| Hospital Phone Number: | 518-471-3221 |
| Emergency: | 518-471-3111 |

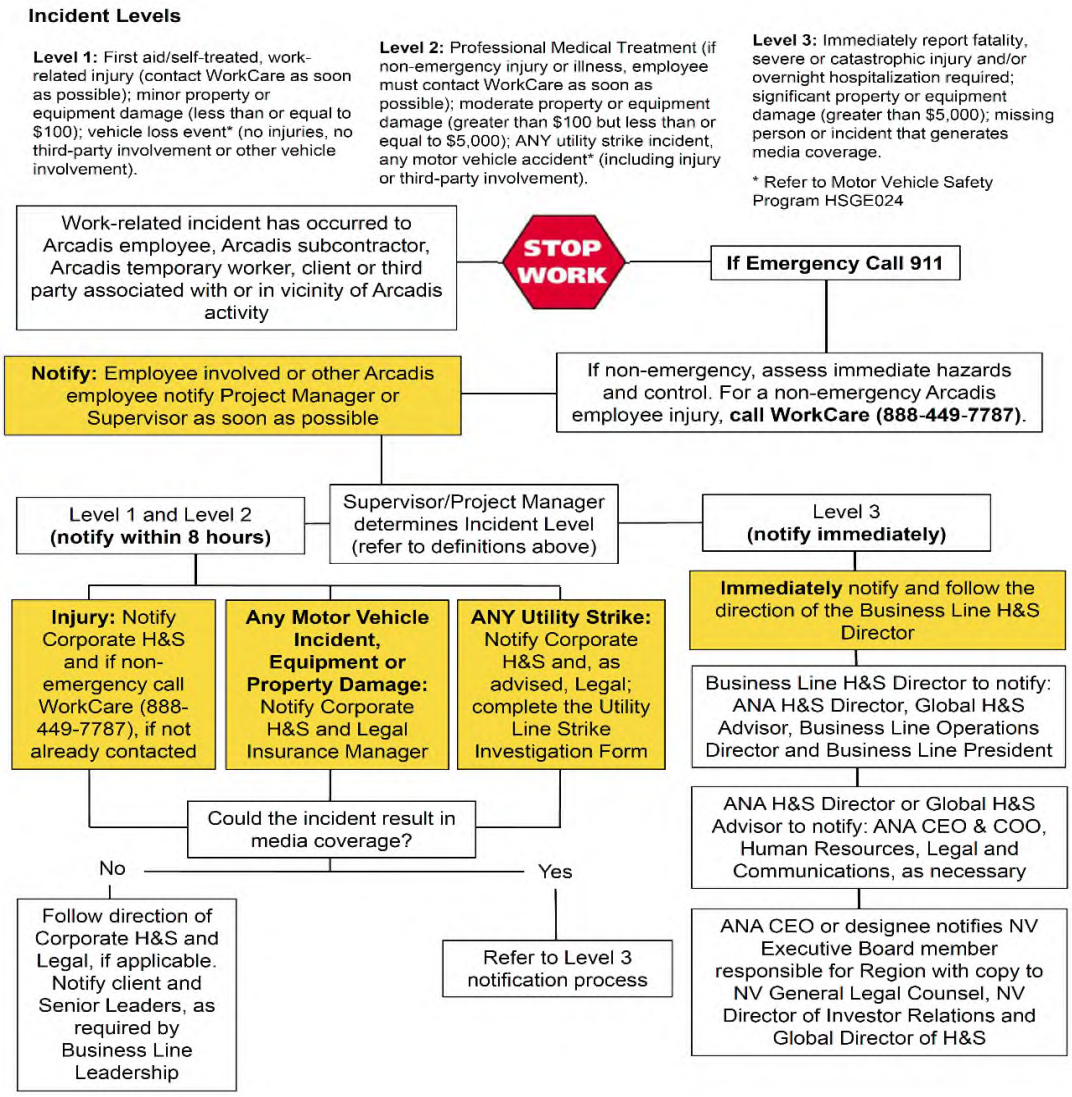
**Supplemental Client Contact Information:**

| | |
|---|---|
| Garry Cummins (National Grid SIR Project Mgr) | 315-440-5825 |
| Randy Hastings (National Grid Property Services Senior Supervisor | 518-937-5884 |
| Derek Lobban (National Grid Fleet Supervisor) | 518-416-8635 |
| Mathew Root (National Grid Sr. Project Engineer) | 518-227-7508 |
| Matt Bunal (NAAE Architectural Engineer) | 315-617-2879 |

**Other Important Phone Numbers:**

| | |
|---|---|
| Poison Control Center | 1-800-222-1222 |
| Nat. Response Ctr. (spills in reportable quantities) | 1-800-424-8802 |
| U.S. Coast Guard (spills to water) | 1-800-424-8802 |

## Incident Reporting Protocol Within Arcadis




## Client Incident Reporting Protocol

**Step 1:** Dial 911 (if necessary) and/or Work Care 800-455-6155
**Step 2:** Contact PIC/PM/TM
**Step 3:** Contact H&S
**Step 4:** Contact Client

**Route to the Hospital**




**1125 Broadway**
Menands, NY 12204

1. Head north toward Broadway — 387 ft
2. Turn left onto Broadway — 0.3 mi
3. Sharp right onto Loudonville Rd — 0.5 mi
4. Continue onto Shaker Rd — 0.1 mi

**Albany Mem Campus**
600 Northern Blvd, Albany, NY 12204

## Site Map Showing Assembly Areas



**Site Type**

The project site is an active facility with the following attributes:

| | |
|---|---|
| Utility | |
| Parking Lot/Private Drive (NON ROW) | |
| Railroad | |
| Commercial | |
| Roadway (public, including ROW) | |

For class I railroads, work within 25 ft of the rails is prohibited unless FRA On-Track Safety and railroad specific trained. For other railroads (i.e. short line railroads), the project or task manager will specify any special training needs. For all rail related work, field staff will have access to the Arcadis Railroad Safety Handbook and/or client rail safety handbook.Work in parking lots will require preparation of a Non-ROW Traffic Safety Plan. Work on roadways or in the right of way will require a ROW Traffic Safety Plan.

**Surrounding Land Use and Topography**

The North Albany Service Center serves as the primary maintenance, supply, storage, and office support facility for National Grid's (formerly Niagara Mohawk) eastern New York operating division. The North Albany Service Center is located on an approximately 25-acre parcel and is bordered by interstate 90 to the north, Bridge Street to the south, a CP Rail Systems, Inc. (CP Rail) railroad right-of-way to the east, and Broadway to the west. The Eric Canal was formerly located to the east of the railroad right-of-way that borders the site. The section of the canal east of the site was abandoned during the 1920s and was filled during the late 1920s/early 1930s.

**Simultaneous Operations (SimOps)**

SimOps is expected or will be conducted in proximity to Arcadis work activities on the project site. SimOps creates unique hazards that could affect Arcadis employees and subcontractors and SimOps hazards identified on site will be addressed in the JSA or similar governing document (i.e. permit) for affected Arcadis work tasks. If the SimOps work activities create a high hazard to Arcadis staff or subcontractors, Arcadis will utilize stop work until the SimOps activity is complete or will coordinate work activities with SimOps workers and/or client to ensure SimOps work hazards are mitigated.

**Site Background**

MGP operations were conducted at the property from the 1870s until the 1940s. MGP operations were primarily conducted in the portion of the property located north of the main service center building (Building 2). Electric/gas utility support services, which began in connection with MGP operation, continue to the present. The southern portion of the property was historically used for ice storage and distribution, lumber planning and milling, and petroleum distribution operations. During the period of industrial use, the property has been bordered to the west by Broadway and to the east by the railroad right-of-way. Historical site usage to the north and south of the current property includes transportation facilities (railway and streetcar), lumber planning and milling, chemical manufacturing, and rendering.

Previous site investigation activities have identified the presence of MGP-related materials (including oils, coal tar, tar-saturated wood chips, purifier waste, light non-aqueous phase liquid and dense nonaqueous phase liquid) and elevated concentrations of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and inorganic constituents in soil and groundwater. Benzene, ethylbenzene, toluene, and xylenes (BTEX) are the primary VOCs of concern, and polynuclear aromatic hydrocarbons are the primary SVOCs of concern. Polychlorinated biphenyls have also been detected in surface and shallow subsurface soil samples collected from the yard storage area in the southern portion of the service center (south of Building 2).

**Project Tasks**

The following tasks are identified for this project:

| | |
|---|---|
| 1 | Construction - Construction contractor oversight |
| 2 | Decontamination - Arcadis oversight of contractors performing decontamination |
| 3 | Drilling - Contractor oversight |
| 4 | Monitoring - Air monitoring using hand held or stationary equipment - non-radiation |
| 5 | Waste- Arcadis oversight of contractors performing IDW containment, segregation and/or sampling |
| 6 | Sampling - Well sampling using peristaltic pumps |
| 7 | Sampling - Free product - all media and all manual methods |
| 8 | Sampling - Soil sampling using mechanical methods |
| 9 | Sampling - Soil sampling using shovel, spade, spoon or trowel |
| 10 | Drilling - Using mechanical methods |
| 11 | Select |
| 12 | Select |
| 13 | Select |
| 14 | Select |
| 15 | Select |
| 16 | Select |
| 17 | Select |
| 18 | Select |
| 19 | Select |
| 20 | Select |

The following documents/plans/support associated with the above task(s) are attached or to be provided:

[X] Required Checklists/Work Forms

*Tailgate Safety Briefing Form*

*Vehicle Inspection Checklist*

[ ] Required Permits

*Not Applicable*

[ ] Required H&S Standards

*Not applicable*

**Short Service Employees (SSEs), Part Time As Needed Employees (PTANs) and Temporary Agency Employees**

SSEs (employees who are employed with Arcadis for less than 1 year or are Inexperienced Workers) have the potential to work on this project. If SSEs are utilized, the project team working in conjunction with the SSE's administrative supervisor will ensure requirements of ARC HSGE019 "Short Service Employees" are completed. SSE's will be identified on the project Tailgate Safety Meeting Form.

**Roles and Responsibilities**

| | Name | Role | Short Service Employee |
|---|---|---|---|
| 1 | John Brussel | Project Manager (PM) | No |
| 2 | Matt Hysell | Associate Project Manager (APM) | No |
| 3 | Matt Hysell | Task Manager | No |
| 4 | To Be Decided | Field Technical Lead | No |
| 5 | To Be Decided | Site Safety Officer (SSO) (HAZWOPER) | No |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |

☐ The staff listed above are the initial participants on this project phase of work. This phase of work will have rotating staff on a daily or weekly basis. See Project scheduling tool or equivalent tool for current staff roles and responsibilities.

**Training**

| All Arcadis employees are required to have the following training to be on site: | Selected Arcadis employees are required to have the following additional training: | Names or Numbers from above |
|---|---|---|
| Arcadis Basic H&S Training Suite(1) | DOT HazMat #1 | 4,5 |
| Defensive Driving - Smith On-Line | None | |
| Hazwoper 40-Hour | None | |
| Hazwoper 8-Hour Annual Refresher | None | |
| None | None | |
| None | None | |
| None | None | |
| None | None | |
| None | None | |
| None | None | |
| None | None | |
| None | None | |
| None | None | |
| Client specific/Other: | None | |
| | None | |

(1) The Arcadis Basic H&S Training Suite includes the following non-certificate trainings: H&S Orientation, Hazard Communication (HAZCOM/GHS), Emergency Action Planning (EAP), Personal Protective Equipment, and Hearing Conservation. The Suite also includes the following certificate issued training: Smith System Forward/Backing Training.

**Protecting Our People: Our Health, Safety and Wellbeing Principles**

Staff working on any of the task(s) listed above must utilize the six Arcadis Fundamental H&S Principles to ensure work is conducted safely. These principles include: 1) Use of TRACK, 2) H&S Planning, 3) Stop Work Authority, 4) "If Not Me Then Who", 5) Stewardship, and 6) Incident Reporting. Every project team member plays an important role in project health and safety. This is more than just having a HASP, training, or PPE. Proactive staff engagement with these principles is critical to a safe work environment.



**General Task Hazard Assessment and Risk Control (HARC)**

| General: | Site-Wide |
|---|---|

The 12 hazard category HARC ratings are not available in this General THA. The mitigated and unmitigated ratings for the hazards presented are based on the Risk Assessment Matrix below. Modify hazards and ratings as necessary to meet project needs.

| Risk Assessment Matrix | | Likelihood Ratings | | | |
|---|---|---|---|---|---|
| Consequences Ratings | | A | B | C | D |
| People | Property | 0 Almost Impossible | 1 Possible but Unlikely | 2 Likely to Happen | 3 Almost Certain to Happen |
| 1-Slight or No Health Effect | Slight or No Damage | 0-Low | 1-Low | 2-Low | 3-Low |
| 2-Minor Health Effect | Minor Damage | 0-Low | 2-Low | 4-Medium | 6-Medium |
| 3-Major Health Effect | Local Damage | 0-Low | 3-Low | 6-Medium | 9-High |
| 4-Fatalities | Major Damage | 0-Low | 4-Medium | 8-High | 12-High |

***Hazard***

Driving - On road - Injury or vehicle damage from motor vehicle accident or incident

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.4 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | HIGH | Smith System (on line) |
| Mitigated Risk: | MEDIUM | JSAs |
| Comments: | Use Smith System "5-Keys" when driving. See Driving JSA for details. | |

***Hazard***

Driving - Driver - Injury, death or property damage due to driver distraction, fatigue, etc.

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.4, 3.21 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | HIGH | Smith System (on line) |
| Mitigated Risk: | LOW | Driver awareness/use of stop work authority |
| Comments: | Use route planning. Keep eyes moving while driving. See Driving JSA. | |

***Hazard***

Biological - skin/eye irritation or damage from poisonous plants

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.17.11 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | LOW | See HASP "Tick/Poisonous Plant Hazards" Section |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Use skin pre-treatment lotions when available. | |

***Hazard***

Biological - bites or stings from exposure to insects or arachnids

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.17: 2,3,7,8,9,10 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | LOW | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Do body check daily. For ticks, see also HASP Tick/Poisonous Plant section. | |

***Hazard***

Biological - cuts, scrapes, skin/eye puncture from exposure to physically damaging plants

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.17.11 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Job Briefing/Site Awareness |
| Mitigated Risk: | LOW | PPE (see HASP "PPE" section) |
| Comments: | | |

**General Task HARC (continued)**

| | | |
|---|---|---|
| ***Hazard*** | | |
| Environmental - Thermal stress - Injury or illness from heat or cold | | |
| Suggested FHSHB Ref: | 3.16 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Field H&S Handbook |
| Mitigated Risk: | LOW | JSAs |
| Comments: | Use job rotation or rest breaks. Stay hydrated and eat regularly. | |
| ***Hazard*** | | |
| Environmental - Inclement weather -Injury or equipment damage from inclement weather | | |
| Suggested FHSHB Ref: | 3.12 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Weather Monitoring |
| Mitigated Risk: | LOW | Cont./Emerg. Planning |
| Comments: | Use 10/30 rule for lightning. See FHSHB section 3.12.2 for details. | |
| ***Hazard*** | | |
| Motion - Musculoskeletal - Injury from lifting, twisting , stooping, or awkward body positions | | |
| Suggested FHSHB Ref: | 3.29.1 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Engineering Controls (specify in comments) |
| Mitigated Risk: | LOW | Admin. Controls (specify in comments) |
| Comments: | Use proper lifting techniques. See FHSHB/HASP Stretching Worksheet. Job rotation. | |
| ***Hazard*** | | |
| Motion - Musculoskeletal - Injury from repeated work activity or body motion | | |
| Suggested FHSHB Ref: | 3.29.2 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Field H&S Handbook |
| Mitigated Risk: | LOW | Admin. Controls (specify in comments) |
| Comments: | Use job rotation or lifting aids. See FHSHB/HASP Stretching Worksheet. | |
| ***Hazard*** | | |
| Gravity - Falls - Injury due to slips and trips | | |
| Suggested FHSHB Ref: | 3.26.4, 4.11 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Site Awareness |
| Mitigated Risk: | LOW | Housekeeping |
| Comments: | Use footwear appropriate for site conditions, plan routes and do not hurry while walking. | |

**Task Specific HARC**

| Task 1: | Construction - Construction contractor oversight |
|---|---|

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: 4

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological* | L | Chemical | L | Driving* | - | Electrical | L |
| Environmental* | H | Gravity* | M | Mechanical | M | Motion* | M |
| Personal Safety | - | Pressure | M | Radiation | - | Sound | M |

* *Hazard rating, if present, excludes General THA hazards in this category.*

***Hazard #1***

Gravity - Struck by - Injury from falling object

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.26.2 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Job Briefing/Site Awareness |
| Mitigated Risk: | LOW | PPE (see HASP "PPE" section) |
| Comments: | Keep a safe distance from raised machinery (e.g., excavator bucket). Wear hard hat onsite. | |

***Hazard #2***

Electrical - Housekeeping - Injury or property damage due to frayed wiring, improperly mounted wiring,

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.25 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | LOW | Housekeeping |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Maintain awareness of electrical components. | |

***Hazard #3***

Environmental - Utilities - Injury or property damage from utility strike/damage

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.36 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | HIGH | Specialized Checklist/Forms |
| Mitigated Risk: | MEDIUM | Field H&S Handbook (see ref. above) |
| Comments: | Various utilities onsite. Use the utility checklist included in this HASP and ensure that three line's of evidence for clearance have been identified. Contact dig safe. Review utility mapping. Soft dig, as needed. GPR/EM surveys strongly recommended. | |

***Hazard #4***

Pressure - Hydraulic - Injury from hydraulic process or device failure

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 2.5, 4.5, 4.6 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | H&S Standards |
| Mitigated Risk: | LOW | PPE (see HASP "PPE" section) |
| Comments: | Inspect equipment each day before use. Ensure hydraulic lines are in good condition. | |

***Hazard #5***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | SDS (see also HASP Hazcom/GHS section) |
| Comments: | Air monitoring required during excavation and earth moving activities. | |

***Hazard #6***

Chemical - liquids, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Hazcom Training |
| Comments: | Wear safety glasses during intrusive activities. | |

**Task Specific HARC (continued)**

| Task 2: | Decontamination - Arcadis oversight of contractors performing decontamination | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): | | | | | | FHSHB Ref: | | 3.10.4 |
| Biological* | L | Chemical | M | Driving* | - | Electrical | - | |
| Environmental* | L | Gravity* | M | Mechanical | - | Motion* | M | |
| Personal Safety | L | Pressure | L | Radiation | - | Sound | M | |

***Hazard #1***

Chemical - liquids, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Keep out of range of water spray. Avoid areas in direction of water spray. Wear safety glasses and chemical resistant gloves. | |

***Hazard #2***

Gravity - Struck by - Injury from falling object

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.26.2 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Keep out of range of water spray. Avoid areas in direction of water spray. Where safety glasses during decontamination activities. | |

**Task Specific HARC (continued)**

| Task 3: | Drilling - Contractor oversight |
|---|---|

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: 4.5

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological* | L | Chemical | L | Driving* | - | Electrical | L |
| Environmental* | L | Gravity* | M | Mechanical | M | Motion* | M |
| Personal Safety | - | Pressure | L | Radiation | - | Sound | H |

***Hazard #1***

Chemical - solids/particulates, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Keep distance away from rig when drill is in use. | |

***Hazard #2***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | See HASP "Monitoring" section |
| Mitigated Risk: | LOW | SDS (see also HASP Hazcom/GHS section) |
| Comments: | Keep distance away from rig when drill is in use. Air monitoring is required. | |

***Hazard #3***

Environmental - Utilities - Injury or property damage from utility strike/damage

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.36 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | HIGH | Specialized Checklist/Forms |
| Mitigated Risk: | MEDIUM | Field H&S Handbook (see ref. above) |
| Comments: | Various utilities onsite. Use the utility checklist included in this HASP and ensure that three line's of evidence for clearance have been identified. Contact dig safe. Review utility mapping. Soft dig, as needed. GPR/EM surveys strongly recommended. | |

***Hazard #4***

Mechanical - Pinch point - Injury by pinching of body part in mechanical process

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.27.4 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Machine Guarding |
| Mitigated Risk: | LOW | Field H&S Handbook (see ref. above) |
| Comments: | Have familiarity with drilling equipment. Know the location and operation of kill switch. | |

**Task Specific HARC (continued)**

| Task 4: | Monitoring - Air monitoring using hand held or stationary equipment - non-radiation |
|---|---|

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: 5.7

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological* | L | Chemical | M | Driving* | - | Electrical | L |
| Environmental* | L | Gravity* | L | Mechanical | L | Motion* | L |
| Personal Safety | L | Pressure | - | Radiation | - | Sound | L |

***Hazard #1***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Specialized Equipment (specify in comments) |
| Comments: | Understand operation of MiniRAE PID and DustTrack particulate monitors. | |

***Hazard #2***

Chemical - solids/particulates, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Wear chemical resistant gloves and safety glasses during intrusive activities. | |

***Hazard #3***

Electrical - Housekeeping - Injury or property damage due to frayed wiring, improperly mounted wiring,

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.25 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Housekeeping |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Maintain and operate equipment as specified by the manufacturer. | |

**Task Specific HARC (continued)**

| Task 5: | Waste- Arcadis oversight of contractors performing IDW containment, segregation a | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): | | | | | | FHSHB Ref: | | 3.31 |
| Biological* | L | Chemical | M | Driving* | - | Electrical | - | |
| Environmental* | L | Gravity* | L | Mechanical | L | Motion* | L | |
| Personal Safety | L | Pressure | M | Radiation | - | Sound | L | |

***Hazard #1***

Chemical - liquids, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Where safety glasses and chemical resistant gloves. | |

***Hazard #2***

Chemical - liquids - injury or illness from vapor inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Air monitoring required when accessing waste containers. | |

***Hazard #3***

Chemical - solids/particulates, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Where safety glasses and chemical resistant gloves. | |

***Hazard #4***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Air monitoring required when accessing waste containers. | |

***Hazard #5***

Mechanical - Pinch point - Injury by pinching of body part in mechanical process

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.27.4 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Site Awareness |
| Comments: | Be careful when securing or loosening drum rings. | |

**Task Specific HARC (continued)**

| Task 6: | Sampling - Well sampling using peristaltic pumps | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): | | | | | | FHSHB Ref: | | 3.9 |
| Biological* | L | Chemical | M | Driving* | - | Electrical | L | |
| Environmental* | L | Gravity* | L | Mechanical | - | Motion* | L | |
| Personal Safety | L | Pressure | L | Radiation | - | Sound | L | |

***Hazard #1***

Chemical - liquids, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | JSAs |
| Comments: | Where safety glasses and chemical resistant gloves. | |

***Hazard #2***

Chemical - liquids - injury or illness from vapor inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | See HASP "Monitoring" section |
| Comments: | Record PID headspace readings when opening well, and keep PID on during sampling. | |

***Hazard #3***

Electrical - Housekeeping - Injury or property damage due to frayed wiring, improperly mounted wiring,

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.25 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Housekeeping |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Maintain and operate equipment as specified by the manufacturer. | |

**Task Specific HARC (continued)**

| Task 7: | Sampling - Free product - all media and all manual methods |
|---|---|

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: 3.9

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological* | L | Chemical | M | Driving* | - | Electrical | L |
| Environmental* | L | Gravity* | L | Mechanical | L | Motion* | L |
| Personal Safety | L | Pressure | L | Radiation | - | Sound | L |

***Hazard #1***

Chemical- liquids - injury or illness from skin absorption

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Avoid splashing. Wear chemical resistant gloves and safety glasses. | |

***Hazard #2***

Chemical- solids/particulates - injury or illness from skin absorption

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Wear chemical resistant gloves and safety glasses. | |

***Hazard #3***

Chemical - liquids - injury or illness from vapor inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | See HASP "Monitoring" section |
| Comments: | Air monitoring required if free product is visible. | |

***Hazard #4***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | See HASP "Monitoring" section |
| Comments: | Air monitoring required when soil is exposed to surrounding air. | |

***Hazard #5***

Chemical - solids/particulates, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Wear chemical resistant gloves and safety glasses. | |

***Hazard #6***

Motion - Cuts and scrapes - Injury from moving object impacting skin or eye

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 2.5, 3.22 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Site Awareness |
| Comments: | Wear work gloves under chemical resistant gloves. | |

**Task Specific HARC (continued)**

| Task 8: | Sampling - Soil sampling using mechanical methods |
|---|---|

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: 3.9

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological* | L | Chemical | L | Driving* | - | Electrical | M |
| Environmental* | L | Gravity* | M | Mechanical | M | Motion* | M |
| Personal Safety | L | Pressure | L | Radiation | - | Sound | H |

***Hazard #1***

Chemical - solids/particulates, skin or eye irritation/damage/allergy

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Wear chemical resistant gloves and safety glasses. | |

***Hazard #2***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | See HASP "Monitoring" section |
| Comments: | Air monitoring required when soil is exposed to surrounding air. | |

***Hazard #3***

Motion - Cuts and scrapes - Injury from moving object impacting skin or eye

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 2.5, 3.22 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Site Awareness |
| Comments: | Wear work gloves under chemical resistant gloves. | |

***Hazard #4***

Electrical - Housekeeping - Injury or property damage due to frayed wiring, improperly mounted wiring,

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.25 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Housekeeping |
| Mitigated Risk: | LOW | Inspections |
| Comments: | Maintain and operate equipment as specified by the manufacturer. | |

**Task Specific HARC (continued)**

| Task 9: | Sampling - Soil sampling using shovel, spade, spoon or trowel |
|---|---|

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: 3.9

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological* | L | Chemical | L | Driving* | - | Electrical | - |
| Environmental* | M | Gravity* | M | Mechanical | - | Motion* | M |
| Personal Safety | L | Pressure | L | Radiation | - | Sound | L |

***Hazard #1***

Chemical- solids/particulates - injury or illness from skin absorption

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.9, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Wear chemical resistant gloves and safety glasses. | |

***Hazard #2***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | See HASP "Monitoring" section |
| Comments: | Air monitoring required when soil is exposed to surrounding air. | |

***Hazard #3***

Motion - Cuts and scrapes - Injury from moving object impacting skin or eye

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 2.5, 3.22 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | Wear work gloves under chemical resistant gloves. | |

**Task Specific HARC (continued)**

| Task 10: | Drilling - Using mechanical methods |
|---|---|

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: 4.5

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological* | L | Chemical | L | Driving* | - | Electrical | M |
| Environmental* | L | Gravity* | M | Mechanical | M | Motion* | H |
| Personal Safety | L | Pressure | L | Radiation | - | Sound | H |

***Hazard #1***

Motion - Struck by - Bodily injury from impact with moving object

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 2.5, 3.22 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | ROW TSP |
| Mitigated Risk: | LOW | Site Awareness |
| Comments: | Reference ROW TSP to set up traffic controls. Use a flagger. Use the buddy system when setting up traffic controls. | |

***Hazard #2***

Sound - Noise - Injury or illness due to noise exposure

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.15 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Medical Surveillance |
| Comments: | Use ear protection during drilling operations. All onsite employees must be enrolled in medical surveillance. | |

***Hazard #3***

Mechanical - Pinch point - Injury by pinching of body part in mechanical process

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.27.4 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | Site Awareness |
| Mitigated Risk: | LOW | PPE (see HASP "PPE" section) |
| Comments: | Stay at least 5 feet away from moving parts of the drill rig. Do not wear loose clothing, and tie long hair back. Avoid wearing jewelry while drilling. | |

***Hazard #4***

Chemical - solids/particulates, injury or illness from inhalation

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.2, 3.22, 3.30, 3.33 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | MEDIUM | PPE (see HASP "PPE" section) |
| Mitigated Risk: | LOW | Job Briefing/Site Awareness |
| Comments: | If excessive dust is being generated, use water or other mitigation methods. Wear safety-glasses. | |

***Hazard #5***

Environmental - Utilities - Injury or property damage from utility strike/damage

| | | |
|---|---|---|
| Suggested FHSHB Ref: | 3.36 | To mitigate this hazard, use TRACK and the following: |
| Overall Unmitigated Risk: | HIGH | Site Awareness |
| Mitigated Risk: | MEDIUM | H&S Standards |
| Comments: | Various utilities onsite. Use the utility checklist included in this HASP and ensure that three line's of evidence for clearance have been identified. Contact dig safe. Review utility mapping. Soft dig, as needed. GPR/EM surveys strongly recommended. | |

**Hazard Communication (HAZCOM)/Global Harmonization System (GHS)**

| | |
|---|---|
| | HAZCOM/GHS for this project is managed by the client or contractor |
| | Project will utilize <=3 Chemical(s)/Product(s) subject to HAZCOM/GHS |

*List the chemicals anticipated to be used by Arcadis on this project per HAZCOM/GHS requirements.*
(Modify quantities as needed)

| | **Preservatives** | Qty |
|---|---|---|
| | Not applicable | |
| X | Hydrochloric acid | <500 ml |
| | Nitric acid | <500 ml |
| X | Sulfuric acid | <500 ml |
| X | Sodium hydroxide | <500 ml |
| | Zinc acetate | <500 ml |
| X | Ascorbic acid | <500 ml |
| | Acetic acid | <500 ml |
| | Isopropyl alcohol | < 4 gal. |
| | Formalin (<10%) | < 4 gal. |
| | Methanol | <500 ml |
| | Sodium bisulfate | <500 ml |

| | **Decontamination** | Qty |
|---|---|---|
| | Not applicable | |
| X | Alconox | ≤ 5 lbs |
| | Liquinox | ≤ 1 gal |
| | Acetone | ≤ 1 gal |
| X | Methanol | ≤ 1 gal |
| | Hexane | ≤ 1 gal |
| | Isopropyl alcohol | ≤ 4 gal |
| X | Nitric acid | ≤ 1 L |
| | Other: | |

| | **Calibration** | Qty. |
|---|---|---|
| | Not applicable | |
| X | Isobutylene/air | 1 cyl |
| | Methane/air | 1 cyl |
| | Pentane/air | 1 cyl |
| | Hydrogen/air | 1 cyl |
| | Propane/air | 1 cyl |
| | Hydrogen sulfide/air | 1 cyl |
| | Carbon monoxide/air | 1 cyl |
| | pH standards (4,7,10) | ≤ 1 gal |
| | Conductivity standards | ≤ 1 gal |
| | Other: | |

| | **Fuels** | Qty. |
|---|---|---|
| X | Not applicable | |
| | Gasoline | ≤ 5 gal |
| | Diesel | ≤ 5 gal |
| | Kerosene | ≤ 5 gal |
| | Propane | 1 cyl |
| | Other: | |

| | **Kits** | |
|---|---|---|
| X | Not applicable | |
| | Hach (specify): | 1 kit |
| | DTECH (specify): | 1 kit |
| | Other: | 1 kit |

| | **Remediation** | Qty. |
|---|---|---|
| X | Not applicable | |
| | | |
| | | |
| | | |
| | | |
| | | |

| | **Other:** | Qty. |
|---|---|---|
| | Not applicable | |
| X | Spray paint | ≤ 6 cans |
| | WD-40 | ≤ 1 can |
| | Pipe cement | ≤ 1 can |
| | Pipe primer | ≤ 1 can |
| | Mineral spirits | ≤ 1 gal |

| | **DOT(1):** | Qty. |
|---|---|---|
| | MOT eligible soils | |
| | MOT eligible water | |
| | MOT eligible solids | |
| | MOT eligible liquids | |
| | | |
| | | |
| | | |

(1) Attach applicable Materials of Trade (MOT) Quick Form to shipping determination or this HASP. SDS not generally applicable to this category.

SDSs for this project are attached to this HASP.

Contractors on this project are anticipated to use materials subject to the HAZCOM Standard under OSHA (or state OSHA) regulations. Contractor SDSs are not required for this project.

This project will not be utilizing materials subject to the HAZCOM Standard in bulk storage. In this HASP, bulk storage means any material stored on the project site in a bulk packaging >119 gallons (> 450 L) liquid capacity or a palletized quantity of a material in packagings ≤119 gallons (≤450 L) liquid capacity.

**Air Monitoring**

| | |
|---|---|
| | There are no atmospheric chemical, radiological, or particulate hazards on this project requiring air monitoring. |
| | Air monitoring is the responsibility of the client or subcontractor. |
| X | Air monitoring is required for the following tasks: |

Construction - Construction contractor oversight

Drilling - Contractor oversight

Monitoring - Air monitoring using hand held or stationary equipment - non-radiation

Waste- Arcadis oversight of contractors performing IDW containment, segregation and/or sampling

Select

***Constituents of Interest:***

Time Weighted Averages (TWAs) are ACGIH 8 Hr Threshold Limit Values (TLVs) unless noted.

| Benzene | | | |
|---|---|---|---|
| TWA | 0.5 ppm, OSHA Reg. See Notes | LEL/UEL (%): | 1.2/7.8 |
| STEL | 2.5 ppm | RGD (Air = 1): | NA |
| IDLH | 500 ppm, NIOSH | VP (mmHg): | 75 |

| Ethylbenzene | | | |
|---|---|---|---|
| TWA | 20 ppm | LEL/UEL (%): | 0.8/6.7 |
| STEL | 125 ppm, NIOSH | RGD (Air = 1): | NA |
| IDLH | 800 ppm, NIOSH | VP (mmHg): | 7 |

| Toluene | | | |
|---|---|---|---|
| TWA | 20 ppm | LEL/UEL (%): | 1.1/7.1 |
| STEL | 150 ppm, NIOSH | RGD (Air = 1): | NA |
| IDLH | 500 ppm, NIOSH | VP (mmHg): | 21 |

| Xylenes | | | |
|---|---|---|---|
| TWA | 20 ppm | LEL/UEL (%): | 1.1/7.0 |
| STEL | 150 ppm, NIOSH | RGD (Air = 1): | NA |
| IDLH | 900 ppm, NIOSH | VP (mmHg): | 9 |

| Naphthalene | | | |
|---|---|---|---|
| TWA | 10 ppm, skin | LEL/UEL (%): | 0.9/5.9 |
| STEL | NA | RGD (Air = 1): | NA |
| IDLH | 250 ppm, NIOSH | VP (mmHg): | 0.08 |

| Cyanide as CN | | Anticipated Breathing Zone Concentration <= | 3 | mg/m3 |
|---|---|---|---|---|
| TWA | 5 mg/m3, skin, OSHA | LEL/UEL (%): | NA/NA | |
| STEL | NA | RGD (Air = 1): | NA | |
| IDLH | NA | VP (mmHg): | NA | |

| None | | | |
|---|---|---|---|
| TWA | NA | LEL/UEL (%): | NA |
| STEL | NA | RGD (Air = 1): | NA |
| IDLH | NA | VP (mmHg): | NA |

TWA - Time Weighted Average (ACGIH TLV unless noted)
STEL - Short Term Exposure Limit
IDLH - Immediately Dangerous to Life and Health

LEL/UEL - Lower/Upper Explosive Limit
RGD - Relative Gas Density
VP (mmHg) - Vapor Pressure (millimeters mercury)

Notes:
One or more constituents above is listed with a skin notation. Avoid conditions where dusts, mists, or aerosols are created. Avoid skin contact with impacted media.

As noted, one or more of the above constituents is an OSHA regulated substance. If exposure is expected to be above the TWA, contact a CIH or CSP for assistance unless otherwise permitted by a substance specific plan template identified in this section.

***Required Monitoring Instruments, Action Levels and Monitoring Frequency***

Photoionization Detector  Select Lamp: 10.6 eV

| Action levels are in PID units (1): | | | Computed action levels have been manually adjusted. |
|---|---|---|---|
| < | 2.3 | | Continue working |
| | 2.3 | - 4.6 | Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution. |
| > | 4.6 | | Stop work and contact SSO |

(1) Computed action levels are for PIDs which have not been programmed to correct TLVs for specific constituents or mixtures.

Particulate/Aerosol monitoring is required.

| Action levels are in mg/m3 | | | Computed action levels have been manually adjusted. |
|---|---|---|---|
| < | 1.500 | | Continue working |
| | 1.5 - 3 | | Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution. |
| > | 3.000 | | Stop work and contact SSO |

Breathing zone air monitoring using the above instruments will be performed at the following frequency:
Continuously

The monitoring instrument(s) used must be capable of data logging if continuous monitoring is required. Staff using these instruments must be trained in data logging procedures for the actual instrument(s) used. Data logging results must be backed up daily.

Multigas (including LEL/O2 and Hg vapor) monitoring is not required.

Compound specific monitoring using indicator tubes, chips, or electrochemical sensors is not required.

**Tick and Poisonous Plant Hazards**

For all projects with outdoor work, biological hazards must be addressed in the tailgate safety meeting each day. The following controls must be used to mitigate biological hazards while working and must also be discussed in the tailgate safety meeting. For low risk situations, the discussion must include exposure to weeds/vegetation near fences, buildings, etc.

**Controlling Tick Hazards**

*Risk Guide for Ticks:*

| | |
|---|---|
| **Low** | Paved areas; parking lots; well manicured lawns and fields; no work taking place within 15 feet of vegetated areas; work in REGIONS with no tick populations; sub-freezing temperatures, snow or ice cover on ground.* |
| **Medium** | Brush hogged fields, wetlands, and grasslands; forested areas with little undergrowth; weeds less than knee height; moderately dense foliage; sporadic or moderately vegetated shaded areas; average leaf accumulation and decaying material on the ground; work taking place in fields after application of insecticide; work in REGIONS with a recognized moderate tick populations; outdoor work during spring, summer and fall months.* |
| **High** | Uncut fields, wetlands, forested areas, and grasslands; weeds taller than knee height; heavy dense foliage; heavily vegetated shaded areas; excessive accumulations of leaves and decaying material on the ground; work in REGIONS with recognized heavy tick populations; areas with posted tick hazard warnings; outdoor work during spring, summer and fall months.* |

*Cold weather does not eliminate risk of exposure to deer ticks as they may be active all year in areas that experience subfreezing temperatures.

Ticks are ranked as a **Low** risk for this project

Care should be taken to avoid walking through or working in tall grasses, overgrown or bushy vegetation to the extent reasonable and practical. No single control is effective against ticks.

*Select required controls below:*

*Engineering Controls*

- [ ] Mowing of work area
- [ ] Clearing overgrown vegetation
- [ ] Pesticide application
- [ ] Other: _____

*Administrative Controls*

- [X] Complete tick check morning/evening
- [ ] Scheduled tick check: _____
- [ ] Inspect backpacks, equipment cases, etc. daily
- [ ] Vehicle cab - maintain good housekeeping
- [ ] Other: _____

*Personal Protective Equipment*

- [ ] Light colored clothing
- [ ] Light colored hat/hardhat
- [ ] Pants tucked in boots
- [ ] Shirt tucked into pants
- [X] Long sleeved shirt and long pants
- [ ] White Tyvek pants
- [ ] White coveralls/Tyvek
- [ ] Taped cuffs/pant legs
- [ ] Tick gators
- [ ] Double sided tape/duct tape sticky side out
- [ ] Insect mesh/netting for face/head or whole body suit
- [ ] Other: _____

Heat stress signs/symptoms and controls to also be addressed in tailgate safety meeting if temperatures >80°F

*Repellents*

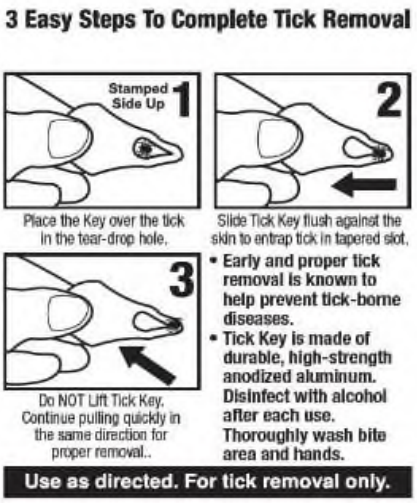
- [X] Repellents will not be used
- [ ] Permethrin impregnated clothing (purchased)
- [ ] Permethrin (0.5% self applied/treated to clothing)
- [ ] Deet 20-40% applied to skin
- [ ] Other: _____

If repellents are not used, additional PPE controls must be considered.

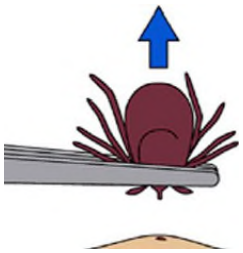
*Tick Removal and First Aid*

Ticks removed within 24 hours of embedment represent a very low risk for adverse outcomes. Perform tick checks as directed above. To properly remove a tick:

*Using a Tick Removal Tool*




*Using Tweezers*



1) Use point tip tweezers, if available, to reduce potential of crushing the ticks body
2) Grasp the tick as close to skin as possible
3) Pull upward with even pressure.

Do not crush tick with fingers

After removal, wash affected area with alcohol or iodine. Wash hands thoroughly after removal.
Document date/time of the removal in field notes, field form or H&S app.
If rash or fever develops, call WorkCare

**Poisonous Plants (Poison Ivy, Poison Oak, Poison Sumac)**

All work outdoors, regardless of time of year, must address poisonous plant hazards and controls in the tailgate safety meeting. For low risk projects, the discussion should consider potential vegetation exposure near fences, buildings, work near trees, etc.

**Controlling Exposure to Poisonous Plants**

Poisonous Plants are ranked as a **Low** risk on this project

*Select required controls below:*

*Engineering Controls*

- [ ] Not applicable
- [ ] Mowing of work area
- [ ] Clearing overgrown vegetation
- [ ] Herbicide application
- [ ] Other: _____

*Administrative Controls*

- [X] Identify and avoid (see ID Quick Guide below)
- [ ] Watch for signs or symptoms of exposure
- [ ] Vehicle cab - maintain good housekeeping
- [ ] Other: _____

*Personal Protective Equipment*

- [ ] Gloves
- [ ] Hat/hardhat/head covering
- [ ] Pants tucked in boots
- [ ] Shirt tucked into pants
- [X] Long sleeved shirt and long pants
- [ ] White coveralls/Tyvek
- [ ] Taped cuffs/pant legs
- [ ] Dust mask (during burning activities, etc.)
- [ ] Other: _____

Heat stress signs/symptoms and controls to also be addressed in tailgate safety meeting if temperatures >80°F

*Repellents*

- [X] Repellents will not be used
- [ ] Barrier creams
- [ ] Other: _____

*Skin Decontamination*

- [ ] Wash with post-exposure soap and water
- [ ] Wash with soap and water (use hot water if available)
- [ ] Hot shower at end of day
- [ ] Other: _____

*Equipment Decontamination*

Due to the low risk associated with poisonous plants on this project, portable equipment and tools may still have a potential to be contaminated with urushiol (the oil that causes allergic reactions and dermatitis in poisonous plants covered by this plan). It is recommend to decontaminate handles, grips, and hand holds of tools and equipment with post-exposure soap and water or alcohol spray (if safe to do so for the equipment/tool being decontaminated) as a best practice.

*Clothing Decontamination*

Wash work clothing in hot water separate from other clothing. Even though there is a low risk for poisonous plants on this project, work boots should be considered potentially contaminated with urushiol. Decontaminate with post-exposure soap and water or hot soap and water. If safe for the boot, consider spraying with alcohol spray of post exposure soap is not available.

*First Aid*

If skin irritation or other signs of allergic reaction develops contact WorkCare for assistance. Document date and time of exposure, if known, in field notes, field form or H&S app.

*Identification Quick Guide*

Ticks:

American Dog Tick



Blacklegged (Deer) Tick



Brown Dog Tick



Groundhog Tick



Gulf Coast Tick



Lone Star Tick



Rocky Mountain Wood Tick



Soft Tick



Poison Ivy:







Poison Oak:







Poison Sumac:



For other biological hazards, address the hazards and controls in the JSA for the work task.

**Personal Protective Equipment (PPE)**

See JSA or Permit for the task being performed for required PPE. If work is not conducted under a JSA or Permit, refer to the governing document for PPE requirements. At a minimum, the following checked PPE is required for all tasks during field work (outside of field office trailers and vehicles) not covered by a JSA or Permit on this project:

| Minimum PPE required to be worn by all staff on project: | | | | | | Specify Type: |
|---|---|---|---|---|---|---|
| X | Hard hat | | Snake chaps/guards | | Coveralls: | |
| X | Safety glasses | | Briar chaps | | Apron: | |
| | Safety goggles | | Chainsaw chaps | X | Chem. resistant gloves: | Nitrile |
| | Face shield | | Sturdy boot | | Gloves other: | |
| X | Hearing protection | X | Steel or comp. toe boot | | Chemical boot: | |
| | Rain suit | | Metatarsal boot | | Boot other: | |
| | Other: | | | X | Traffic vest, shirt or coat: | Class II |
| | | | | | Life vest: | |

Task specific PPE:
Comments:

**Medical Surveillance**

All Arcadis employees performing field work will be required to be current in HAZWOPER medical surveillance.

Client and DOT mandated drug and alcohol testing is not required for this project and will not be performed.

**Hazardous Materials Shipping and Transportation**

A non-regulated shipping determination is attached to this HASP. There are currently no plans to sample hazardous soil/material on-Site. Shipping of this material is being entirely performed by the client and the client's waste handling subcontractor. Arcadis will not sample or ship this material without creating a new shipping determination. Known locations of hazardous waste are as follows:
WC-5 (9-15 ft bgs), WC-6 (11-16 ft bgs), WC-7 (7-16 ft bgs), WC-8 (8-16 ft bgs), WC-10 (11-21.6 ft bgs)

**Traffic Safety and Traffic Safety Plans (TSPs)**

All or portions of the project work will be conducted in a parking lot and/or private roadway. A Non-ROW TSP addressing this work is attached to this HASP.

**Arcadis Commercial Motor Vehicles (CMVs)**

CMVs operated by Arcadis employees on public roadways will not be utilized on this project. Arcadis defines a CMV as any single vehicle with a gross vehicle weight rating (GVWR) ≥10,001 pounds or a truck and trailer combination with a combined GVWR ≥10,001 pounds (GVWR of truck + GVWR of trailer = ≥10,001 pounds).

**Site Control**

The scope of work on this project does not require use of site control.

**Decontamination**

Decontamination protocols are addressed in the applicable task JSA(s) for this project. The applicable JSAs are attached to this HASP.

**Sanitation**

Restroom facilities and potable water will be provided by the client for this project. Unless alternate requirements are stipulated in a plan supplement (i.e. Heat Injury and Illness Prevention Plan), permit or JSA, temporary restroom facilities will be provided with one toilet for every 20 project workers and bottled or non-plumbed potable water will be provided to project workers at 1 gallon/worker/day.

**Safety Briefings**

Arcadis will lead all safety briefings on this project and will document the safety briefing on a Tailgate Safety Briefing form or logbook. Safety briefings will be conducted once at the beginning of each work day unless the Site Safety Officer deems more frequent safety briefings will be required based on work being conducted. All project workers, including Arcadis subcontractors, will be required to attend the safety briefing. Site visitors and project workers not on duty during the morning safety briefing will receive the safety briefing upon their arrival onto the project site for the day.

**Employee Health and Safety Engagement**

The CPM or APM is responsible for reviewing and establishing H&S engagement goals for the project. These goals are summarized below.

Hazard Observations (via H&S App or TIP) required at the following frequency on this project:
1 per task

Close Call reporting (via H&S app) goals for this project:
1 NM per event

Other (specify):

**Safety Equipment and Supplies**

Safety equipment/supply requirements are addressed in the JSA or Permit for the task being performed. If work is not performed under a JSA or Permit, the following safety equipment is required to be present on site in good condition unless otherwise noted (Check all that apply):

| | | | |
|---|---|---|---|
| X | First aid kit | | Insect repellent: |
| | Bloodborne pathogens kit | X | Sunscreen |
| X | Fire extinguisher | | Air horn |
| | Eyewash (ANSI compliant) | X | Traffic cones |
| X | Eyewash (bottle) | | 2-way radios |
| X | Drinking water | | Heat stress monitor |
| | Other: | X | See Tick and Poisonous Plant Hazards section for additional equipment/supply information. |

**International Travel**

International travel is not required for this project.

**Spill Control and Containment**

Spill control and containment planning and implementation is not required for this project.

**Use of Electronic Devices in Areas of Increased Safety Risk**

Use of electronic devices (tablets, laptops, and/or cell phones) to collect data or document work is not anticipated on this project. If electronic devices are used, distraction hazards and use must be addressed and documented in the job briefing/safety briefing.

**Signatures**

I have read, understand and agree to abide by the requirements presented in this health and safety plan. I understand that I have the absolute right to stop work if I recognize an unsafe condition affecting my work until corrected.

| Printed Name | Signature | Date |
|---|---|---|
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Add additional sheets if necessary

**You have an absolute right to STOP WORK if unsafe conditions exist!**

**Attachment A**
JSAs

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | HASP 1 | **Status** | Complete |
| **Job Name** | General Industry-Driving - passenger vehicles | **Created Date** | 12/6/2024 |
| **Task Description** | Driving a car, van, or truck on public roadways. | **Completed Date** | 12/06/2024 |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | 30003953.00011 |
| **Project Name** | North Albany Service Center |
| **Project Manager** | John Brussel |

## User Roles

| Role | Employee | Due Date | Completed Date |
|---|---|---|---|
| Developer | Matthew Hysell | 12/6/2024 | 12/6/2024 |
| HASP Reviewer | Elizabeth Hover | 12/6/2024 | 12/6/2024 |
| Quality Reviewer | | | |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Pre-Trip Inspection | 1 | Failing to perform pre-trip inspections may cause mechanical failure, accident or injury. | Perform walk around of vehicle with particular attention to tire inflation and condition. Check lights, wipers, seatbelts for proper operating condition. Properly adjust seat and mirrors prior to vehicle operation. Use or review vehicle inspection checklist as required under the MVSP. | ARC HSGE024 Motor Vehicle Safety Standard (MVSP) |
| | | 2 | Scrapes, cuts, burns to hand if inspecting engine fluids and/or tires. Eye splash hazard if inspecting engine fluids. Pinch or crush hazards when opening or closing hood, trunk, or tailgate. | Wear protective gloves and safety glasses as described below when checking under hood or tires. Use TRACK and keep hands clear when opening/closing hood, trunk, or tailgate to avoid crush or pinch hazard. | |
| | | 3 | Struck by other vehicles while walking around vehicle performing inspections. | Wear high visibility vest, shirt, or coat while performing inspections in parking lots or other areas with a traffic hazard. Remain vigilant of moving vehicles or equipment in area, face oncoming vehicles to extent practical. | |
| | | 4 | Improperly secured cargo may dislodge creating injury, property damage, or road hazard. | Ensure all cargo is properly secured to prevent movement while the vehicle is in operation. This includes cargo in the cab of | |
| 2 | Driving a motor vehicle on public streets | 1 | Failing to observe traffic flow ahead increases risk of hard braking resulting in potential impact of vehicle ahead, being struck by another vehicle from behind, and decreases decision making time. | Use Smith System Key #1, "Aim High in Steering". **Look ahead (15 seconds if possible) to observe traffic flow and traffic signals.** Adjust speed accordingly to keep vehicle moving and avoid frequent braking. Select lane of least traffic and adjust speed based on observed signal timing when possible. Avoid following directly behind large vehicles that obscure view ahead. | Smith System "5-Keys" is a registered trademark of Smith System Driver Improvement Institute, Inc. |
| | | 2 | Failing to observe vehicles, pedestrians, bicyclists, and other relevant objects in vicinity of your vehicle increases risk of side swipes, rear ending, and third party injury. | Use Smith System Key #2, "Get the Big Picture". **Maintain 360 degrees of awareness around vehicle.** Check a mirror every 6-8 seconds, maintain space around the vehicle, choose a lane that avoids being boxed in. Look for pedestrian activity ahead in crosswalks or sidewalks. Watch for construction zone approach signs and act early by executing lane changes and reducing speed. | |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 2 | Driving a motor vehicle on public streets | 3 | Failing to keep your eyes moving increases risk of not seeing relevant vehicles, pedestrians, and objects in your vicinity that may impair your ability to make timely and appropriate driving decisions and also increases risk of accident. | Use Smith System Key #3, "Keep Your Eyes Moving". **Move your eyes every 2 seconds and avoid staring while evaluating relevant objects.** Scan major and minor intersections prior to entering them. Check mirrors. | |
| | | 4 | Failing to maintain space around and in front of your vehicle increases risk of striking another vehicle or being struck by another vehicle. Insufficient space shortens time for effective driving decision making resulting in increased accident risk. | Use Smith System #4, "Leave Yourself an Out". **Use 4 second rule when following a vehicle.** Avoid driving in vehicle clusters by adjusting speed and using lanes that permit maximum space and visibility. When stopped, keep one car length space in front of vehicle ahead or white line. | |
| | | 5 | Failing to communicate with other drivers and pedestrians increases risk of striking vehicles, pedestrians, or being struck by other vehicles, especially from the rear. | Use Smith System Key #5, "Make Sure They See You". **Brake early and gradually when stopping to reduce potential of being rear ended.** Keep foot on brake while stopped. Use turn signals and horn effectively. Establish eye contact with other drivers and pedestrians to extent practical. Use vehicle positioning that promotes being seen. | |
| | | 6 | Distractions within the vehicle takes focus off driving, increases risk of accident decreases time for making effective driving decisions. | **Cell phone use (any type or configuration) is prohibited while the vehicle is in motion.** Familiarize yourself with vehicle layout and controls (radio, temperature controls, etc.) prior to operating unfamiliar vehicles. Set controls prior to operating vehicle. Use GPS in unfamiliar areas to avoid use of paper maps/directions while driving. Set GPS prior to vehicle operation. Pull over and stop to modify GPS functions. Avoid consuming food or drink while driving. | |
| 3 | Parking | 1 | Parking vehicle in areas of clustered parked vehicles or near facility entrance may impair visibility to oncoming traffic in lot and increase exposure to pedestrian traffic. | **Use pull through parking or back into parking space when permitted or practical.** When practical and safe to do so, park away from other vehicles and avoid parking near the facility entrance or loading docks. If available, use a spotter to aid in backing activity. Back no further than necessary and back slowly. Get out and look (GOAL) if uncertain of immediate surroundings. Tap horn prior to backing. | |

## PPE Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Eye Protection** | safety glasses | While checking engine or tires | Required |
| **Hand Protection** | work gloves (specify type) | Leather or equivalent checking engine or | Required |

## Supplies

| Type | Supply | Description | Required |
|---|---|---|---|
| **Communication Devices** | mobile phone | | Required |
| | other | Vehicle kit (applies to company trucks) | Required |
| **Miscellaneous** | fire extinguisher | Applies to company trucks | Required |
| | first aid kit | Applies to company trucks | Required |

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | 16892 | **Status** | (3) Completed |
| **Job Name** | Environment-Drilling, soil sampling, well installation | **Created Date** | 4/19/2019 |
| **Task Description** | Drilling and soil sampling | **Completed Date** | 04/22/2019 |
| **Template** | False | **Auto Closed** | False |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | B00366481401 |
| **Project Name** | NG SIR NORTH ALBANY MGP SITE |
| **PIC** | YOUNG, TERRY |
| **Project Manager** | JONES, MICHAEL |

## User Roles

| Role | Employee | Due Date | Completed Date | Supervisor | Active |
|---|---|---|---|---|---|
| Developer | Healy, Lawrence C | 5/10/2019 | 4/19/2019 | Brien, Jason D | ; |
| HASP Reviewer | Hover, Elizabeth A | 5/3/2019 | 4/22/2019 | Hill, Sarah A | ; |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Set up necessary traffic and public access controls | 1 | Struck by vehicle due to improper traffic controls | Use a buddy system for placing site control cones and/or signage. Position vehicle so that you are protected from moving traffic. Wear Class II traffic vest. If work is conducted in a ROW, reference ROW Traffic Safety Plan and use a flagger for traffic. | FHSFB V (F) Traffic Safety Plan. |
| 2 | Utility Clearance | 1 | Potential to encounter underground or above ground utilities while drilling. | Complete utility clearance in accordance with the ARCADIS Utility Clearance H&S Standard. | ARCADIS H&S Standard ARCHSFS019 |
| 3 | General drill rig operation | 1 | Excessive noise is generated by rig operation. | When the engine is used at high RPMs or soil samples are being collected, use hearing protection. | FHSFB III (F,L) and IV (E) |
| | | 2 | During drill rig operation, surfaces will become hot and cause burns if touched, and COCs in the soils more readily vaporize generating airborne contaminates. | Due to friction and lack of a drilling fluid, heat will be produced during this method. Mainly drill augers. Be careful handling split spoons. Wear proper work gloves. When soils and parts become heated, the COC could volatilize. Air monitoring should always be performed in accordance with the HASP. | |
| | | 3 | Moving parts of the drilling rig can pull you in causing injury. Pinch points on the rig and auger connections can cause pinching or crushing of body parts. | Stay at least 5 feet away from moving parts of the drill rig. Know where the kill switch is, and have the drillers test it to verify that it is working. Do not wear loose clothing, and tie long hair back. Avoid wearing jewelry while drilling. Cone off the work area to keep general public away from the drilling rig. | |
| | | 4 | Dust and debris can cause eye injury and soil cuttings and/or water could contain COCs. | Wear safety glasses and stay as far away from actual drilling operation as practicable. Wear appropriate gloves to protect from COCs. | |
| | | 5 | Drilling equipment laying on the ground (i.e. augers, split spoons, decon equipment, coolers, etc.), create a tripping hazard. Water from decon buckets generate mud and cause a slipping hazard. | Keep equipment and trash picked up, and store away from the primary work area. | |
| | | 6 | The raised derrick can strike overhead utilities, tree limbs or other elevated items | Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Clearance H&S Standard for guidance. | |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 4 | Hollow stem auger drilling | 1 | All hazards in step 3 apply. Additionally, The raised derrick can strike overhead utilities, tree limbs or other elevated items | Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance. | FHSFB III (F,L,S,AD) and IV (E) |
| | | 2 | Hands or fingers can get caught and crushed if trying to clean by hand or with tools while the auger is still turning. | Auger should always be stopped and clutch disengaged prior to cleaning. | |
| 5 | Direct push drilling | 1 | The drill rods will be handled by workers most of the time rather than the rig doing it, therefore pinch points can cause lacerations and crushing of fingers/body parts. | Keep a minimum of 5 feet away from drill rig operation and moving parts. | FHSFB III (F,L,S,AD) |
| | | 2 | The direct push rigs are usually meant to fit in spaces where larger rig can't. Tight spaces can pin workers. | Do not put yourself between the rig and a fixed object. Use Spotters or a tape measure to ensure clearances in tight areas. Pre-plan equipment movement from one location to the next. | |
| | | 3 | Some direct push equipment is controlled by wireless devices. These controls can fail and equipment can strike workers or cause damage to property. | The drill rig should be used in a large open area to test wireless controls prior to moving to boring locations. The operator of the rig will test the kill switch with wireless remote prior to use. Operator will stay in range of rig while moving so that wireless signal will not be too weak and cause errors to the controls. | |
| | | 4 | Sampling sleeves must be cut to obtain access to soil. Cutting can cause lacerations. | It's preferable to let the driller cut the sleeves open. Many drillers have holders for the sleeve to allow for stability when cutting. If you cut the sleeves, use a hook blade, change blade regularly, and cut away from the body. | |
| | | 5 | Soil cores may contain contaminated media. | Wear nitrile gloves and safety glasses for protection from contaminated media when logging soil borings. | |
| 6 | Sample collection and processing | 1 | Injuries can result from pinch points on sampling equipment, and from breakage of sample containers. | Care should be taken when opening sampling equipment. Look at empty containers before picking them up, and do not over-tighten container caps. Use dividers to store containers in the cooler so they do not break. | Sample Cooler Handling JSA |
| | | 2 | Lifting heavy coolers can cause back injuries. | Use two people to move heavy coolers. Use proper lifting techniques. | |
| 7 | Soil cutting management | 1 | Moving full drums can cause back injury, or pinching/ crushing injury. | Preferably have the drilling contractor move full drums with their equipment. If this is not practicable, use lift assist devices such as drum dollies, lift gates, etc. Employ proper lifting techniques, and perform TRACK to identify pinch/crush points. Wear leather work gloves, and clear all walking and work areas of debris prior to moving a drum. | Drum Handling JSA. FHSFB III (S,AJ) |

## PPE — Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Dermal Protection** | long sleeve shirt/pants | | Recommended |
| **Eye Protection** | safety glasses | | Required |
| **Foot Protection** | steel-toe boots | | Required |
| **Hand Protection** | chemical resistant gloves (specify type) | Nitrile | Required |
| | work gloves (specify type) | ANSI A2 Cut Resistant Gloves | Required |
| **Head Protection** | hard hat | | Required |
| **Hearing Protection** | ear plugs | | Required |
| **Miscellaneous PPE** | traffic vest--Class II or III | | Required |
| **Respiratory Protection** | dust mask | | Recommended |

## Supplies

| Type | Supply | Description | Required |
|---|---|---|---|
| **Communication Devices** | mobile phone | | Required |
| **Decontamination** | Decon supplies (specify type) | Driller to provide and manage | Recommended |
| **Miscellaneous** | fire extinguisher | | Required |
| | first aid kit | | Required |
| **Personal** | eye wash (specify type) | bottle | Required |
| | water/fluid replacement | | Required |
| **Traffic Control** | barricades | | Recommended |
| | traffic cones | | Required |
| | signage | | Required |
| | flag | | |

## Review Comments

| Reviewer | | Comments |
|---|---|---|
| **Employee:**<br>**Role**<br>**Review Type**<br>**Completed Date** | Hover, Elizabeth A<br>HASP Reviewer<br>Approve<br>4/22/2019 | |

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | 16888 | **Status** | (3) Completed |
| **Job Name** | Environment-Drum sampling/handling | **Created Date** | 4/19/2019 |
| **Task Description** | Drum Sampling | **Completed Date** | 04/22/2019 |
| **Template** | False | **Auto Closed** | False |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | B00366481401 |
| **Project Name** | NG SIR NORTH ALBANY MGP SITE |
| **PIC** | YOUNG, TERRY |
| **Project Manager** | JONES, MICHAEL |

## User Roles

| Role | Employee | Due Date | Completed Date | Supervisor | Active |
|---|---|---|---|---|---|
| Developer | Healy, Lawrence C | 5/10/2019 | 4/19/2019 | Brien, Jason D | ; |
| HASP Reviewer | Hover, Elizabeth A | 5/3/2019 | 4/22/2019 | Hill, Sarah A | ; |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Inspect Drums for signs of Bulging, Leaking, Crystals, Temperature, and Odor | 1 | Exposure to chemicals stored in drum or container. | Read drum labels for information about contents. Review all relevant MSDSs about chemical contents. If labels are not attached, call PM or Local H&S Representative. | None |
| | | 2 | Contents of the drum can cause fire/explosion hazard. | Use air monitoring meters to screen drums. % LEL and VOCs (PPM). If either of the values are above the action levels described in the HASP or MSDS then Stop Work, move away from the area, and reassess the situation. Call PM and H&S staff for support. | |
| 2 | Remove lids or bungs from Drums | 1 | Hand Injuries can occur from sharp edges, pinch points, and from use of hand tools. | Wear appropriate work gloves. When removing ring from drum, fingers can get pinched between ring and drum. Keep fingers clear of this space. Select proper tool for task. If large amount of drums will be encountered, use a speed or drum wrench. | Employee H&S Field book, Section III Subpart II, page 104. Also Section III Subpart L, page 38. |
| | | 2 | Rapid depressurization from empty or partially full drums can cause flying parts or volatile COCs releasing on staff. | Do not handle or open bulging drums (contact Corp H&S for assistance). Bleed any built up pressure by carefully loosening bung prior to removing ring. Keep face and arms away from bung opening when loosening. Slightly lift lid, insert end of air monitoring device to monitor air inside drum. | |
| | | 3 | Use of mechanical tools to remove bolts from drum lids causes excessive noise. | Wear hearing protection. | |
| | | 4 | Splashing can occur if filling drum, or collecting samples. | Wear eye and face protection. Pour liquids into drum slowly to minimize splashing. | |
| | | 5 | When working with COCs that have fire/explosive properties, sparking or heat could cause fire/explosion. | Use brass or non-spark hand tools if such a hazard exists or is suspected. | |
| 3 | Sample Contents from Drums | 1 | Exposure to COCs can occur by contacting impacted contents. | Select proper dermal protection for task, at a minimum nitrile gloves should be worn. Wear appropriate eye face and body protection as outlined in the HASP. | |
| | | 2 | Staff can be exposed to chemical vapors/fumes when sampling. | Conduct air monitoring as outlined in the HASP, and if required, select appropriate respiratory protection for the task. | |
| | | 3 | Sharp edges and broken sample containers can cause lacerations. | Discard any broken sample ware or glass properly. Where ANSI Level A2 cut resistant gloves. Do not over tighten sample containers. | |
| | | 4 | Chemical burns or skin irritation can occur from contact with sample preservatives. | Wear chemical protective gloves when collecting samples, or when handling damaged sample containers. | |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 3 | Sample Contents from Drums | 4 | Chemical burns or skin irritation can occur from contact with sample preservatives. | Wear chemical protective gloves when collecting samples, or when handling damaged sample containers. | |
| 4 | Replace drum lids | 1 | Hand Injuries can occur from sharp edges, pinch points, and from use of hand tools. | see step 2 above | |
| 5 | Moving and Storing Drums | 1 | Drum storage areas can be accessed by the general public, or may not be secure. | Calculate how many drums will be stored in new location. Ensure that drums are not easily accessed by the general public. Do not store such that drums impede pedestrian or vehicular traffic. | |
| | | 2 | Muscle strain can occur when lifting/pulling/pushing drums. | Drums that are full can weigh as much as 800 lbs. Use a lift assist device whenever possible, and use a team lift approach. When moving soil drum generated by drilling, have drillers use their equipment to move the drums. Using dolly, slightly lift drum away from dolly to install forks under drum. Slowly let drum come back down and rest on dolly. Using hook on top of dolly, ensure it latches on top of drum bung. | |
| | | 3 | Body parts can be pinched between lift device, or drum and the ground. | Be aware of hand and foot placement during drum staging. Do not hurry through task. | |
| | | 4 | When moving, the drum can tip or the dolly could become unstable from uneven ground surface. | Plan travel route with drum prior to moving. With drum secure on dolly, have one employee pull back on dolly, and other employee slowly push back on drum toward dolly. Have second worker act as spotter for traffic, pedestrians, and any trip hazards along the way. | |
| | | 5 | Drum label missing, damage, or hard to read. | If content of drum cannot be discerned. Call SSO or project manager about content of drum and label correctly. If sampling for waste characterization use "This container on hold pending analysis label". | |

## PPE — Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Dermal Protection** | chemical protective suit (specify type) | | Recommended |
| **Eye Protection** | face shield | | Required |
| | safety goggles | | Required |
| **Hand Protection** | chemical resistant gloves (specify type) | Nitrile | Required |
| | work gloves (specify type) | ANSI Leve A2 Cut Resistant | Required |
| **Hearing Protection** | ear plugs | | Required |

## Review Comments

| Reviewer | | Comments |
|---|---|---|
| **Employee:**<br>**Role**<br>**Review Type**<br>**Completed Date** | Hover, Elizabeth A<br>HASP Reviewer<br>Approve<br>4/22/2019 | |

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | 16889 | **Status** | (3) Completed |
| **Job Name** | Environment-Groundwater Sampling and free product recovery | **Created Date** | 4/19/2019 |
| **Task Description** | Groundwater Sampling | **Completed Date** | 04/22/2019 |
| **Template** | False | **Auto Closed** | False |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | B00366481401 |
| **Project Name** | NG SIR NORTH ALBANY MGP SITE |
| **PIC** | YOUNG, TERRY |
| **Project Manager** | JONES, MICHAEL |

## User Roles

| Role | Employee | Due Date | Completed Date | Supervisor | Active |
|---|---|---|---|---|---|
| Developer | Healy, Lawrence C | 5/10/2019 | 4/19/2019 | Brien, Jason D | ; |
| HASP Reviewer | Hover, Elizabeth A | 5/3/2019 | 4/22/2019 | Hill, Sarah A | ; |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Stage at pre-determined sampling location and set up work zone and sampling equipment | 1 | Personnel could be hit by vehicular traffic | Set up cones and establish work area. Position vehicle so that field crew is protected from site traffic. Unload as close to work area as safely possible. | FHSFB III (L,AM) |
| | | 2 | Vehicles parked too close to stationary objects may strike them when driving from location. | Park vehicle so first movement is forward. Park in a location that will be free of stationary objects, such as bollards, monitoring wells, fence posts, etc. when the vehicle pulls forward. Avoid backing! | |
| | | 3 | Sampling equipment, tools and monitoring well covers can cause tripping hazard | Keep equipment picked up and use TRACK to assess changes. | |
| 2 | Open wells to equilibrate and gauge wells | 1 | When squatting, personnel can be difficult to see by vehicular traffic. | Wear class II traffic vest if wells are located proximal to vehicular traffic. Use tall cones and the buddy system if practicable. | FHSFB III (S,AF) |
| | | 2 | Pinch points on well vault can pinch or lacerate fingers | Use correct tools to open well vault/cap. Wear ANSI Level A2 cut-resistant gloves when removing well vault lids, and chemical protective gloves while gauging. Wear proper PPE including safety boots, knee pads and safety glasses. | |
| | | 3 | Lifting sampling equipment can cause muscle strain | Unload as close to work area as safely possible; use proper lifting and reaching techniques and body positioning; don't carry more than you can handle, and get help moving heavy or awkward objects. | |
| | | 4 | Pressure can build up inside well causing cap to release under pressure | Keep head away from well cap when removing. If pressure relief valves are on well use prior to opening well | |
| 3 | Begin Purging Well and Collecting Parameter Measurements | 1 | Electrical shock can occur when connecting/disconnecting pump from the battery. | Make sure equipment is turned off when connecting/disconnecting. Wear leather gloves. Use GFCIs when using powered tools and pumps. Do not use in the rain or run electrical cords through wet areas. | FHSFB III (C,M,AB,AF) |
| | | 2 | Purge water can spill or leak from equipment | Stop purging activities immediately, stop leakage and block any drainage grate with absorbent pads. Call PM to notify them of any reportable spill. | |
| | | 3 | Water spilling on the ground can cause muddy/slippery conditions | Be careful walking in work area when using plastic around well to protect from spillage | |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 3 (cont.) | Begin Purging Well and Collecting Parameter Measurements | 4 | Lacerations can occur when cutting materials such as plastic tubing | When cutting tubing, use tubing cutter. No open fixed blades should ever be used. When possible wear work gloves, ANSI Level A2 cut-resistant gloves. | |
| | | 5 | Purge water can splash into eyes | Pour water slowly into buckets/drums to minimize splashing. Wear safety glasses. | |
| 4 | Collect GW or Free Product Sample | 1 | Working with bailer rope can cause rope burns on hands. | Slowly raise and lower the rope or string for the bailer. Wear appropriate gloves for the task. | FHSFB III (S, AF) |
| | | 2 | Sample containers could break or leak preservative | Discard any broken sampleware or glass properly. Do not overtighten sample containers. Wear chemical protective gloves over ANSI Level A2 cut-resistant gloves. | |
| 5 | Recovery of Free Product from well | 1 | Exposure to free product | Additional chemical protection may be necessary based on the type of product. Additionally, safety goggles, a face shield, or respiratory protection may be required. Verify in the HASP. | |
| 6 | Staging of Well Purge water and/or Free Product | 1 | Muscle strains can occur when moving purge water or drums | If using buckets, do not fill buckets up to the top. Always keep lid on buckets when traveling or moving them to another location. Only half fill buckets so when dumping the buckets weigh less. See drum handling JSA for movement of drums. | Drum handling JSA |

## PPE — Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Dermal Protection** | long sleeve shirt/pants | | Recommended |
| **Eye Protection** | safety glasses | | Required |
| **Foot Protection** | steel-toe boots | | Required |
| **Hand Protection** | chemical resistant gloves (specify type) | Nitrile | Required |
| | work gloves (specify type) | ANSI Level A2 Cut Resistant | Required |
| **Head Protection** | hard hat | | Required |
| **Hearing Protection** | ear plugs | | Recommended |
| **Miscellaneous PPE** | other | Knee pads | Required |

## Supplies

| Type | Supply | Description | Required |
|---|---|---|---|
| **Communication Devices** | mobile phone | | Required |
| **Decontamination** | Decon supplies (specify type) | alconox, DI water, spray bottle | Required |
| **Miscellaneous** | fire extinguisher | | Required |
| | first aid kit | | Required |
| | flashlight | | Required |
| **Personal** | eye wash (specify type) | bottle | Required |
| | insect repellent | | Recommended |
| | sunscreen | | Recommended |
| | water/fluid replacement | | Required |
| **Traffic Control** | barricades | | Recommended |
| | traffic cones | | Required |

## Review Comments

| Reviewer | | Comments |
|---|---|---|
| **Employee:**<br>**Role**<br>**Review Type**<br>**Completed Date** | Hover, Elizabeth A<br>HASP Reviewer<br>Approve<br>4/22/2019 | |

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | 16891 | **Status** | (3) Completed |
| **Job Name** | Environment-Sample cooler handling | **Created Date** | 4/19/2019 |
| **Task Description** | Sample Cooler Handling | **Completed Date** | 04/22/2019 |
| **Template** | False | **Auto Closed** | False |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | B00366481401 |
| **Project Name** | NG SIR NORTH ALBANY MGP SITE |
| **PIC** | YOUNG, TERRY |
| **Project Manager** | JONES, MICHAEL |

## User Roles

| Role | Employee | Due Date | Completed Date | Supervisor | Active |
|---|---|---|---|---|---|
| Developer | Healy, Lawrence C | 5/10/2019 | 4/19/2019 | Brien, Jason D | ; |
| HASP Reviewer | Hover, Elizabeth A | 5/3/2019 | 4/22/2019 | Hill, Sarah A | ; |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Transfer field samples to sample packing area | 1 | Lifting heavy coolers may result in muscle strain especially to lower back. | Use proper lifting techniques and keep back straight. Use buddy system for large coolers, Use mechanical aids like hand trucks if readily available to move coolers. Do not over fill coolers with full sample containers for temporary movement to the sample prep area. Ensure an adequate supply of sample coolers are in field. | FHSFB III (B,F,I,AF,AG) |
| | | 2 | Hazards to hands from broken glass caused by over tightening lids or improper placement in cooler | Inspect all bottles and bottle caps for cracks/leaks before and after filling container. Do not over tighten sample lids. Clean up any broken bottles immediately, avoid contact with sample preservatives. Wear ANSI Level A2 cut-resistant gloves (under nitrile gloves) when handling broken glass. | |
| | | 3 | Exposure to chemicals ( acid preservatives or site contaminants) on the exterior of sample bottles after filling. | Wear protective gloves for acid preservatives and safety glasses with side shields during all sample container handling activities (before and after filling), Once filled follow project specific HASP PPE requirements for skin and eye protection. | |
| | | 4 | Samples containing hazardous materials may violate DOT/IATA HazMat shipping regulations | All persons filling a sample bottle or preparing a cooler for shipment must have complete ARCADIS DOT HazMat shipping training. Compare the samples collected to the materials described in the Shipping Determination for the Project and ensure consistent. Re-perform all Shipping determinations if free product is collected and not anticipated during planning. | |
| 2 | Sample cooler selection | 1 | Sample coolers with defective handles, lid hinges, lid hasps cracked or otherwise damaged may result in injury (cuts to hands, crushing of feet if handle breaks etc.) | Only use coolers that are new or in like new condition, No rope handled coolers unless part of the manufacturer's handle design. | ARCADIS Shipping Guide US-001 |
| | | 2 | Selection of excessively large coolers introduces lifting hazards once the cooler is filled. | Select coolers and instruct lab to only provide coolers of a size appropriate for the material being shipped. For ordinary sample shipping sample coolers should be 48 quart capacity or smaller to reduce lifting hazards. | |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 3 | Pack Samples | 1 | Pinch points and abrasions to hands from cooler lid closing unexpectedly | Beware that lid could slam shut; block/brace if needed; be wary of packing in strong winds. New coolers may be more prone to self-closing, tilt cooler back slightly to facilitate keeping lid open. | FHSFB III (M,AF) |
| | | 2 | Awkward body positions and contact stress to legs and knees when preparing coolers on irregular or hard ground surfaces. | Plan cooler prep activities. Situate cooler where neutral body positions can be maintained if practical, like truck tailgate. Avoid cooler prep on rough gravel surfaces unless knees and legs protected during kneeling. | |
| | | 3 | Frostbite or potential for oxygen deficiency when packing with dry ice. Contact cold stress to fingers handling blue ice or wet ice | Dry ice temperature is -109.30F. Wear thermal protective gloves. DO NOT TOUCH with bare skin! Dry ice sublimates at room temp and could create oxygen deficiency in closed environment. Maintain adequate ventilation! Do not keep dry ice in cab of truck. Wear gloves when handling blue ice or gaging wet ice. Dry Ice is DOT regulated for air shipping, follow procedures in Shipping Determination. | |
| 4 | Sealing, labeling and Marking Cooler | 1 | Cuts to hands and forearms from strapping tape placement or removing old tape and labels | Do not use a fixed, open-blade knife to remove old tags/labels, USE SCISSORS or other safety style cutting device. Only use devices designed for cutting. Do not hurry through task. | FHSHB III (M,AF) |
| | | 2 | Lifting and awkward body position hazards from taping heavy coolers, dropping coolers on feet during taping. | Do not hurry through the taping tasks, ensure samples in cooler are evenly distributed in cooler to reduce potential for overhanging cooler falling off edge of tailgate/table when taping. | |
| | | 3 | Improper labeling and marking may result in violation of DOT/IATA HazMat shipping regulations delaying shipment or resulting in regulatory penalty | Do not deviate from ARCADIS Shipping Guide or Shipping Determination marking or labeling requirements. | |
| 5 | Offering sample cooler to a carrier or lab courier for shipment. | 1 | Lifting heavy coolers may result in muscle strain especially to lower back. | See lifting hazard controls above. | FHSHB III (M,AF) |
| | | 2 | Carrier refusal to accept cooler may cause shipping delay and/or result in violation of DOT HazMat shipping regulations. | Promptly report all rejected and refused shipments to the ARCADIS DOT Program Manager. Do Not re-offer shipment if carrier requires additional labels markings or paperwork inconsistent with your training or Shipping Determination without contacting the ARCADIS DOT Compliance Manager. | |

## PPE — Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Eye Protection** | safety glasses | | Required |
| **Hand Protection** | chemical resistant gloves (specify type) | nitrile | Required |
| | work gloves (specify type) | ANSI Cut Level A2 Gloves | Required |
| **Miscellaneous PPE** | traffic vest--Class II or III | | Required |

## Supplies

| Type | Supply | Description | Required |
|---|---|---|---|
| **Miscellaneous** | first aid kit | | Required |
| | Other | Scissors | Required |
| **Personal** | eye wash (specify type) | bottle | Required |
| **Traffic Control** | barricades | | Recommended |
| | traffic cones | | Required |

## Review Comments

| Reviewer | | Comments |
|---|---|---|
| **Employee:**<br>**Role**<br>**Review Type**<br>**Completed Date** | Hover, Elizabeth A<br>HASP Reviewer<br>Approve<br>4/22/2019 | |

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | 16890 | **Status** | (3) Completed |
| **Job Name** | Environment-Soil sampling/well installation - manual | **Created Date** | 4/19/2019 |
| **Task Description** | Soil sampling using manual methods | **Completed Date** | 04/22/2019 |
| **Template** | False | **Auto Closed** | False |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | B00366481401 |
| **Project Name** | NG SIR NORTH ALBANY MGP SITE |
| **PIC** | YOUNG, TERRY |
| **Project Manager** | JONES, MICHAEL |

## User Roles

| Role | Employee | Due Date | Completed Date | Supervisor | Active |
|---|---|---|---|---|---|
| Developer | Healy, Lawrence C | 5/10/2019 | 4/19/2019 | Brien, Jason D | ; |
| HASP Reviewer | Hover, Elizabeth A | 5/3/2019 | 4/22/2019 | Hill, Sarah A | ; |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Sampling set-up | 1 | Muscle fatigue can occur from lifting heavy equipment in and out of vehicle | Park as close as possible to the sample locations. Use lifting techniques outlined in the Field H&S Handbook | EFHSHB III (A,H,EE) |
| | | 2 | Slips/trips/falls could occur from uneven walking and working surfaces | Remove any gravel or debris from sampling location. Gravel will get stuck in auger and continue to fall back down in hole. A five gallon bucket with the bottom cut out will retain gravel from falling back down in the hole. | |
| 2 | Collect Sample Soil Sample | 1 | Staff can come into contact with impacted soils | Wear chemical protective gloves as outlined in the HASP, and wear safety glasses. | FHSFB III (A,C,G,R,EE) |
| | | 2 | Sharp edges and broken glassware can cause lacerations | Discard any broken sample containers or glass. Do not overtighten sample containers. Wear ANSI level A2 cut-resistant gloves. | |
| | | 3 | Containerizing and moving soil cuttings can cause muscle strains | Dispose of left over soil cuttings in a drum or bucket and dispose properly. Only fill buckets half full due to weight and strength of bucket. Wear leather work gloves and use good lifting techniques when handling buckets. | |
| 3 | Fill in Sample Location | 1 | Open boreholes are a trip hazard | Fill in hole with sand or bentonite. Pack down chips as best as possible. Add a bit of DI Water to make chips swell and fill hole completely. | |
| | | 2 | Muscle strain can occur from lifting bags of sand and/or bentonite. | Use proper lifting techniques as detailed in the Field H&S handbook | |

## PPE — Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Dermal Protection** | splash apron | | Recommended |
| **Eye Protection** | safety glasses | | Required |
| **Foot Protection** | steel-toe boots | | Required |
| **Hand Protection** | chemical resistant gloves (specify type) | Nitrile | Required |
| | work gloves (specify type) | ANSI Level A2 Cut Resistant | Required |
| **Head Protection** | hard hat | | Required |
| **Hearing Protection** | ear plugs | | Required |
| **Miscellaneous PPE** | traffic vest--Class II or III | | Required |
| **Respiratory Protection** | dust mask | | Recommended |

## Supplies

| Type | Supply | Description | Required |
|---|---|---|---|
| **Decontamination** | Decon supplies (specify type) | DI water and Alconox | Required |
| **Miscellaneous** | first aid kit | | Required |
| **Personal** | eye wash (specify type) | bottle | Required |
| | sunscreen | | Recommended |
| | water/fluid replacement | | Required |
| **Traffic Control** | barricades | | Recommended |
| | traffic cones | | Required |

## Review Comments

| Reviewer | | Comments |
|---|---|---|
| **Employee:**<br>**Role**<br>**Review Type**<br>**Completed Date** | Hover, Elizabeth A<br>HASP Reviewer<br>Approve<br>4/22/2019 | |

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | 16886 | **Status** | (3) Completed |
| **Job Name** | Environment-Air Monitoring | **Created Date** | 4/19/2019 |
| **Task Description** | Community Air Monitoring | **Completed Date** | 04/22/2019 |
| **Template** | False | **Auto Closed** | False |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | B00366481401 |
| **Project Name** | NG SIR NORTH ALBANY MGP SITE |
| **PIC** | YOUNG, TERRY |
| **Project Manager** | JONES, MICHAEL |

## User Roles

| Role | Employee | Due Date | Completed Date | Supervisor | Active |
|---|---|---|---|---|---|
| Developer | Healy, Lawrence C | 5/10/2019 | 4/19/2019 | Brien, Jason D | ; |
| HASP Reviewer | Hover, Elizabeth A | 5/3/2019 | 4/22/2019 | Hill, Sarah A | ; |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 1 | Heavy lifting | Utilize appropriate lifting techniques. Team lift object heavier than 50 lbs. Utilize material handling equipment whenever possible. | EFHSHB section 3, subsection R, EE, and LL. |
| | | 2 | Abrasions | Use work gloves when handling equipment and supplies. | |
| | | 3 | Motor vehicle accident | Use Smith System defensive driving techniques. | |
| 2 | Tailgate Safety Meeting | 1 | Unaware of job site hazards, conditions and critical safety actions. | Conduct a tailgate safety briefing each day prior to the start of work and if job site and/or conditions change during the day. Review appropriate sections of the Field Safety & Health Handbook. Ensure that all employees are fully aware of all hazards and are wearing all necessary PPE. Ensure all employees are aware of the locations of emergency equipment and contacts. | ARCHSGE001. EFHSHB section 3, subsection A. |
| 3 | General Environmental Conditions | 1 | Heat Stress | a. Dress appropriately for the weather. b. Take frequent breaks as necessary to cool off. c. Stay hydrated by drinking plenty of water. d. Stay out of direct sunlight when possible. | EFHSHB section 3, subsections A, I, M, N, P, R, and EE. |
| | | 2 | Severe weather | a. Monitor the weather forecast for each day's activities. b. Take immediate shelter in a protected structure or field vehicle in the event of lightning, hail, high winds, or flooding. | |
| | | 3 | Bites/Stings - Insects/Spiders/Snakes | a. Wear insect repellant during outdoor activities. b. Avoid disturbing area that may be a habitat for insects, spiders, or snakes. Use caution when moving rocks, equipment, or other items that may be providing shelter for these animals. c. Wear sturdy boots to protect from snake bites. | |
| | | 4 | Heavy equipment operation in vicinity | a. Establish clearly marked work areas using barrier tape, cones, or other highly visible material. b. Wear safety vests when working in areas within 200 ft of heavy equipment operation. c. Notify the site contact of the work area. | |
| | | 5 | Uneven terrain | a. Survey the working area prior to set up. Mark any holes, pits, or other hazardous terrain. b. Wear sturdy safety shoes. | |
| | | 6 | Struck by vehicle due to improper traffic controls | Wear Class II traffic vest. If work is conducted in a ROW, reference ROW Traffic Safety Plan and use a flagger for traffic. | FHSFB V (F)<br><br>Traffic Safety Plan. |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 4 | Calibrate air monitoring equipment | 1 | Injury due to gas under pressure | Ensure that tubing and connections between gas cylinders, regulators instrument and tubing are secure and damage/leak free. If damaged remove and replace. Install and remove regulator valves away from face, body and other workers. Never leave the regulator installed in the cylinder when not in use. | ARC HSGE017 |
| | | 2 | Exposure to calibration gases (isobutylene, mixture five gases, benzene) | Conduct calibration in a well-ventilated area. | |
| | | 3 | Malfunctioning meters or skipped steps resulting in inadequate personnel protection | Make sure equipment is in proper working order and meets standards set by manufacturer. Replace equipment when needed. Follow operators manual. | |
| | | 4 | Poor or inadequate record keeping | Document all calibration data and note any deficiencies in the calibration or equipment readings. Have second person verify results. | |
| 5 | Equipment/Site Set Up | 1 | Materials handling/heavy lifting | Utilize appropriate lifting techniques. Team lift objects over 50 lbs. Utilize materials handling equipment whenever possible. | |
| | | 2 | Falls from height | Utilize personal fall arrest equipment when exposed to unprotected falls greater than 4 feet in height. | |
| | | 3 | Electricity- shock or electrocution | a. Inspect all extension cords prior to use. Mark all damaged cords and take them out of service. b. Protect cords in use from traffic or other damage. c. Ensure cords are appropriate for the load. | |
| 6 | Monitoring/Data Collection | 1 | Heat stress/Sunburn | Utilize a canopy over the monitoring area. Work in shaded areas when possible. Use sunscreen. Drink plenty of water and take breaks as necessary. | EFHSHB section 3, subsection A, M, R, M, and EE. |
| 7 | Decontamination | 1 | Contact with COC | Wipe down and clean monitoring equipment. Dispose properly of all protective clothing and spent decontamination supplies before leaving the exclusion zone. Remove any soil from boots before leaving the exclusion zone. | EFHSHB section 3, subsections A, I, M, N, P, R, and EE. |
| 8 | Care and storage of air monitoring equipment | 1 | Equipment breakage / malfunction - including batteries and power supply | Maintain integrity of dedicated systems. Properly store all equipment. Charge equipment nightly and as needed during the day. Have extra batteries / power supply onsite. Keep equipment clean. Inspect equipment to verify it is operational. Report any equipment issues to rental company for timely repair/replacement. Replace the saturated filters and clean the bulb with the cleaning kit periodically. | EFHSHB section 3, subsection A, I, M, N, P, and R. |

## PPE — Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Dermal Protection** | long sleeve shirt/pants | | Recommended |
| **Eye Protection** | safety glasses | | Required |
| **Foot Protection** | steel-toe boots | | Required |
| **Hand Protection** | work gloves (specify type) | leather or cotton | Required |
| **Head Protection** | hard hat | | Required |
| **Miscellaneous PPE** | traffic vest--Class II or III | | Required |
| **Respiratory Protection** | dust mask | | Recommended |

## Supplies

| Type | Supply | Description | Required |
|---|---|---|---|
| **Communication Devices** | mobile phone | | Required |
| **Miscellaneous** | first aid kit | | Required |
| | Other | Cones/Traffic control | Required |
| **Personal** | insect repellent | | Recommended |
| | sunscreen | | Recommended |
| | water/fluid replacement | | Required |
| **Traffic Control** | barricades | | Recommended |
| | traffic cones | | Required |

## Job Steps

| Job Step No. | Job Step Description | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|

## Review Comments

| Reviewer | | Comments |
|---|---|---|
| **Employee:** | Hover, Elizabeth A | |
| **Role** | HASP Reviewer | |
| **Review Type** | Approve | |
| **Completed Date** | 4/22/2019 | |

# Job Safety Analysis

## General

| | | | |
|---|---|---|---|
| **JSA ID** | 16887 | **Status** | (3) Completed |
| **Job Name** | Construction-Oversight - excavation and construction | **Created Date** | 4/19/2019 |
| **Task Description** | Construction Oversight | **Completed Date** | 04/22/2019 |
| **Template** | False | **Auto Closed** | False |

## Client / Project

| | |
|---|---|
| **Client** | National Grid |
| **Project Number** | B00366481401 |
| **Project Name** | NG SIR NORTH ALBANY MGP SITE |
| **PIC** | YOUNG, TERRY |
| **Project Manager** | JONES, MICHAEL |

## User Roles

| Role | Employee | Due Date | Completed Date | Supervisor | Active |
|---|---|---|---|---|---|
| Developer | Healy, Lawrence C | 5/10/2019 | 4/19/2019 | Brien, Jason D | ; |
| HASP Reviewer | Hover, Elizabeth A | 5/3/2019 | 4/22/2019 | Hill, Sarah A | ; |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 1 | Ensure that necessary traffic and public access controls are set up | 1 | Struck by vehicle due to improper traffic controls | Ensure a buddy system is used when placing site control cones and/or signage. Position vehicle so that you are protected from moving traffic. Wear Class II traffic vest. If work is conducted in a ROW, reference ROW Traffic Safety Plan and use a flagger for traffic. | FHSFB V (F) Traffic Safety Plan. |
| 2 | Utility Clearance | 1 | Contact with utilities can cause injury, property damage, and cause releases of hazardous substances to the environment. | Establish a minimum of three lines of evidence, and obtain additional lines of evidence as needed for site specific conditions. Maintain utility markings, perform detailed site inspections, and keep open and constant communication between operators, onsite staff, and project management. Always Use Stop Work Authority if there is a question or concern about the location of a utility. | ARCHSFS019 - Utility Clearance HS Standard. FHSHB III (A, G, Q, and MM). |
| | | 2 | Slip trip and falls while performing site clearance activities | Focus on task at hand and do not hurry through task. Avoid reading maps/drawings while walking, stop walking when looking up for overhead utilities. | |
| 3 | Excavation/Trenching and Backfilling Oversight | 1 | Slips trips and falls from poor housekeeping around trench or excavation. | Maintain work area and minimize clutter near excavation. Place excavated material properly and at least 2 feet away from the edge of excavation. Remove potential hazards when possible. Mark hazards when it cannot be removed. Create and maintain awareness of hazard. Maintain barriers, fall hazard warning signage and traffic controls properly. Do not cross over caution tape, safety fencing etc. Follow Project specific STAR Plan | FHSHB III (A,E,G,K,BB,JJ,KK,FF) and FHSHB IV(A,D,L) |
| | | 2 | Excavation or trench collapse trapping workers or creating falls. | Excavation/Trench greater than five (5) feet deep in which subcontractor, employees or others will be entering must be properly sloped, benched, shored or have a trench box in place. Sloping, benching, shoring or use of trench box is not required IF an excavation is less than five (5) feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in. Ensure a Competent Person is on site to inspect and oversee excavation/ trenching activities. Where feasible, stay six (6) feet from edge of excavation/trench. A safe means of egress, such as a stairway, ladder, or ramp, shall be located so that no more than twenty-five (25) feet of lateral travel is necessary for site workers conducting activities in trenches exceeding four (4) feet in depth. | |

## Job Steps

| Job Step No. | Job Step Description | | Potential Hazard | Critical Action | H&S Reference |
|---|---|---|---|---|---|
| 4 | Excavation/Trenching and Backfilling Oversight | 1 | Potential high level of dust, fumes, vapors or particulates creating visibility or inhalation/contact hazards could result in exposure above occupational exposure limit or create an IDLH atmosphere. | Visually monitor air for dust, and wet excavated soil as needed to control dust. Monitor for chemical vapors if hazard exists. The atmosphere must be tested in excavations greater than four (4) feet in depth where oxygen deficiency or toxic or flammable gases are likely to be present, before workers will be permitted to enter. Ensure downwind and perimeter monitoring also performed, if atmospheric hazards exists. | |
| | | 2 | Excessive noise from excavating equipment or pumps. | Make sure all authorized personnel including subcontractors are wearing hearing protection (ear plugs/muffs) when working around noisy equipment. Increase distance from noise hazard when practical. | |
| | | 3 | Potential Leaks of Petroleum Fluids and Lubricants from excavating equipment and support equipment. | Make sure all authorized personnel including subcontractors perform equipment inspections looking for leaks, cracked hoses, and loose fittings. Promptly and properly repair all leaks. | |
| | | 4 | Open Excavation, Unauthorized Entry, or Property Damage | Make sure all authorized personnel including subcontractors mark open excavation with demarcation tape, orange fencing, orange cones, etc. to prevent unauthorized / accidental entry. Make sure controls are adequate for traffic protection after dark or when the site is unstaffed. Backfill excavation area as soon as possible and fence off any excavation not backfilled at the end of the work day. | |
| | | 5 | Contact with potentially impacted groundwater and soil. | Conduct task in a calm, cautious manner. Wear appropriate PPE. Ensure equipment is in working conditions before start of work every day. Stop work immediately and report to the site manager, if any life threatening conditions exist. | |
| | | 6 | Working Around Heavy Machinery | Where feasible, maintain distance from excavation equipment in excess of the swing radius. Maintain eye contact with operators at all time. Ensure equipment is in good working condition before work begins. Wear appropriate PPE, including safety vest. Do not wear loose clothing and pull back long hair. Be aware of and avoid standing in red zones (equipment operator "blind-spots"). No personnel are permitted to stand underneath suspended loads. | |
| 5 | Stockpile Maintenance and Sampling | 1 | Falls climbing on or during covering of stockpile. | Avoid climbing on stockpiles when possible, keep hands free, do not hurry trough tasks such as pulling plastic sheeting up onto or over piles. | FHSHB III (A,E,D,H,M,EE,FF) |
| | | 2 | Overexertion placing plastic sheeting, weight, and straw bales. | Use proper lifting techniques, avoid twisting of body, and forceful pulling/pushing. Do not hurry through task. | |
| | | 3 | Cuts, scrapes, impalement from debris in stockpiles. | Have excavation contractor remove/isolate large chunks of concrete, exposed rebar etc. from stockpile to extent practical. Inspect areas prior to kneeling or placing hands when sampling upon stockpile. | |

## PPE — Personal Protective Equipment

| Type | Personal Protective Equipment | Description | Required |
|---|---|---|---|
| **Dermal Protection** | long sleeve shirt/pants | | Required |
| **Eye Protection** | safety glasses | | Required |
| **Foot Protection** | steel-toe boots | | Required |
| **Hand Protection** | chemical resistant gloves (specify type) | Nitrile | Required |
| | work gloves (specify type) | Leather when hand hazard exists; nitrile for soil/ | Required |
| **Head Protection** | hard hat | | Required |
| **Hearing Protection** | ear plugs | When working near heavy equipment | Required |
| **Miscellaneous PPE** | traffic vest--Class II or III | | Required |
| **Respiratory Protection** | dust mask | | Recommended |

## Supplies

| Type | Supply | Description | Required |
|---|---|---|---|
| **Communication Devices** | mobile phone | Remote area, check reception | Required |
| **Decontamination** | Decon supplies (specify type) | Water and Alconox | Required |
| **Miscellaneous** | fire extinguisher | | Required |
| | first aid kit | | Required |
| | flashlight | | Required |
| **Personal** | eye wash (specify type) | | Required |
| | insect repellent | | Recommended |
| | sunscreen | | Recommended |
| | water/fluid replacement | | Required |
| **Traffic Control** | barricades | | Recommended |
| | Other | Cones/tape to delineate trenches prior to backfill | Required |
| | traffic cones | | Recommended |

## Review Comments

| Reviewer | | Comments |
|---|---|---|
| **Employee:**<br>**Role**<br>**Review Type**<br>**Completed Date** | Hover, Elizabeth A<br>HASP Reviewer<br>Approve<br>4/22/2019 | |

**Attachment B**
Shipping Determination

**SHIPPING/TRANSPORTATION DETERMINATION FORM** Revision 11

Non-Regulated Shipping Determination

| | |
|---|---|
| Date: | 9/9/2020 |
| Project Name: | North Albany Service Center |
| Project Number: | 300058019 |

*1) Check the following to certify the sample media being transported/shipped meet non-regulated or not restricted status:*

☐ Samples will not be collected on this project

*OR*

☑ The following samples have been reviewed and do not meet criteria of a regulated shipment under DOT or IATA:

*Check applicable media that will be sampled on the project:*

| | | |
|---|---|---|
| ☑ Soil | ☑ Groundwater | ☐ Air samples |
| ☐ Sediment | ☐ Surface water | ☐ Tissue, body part, or body fluid (1) |
| ☐ Sludge | ☐ Process water | ☐ Plant tissue, part or fluid |
| ☐ Bldg. materials | ☐ Waste water | ☐ Mold |
| ☐ Articles | ☐ Potable water | ☐ Investigation derived waste (all media types) |
| | ☐ Product | ☐ Other: |

☑ The following location(s) and media are not covered by above, are considered HazMat for shipping/transportation, and are subject to an additional shipping determination:

1a NAPL's, Free-Product, and/or Coal tar-like material, if encountered.

The following locations are known to contain hazardous waste and are not covered under this shipping determination:

WC-5 (9-15 ft bgs) WC-6 (11-16 ft bgs) WC-7 (7-16 ft bgs)
WC-8 (8-16 ft bgs) WC-10 (11-21.6 ft bgs)

*2) For sample preservatives, the following checkboxes must be checked confirming a non-regulated/not restricted determination:*

☐ Sample containers will be filled and preserved in accordance with EPA SW-846 protocols (2)
☑ Sample containers will not be field preserved with acids or bases by Arcadis staff
☐ Empty but preserved sample containers will not be return shipped to the laboratory or office
☐ EPA Method 5035 (TerraCore) samples will not be collected (3)

Supplemental information used to confirm section 1 and 2 conclusions:

- Work plan/QAPP
- Analytical data (attached)

*3) Certify the following by checking the applicable categories that will be shipped or transported on this project (at least one category must be checked):*

☐ Equipment and supplies will not be transported or shipped on this project.

*OR*

☑ Rental equipment being transported/shipped will not contain materials subject to DOT/IATA regulation (4)
☑ Field test kits, fire extinguishers and first aid kits will not be shipped
☐ Remediation chemicals transported in quantities >440 pounds gross weight per vehicle are not DOT regulated
☐ Other equipment and supplies used on this project are:
  ☐ Not regulated for transport; and/or
  ☐ Eligible for materials of trade exception (5)

☐ The following equipment/supplies are not covered by above, are considered HazMat for shipping/transportation, and are subject to an additional shipping determination:

3a

Supplemental information used to confirm this conclusion:

Completion of the "Determination" worksheet or use of generic shipping determination is required for each material listed in section 1a and/or 3a above. Issue this worksheet and "Field Quick View" worksheet(s), and/or generic shipping determination(s) to field staff unless otherwise instructed on "Determination" worksheet.

3) Certification:

I certify that I am current in HazMat #1 or approved equivalent and the above determination is true and correct to the best of my knowledge.

Name : L. Carey Healy

Signature:

Reviewed By: Josh Sinay

May be signed by any currently trained HazMat #1 employee

Notes:

1) This category applies to mammals, reptiles, birds, fish, insects, arachnids and all other vertebrate and invertebrate organisms.
2) This category is limited to containers preserved with ≤4 ml of preservatives and excludes containers used to preserve human or animal tissue described in footnote 1.
3) Unhide and review the generic Quick Form for TerraCores for details
4) Unhide and attach the generic Quick Form for rental equipment.
5) Unhide and attach the generic Quick Form for MOT transport.

**Attachment C**
Traffic Safety Plan

**Traffic Safety Plan (TSP)**

## 1.0 General

| | |
|---|---|
| Plan type | Non-Right of Way (Non-ROW) |
| Project Name: | North Albany Service Center |
| Project Number: | 30003953.00011 |
| Developer Name: | Matt Hysell |
| Duration of Project (in hours or days): | 7.9 Hours per day for 2 days |
| Time Restrictions (Y/N, if Y describe below): | N |
| Not Applicable | |
| Not Applicable | |
| Not Applicable | NA |
| Not Applicable | |
| Not Applicable | NA |

☐ Working on multiple roads?

Comments:

## 2.0 Work Description

Provide a brief description of scope of work:

Construction oversight to vacuum excavate trenches and perform community air monitoring. Work will take place near the Versaire building on an active facility parking lot.

## 3.0 Type and Duration

Work locations on this project will be: Intermediate work (1-8 hours per location)

Non-ROW work will be performed in: Active parking lot

Special traffic conditions may include (select most prevalent): Construction equipment

## 4.0 Traffic Control Layout, Number of Devices Required, and Phasing

The following Non-ROW requirements in the Traffic Safety Handbook applies:

Section 7.3 Intermediate Duration Work in Parking Areas (1 to 8 Hours) (DOT Facts-302b)

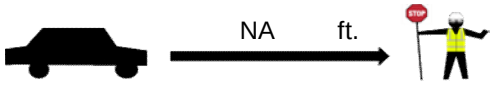
The menu below will be blank and is not applicable.

The menu below will be blank and is not applicable.

Non-ROW configuration:
An example non-ROW traffic control configuration for this project is illustrated below. The actual type and number of devices required are specified below. Don't leave vehicle doors open. Don't establish controls within 25 ft of the front or rear of parked large vehicles/rolling equipment without coordinating with the vehicle/equipment operator.



Intermediate Term (1-8 Hours)
Channelizing Cones with Caution Tape

| ROW minimum sign spacing distances for "A", "B" and "C" (as applicable) in referenced DOT Facts. | ROW oncoming traffic minimum site distance required to see Flagger and properly decelerate and stop. |
|---|---|
| A NA ft.<br>B NA ft.<br>C NA ft. |  NA ft. |

ROW Cone Calculation (Values are default. Light grey fields may be modified based on actual road conditions)

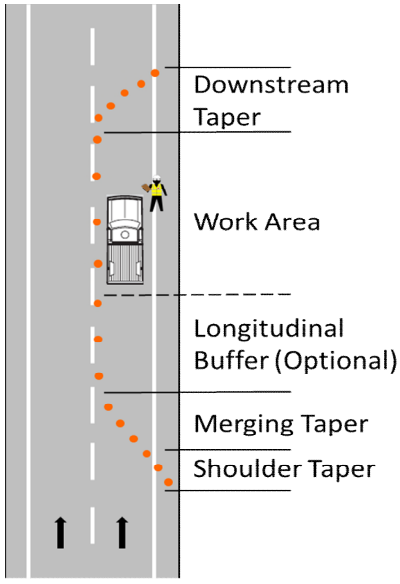
| | | |
|---|---|---|
| | Active work area length (feet) | 200 |
| ☐ | Apply Optional Longitudinal Buffer (ft)? | 0 |
| | Lane width of offset (feet) | 12 |
| | Shoulder width of offset (feet) | 8 |
| | Posted speed limit | NA |

☐ **Shoulder Taper**

| | |
|---|---|
| Taper Length (feet) | NA |
| Cones Required | NA |
| Cones Spacing (max., ft) | NA |

☐ **Merging Taper**

| | |
|---|---|
| Taper Length (feet) | NA |
| Cones Required | NA |
| Cones Spacing (max., ft) | NA |



☐ **Work Area**

| | |
|---|---|
| Cone Spacing (max., ft) | NA |
| Cones Required | NA |

☐ **Downstream Taper**

| | |
|---|---|
| Taper Length (feet) | NA |
| Cones Required | NA |
| Cone Spacing (max., ft) | NA |

**Cones Required (minimum)** NA

Note: Review taper configuration and cone spacing after ROW implementation to ensure traffic is moving efficiently without motorist confusion in the RWZ.

Select the traffic control devices to be used and enter number each required:

| *Check all that apply:* | | *Wording or Pictogram* | *Number:* |
|---|---|---|---|
| | Warning signs | | |
| | Warning signs | | |
| | Warning signs | | |
| | Stop/Slow paddle | | |
| | Red flag | | |
| | Drums | | |
| 6 | Channelizer cone (42 inch height, 10 lb base) | | |
| | Channelizer cone (42 inch height, 30 lb base) | | |
| | Traffic cones (≥ 18 inches tall) | | NA |
| | Barricade: | | |
| 6 | Flags for cones | | |
| | Lights (for night work) | | |
| | Plastic fencing (rolls) | | |
| 2 | Caution tape (rolls) | | |
| | Other (specify): | | |

**Non-ROW Phasing:**

1) Position truck as shield, if practical

2) Deploy traffic control devices

3) Affix flags, caution tape or fencing

4) Unload project equipment

5) Commence work

6) SSO to maintain controls

7) Remove controls in reverse order

Electronic Device Use Safety

Electronic devices (tablets, laptops and cell phones) used for data collection or work documentation are not anticipated to be used on this project. If these devices are used for data collection or work documentation, their use and distraction hazards must be addressed in the safety briefing.

Reviewed By:

HASP Reviewer: _____

**Traffic Safety Plan (TSP)**

## 1.0 General

| | |
|---|---|
| Plan type | Right of Way (ROW) |
| Project Name: | North Albany Service Center |
| Project Number: | 30003953.00011 |
| Developer Name: | Matt Hysell |
| Duration of Project (in hours or days): | 7.9 Hours per day for 2 days |
| Time Restrictions (Y/N, if Y describe below): | N |
| Roadway Work Zone Start Point | Bridge street just south of Broadway intersection |
| Roadway Work Zone End Point | Bridge Street just north of Mill Street |
| Posted Speed Limit (roadway in mph) | 30 |
| Number of Lanes (each direction) | 1 |
| Road Category Type (select) | Urban (≤40 mph) |

☐ Working on multiple roads?

Comments: Vacuum truck will be located within the parking lanes. There will be no encroachment into travel lanes. Use Road Work Ahead sign instead of Shoulder Work Ahead.

## 2.0 Work Description

Provide a brief description of scope of work:

Vacuum excavation for soil borings along Bridge Street between Broadway and Mill Street.

## 3.0 Type and Duration

Work locations on this project will be: Intermediate work (1-8 hours per location)

Roadway work will be performed: On shoulder

Special traffic conditions may include (select most prevalent): Construction equipment

## 4.0 Traffic Control Layout, Number of Devices Required, and Phasing

The following traffic control configuration in the Traffic Safety Handbook applies:

Section 6.2 Work on the Shoulder (DOT Facts-301j)

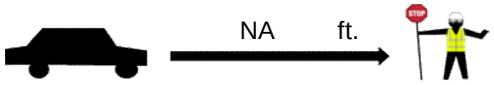
The menu below will be blank and is not applicable.

The menu below will be blank and is not applicable.

All Arcadis vehicles in a ROW will, at a minimum, have a functioning high intensity strobe or rotating orange light. All Arcadis employees in the ROW will wear, at a minimum, a retroreflective high visibility outer clothing meeting ANSI Class II or III requirements and other PPE required by JSA or HASP. Don't leave vehicle doors open. Park vehicles in ROW with front wheels turned to the right. Avoid work configurations requiring standing to rear of vehicles. Stage equipment in vehicles where it can be accessed from the right side of the vehicle to the extent practical. Do not park within 25 ft of the rear or front of parked large vehicles/construction equipment.



Intermediate Term (1-8 Hours)
Channelizing Cones with Caution Tape

| ROW minimum sign spacing distances for "A", "B" and "C" (as applicable) in referenced DOT Facts. | ROW oncoming traffic minimum site distance required to see Flagger and properly decelerate and stop. |
|---|---|
| A 100 ft.<br>B 100 ft.<br>C 100 ft. | NA ft.  |

ROW Cone Calculation (Values are default. Light grey fields may be modified based on actual road conditions)

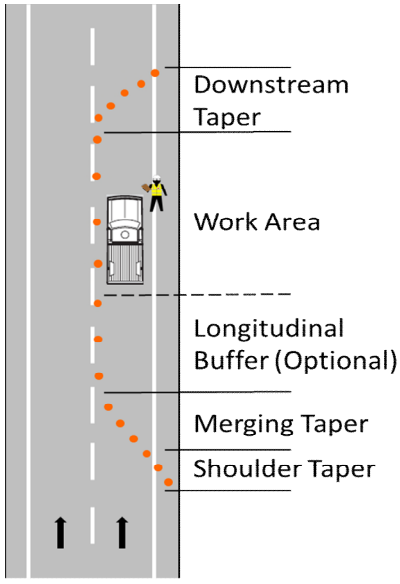
| | | |
|---|---|---|
| | Active work area length (feet) | 200 |
| ☐ | Apply Optional Longitudinal Buffer (ft)? | 0 |
| | Lane width of offset (feet) | |
| | Shoulder width of offset (feet) | 8 |
| | Posted speed limit | 30 |

☐ **Shoulder Taper**

| | |
|---|---|
| Taper Length (feet) | NA |
| Cones Required | 0 |
| Cones Spacing (max., ft) | NA |

☐ **Merging Taper**

| | |
|---|---|
| Taper Length (feet) | NA |
| Cones Required | 0 |
| Cones Spacing (max., ft) | NA |



| | | | |
|---|---|---|---|
| x | **Work Area** | | |
| | Cone Spacing (max., ft) | 60 | |
| | Cones Required | 3 | Note: Review taper configuration and cone spacing after ROW implementation to ensure traffic is moving efficiently without motorist confusion in the RWZ. |
| | **Downstream Taper** | | |
| | Taper Length (feet) | NA | |
| | Cones Required | 0 | |
| | Cone Spacing (max., ft) | NA | |
| | **Cones Required (minimum)** | 3 | |

Select the traffic control devices to be used and enter number each required:

| *Check all that apply:* | | *Wording or Pictogram* | *Number:* |
|---|---|---|---|
| x | Warning signs | Road Work Ahead | 1 |
| x | Warning signs | End Road Work | 1 |
| | Warning signs | | |
| | Stop/Slow paddle | | |
| | Red flag | | |
| | Drums | | |
| 3 | Channelizer cone (42 inch height, 10 lb base) | | |
| | Channelizer cone (42 inch height, 30 lb base) | | |
| | Traffic cones (≥ 18 inches tall) | | 3 |
| | Barricade: | | |
| | Flags for cones | | |
| | Lights (for night work) | | |
| | Plastic fencing (rolls) | | |
| | Caution tape (rolls) | | |
| | Other (specify): | | |

**ROW Phasing:**

1) Deploy warning signs at first approach, if required

2) Deploy subsequent approach warning signs, if required

3) Deploy channeling devices, if required, starting with first approach

4) Deploy "End Road Work" signs, if required

5) Position vehicle as shield to the extent practical

6) Commence work, SSO or designated contractor to maintain devices

7) Remove devices in reverse order

Electronic Device Use Safety

Electronic devices (tablets, laptops and cell phones) used for data collection or work documentation are not anticipated to be used on this project. If these devices are used for data collection or work documentation, their use and distraction hazards must be addressed in the safety briefing.

Reviewed By:

HASP Reviewer: _____

EJE Reviewer Ari Deitch, PE, PTOE, PTP, RSP

**Attachment D**
HASP Forms

# Task Improvement Process

## General

Observed Company:

Observation Type:

TIP Form: H&S Field Multi-Task (General)

Task Observed:

Observee Name:

Observer Name:

Observation Date:

Project Number: 30003953.00011

Project Name: North Albany Service Center

Supervisor:

Equipment On Site:

Pertinent Information:

## Observation

| Task | Correct | Questionable | Comments |
|---|---|---|---|
| **General** | | | |
| PPE worn according to HASP/JLA specifications and inspected before use? | | | |
| STOP work authority used where appropriate? | | | |
| **Body Use/Positioning** | | | |
| Proper lifting/pushing/pulling techniques used (no awkward positions/posture; no twisting or excessive reaching; no straining; no excessive weight; load under control/stable; etc.)? | | | |
| Body parts away from pinch points (clear or protected from being caught between objects/equipment or from contacting sharp objects/edges, etc.)? | | | |
| Body parts not in the Line of Fire (protected from being struck by traffic, equipment, falling/flying objects, etc.)? | | | |
| **Work Procedures/Environment** | | | |
| Correct type and number of barricades/warning devices/cones? | | | |

| | | | |
|---|---|---|---|
| Communication with others when necessary (hand signals, flags, etc.)? | | | |
| Right tools and equipment selected for the job and inspected before use? | | | |
| Tools and equipment used properly? | | | |
| Housekeeping performed (work areas and pathways clear of hazards, uneven surfaces addressed, etc.)? | | | |
| Slip/trip/fall hazards addressed (path selected and cleared, eyes on path, speed footing, etc.)? | | | |
| Proper energy control (electrical systems grounded, lock out/tag out performed, isolated, cords/fixtures in good condition, GFCI inspected and utilized when appropriate and used properly, etc.)? | | | |
| Protected from overhead/underground utilities (proper clearance, properly marked, spotters as necessary, etc.)? | | | |
| Safe work on/near water (appropriate flotation device, appropriate boat for body of water and operation of boat, etc.)? | | | |
| Chemical/Radiation protection (decontamination zones set up properly, air monitoring, completed, and logged, etc.)? | | | |
| Fall from elevated height prevention (maintains 3-points of contact, appropriate ladder, mounting/dismounting vehicle/equipment, fall arrest system, etc.)? | | | |
| Any additional safety issues identified: | | | |

**Tip Summary** **Enter details of the TIP and follow up discussion provide details on how any questionable items were resolved.**

Discussion following the TIP led by: _____

Date of follow-up discussion: _____

Positive Comments:

| |
|---|
| |

Discussion Summary Completed:

- ☐ Supervisor Led
- ☐ Peer to Peer
- ☐ Arcadis Employee to Subcontractor

Summary of Questionable Items

| |
|---|
| |

**Action Items (Optional)** Assign appropriate action items based on the observations made. You can add more than one action item if needed.

| Item # | Action Item | Responsible Person | Due Date | Comp. Date |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |

## Standard Review

Reviews to be performed after entry of this TIP into 4-Sight.

## Quality Review

Quality Reviews to be performed after entry of this TIP into 4-Sight.

## Field Validation and Verification

Use the 4-Sight generated copy of this TIP to perform field V&V activities.

# PID Calibration Log

ARCADIS

Zero  Gas Source: ____________________ Instrument Type: ____________________ PAGE ____ of ____

Lot Number/Expiration Date: ____________________ Serial Number: ____________________

Calibration Gas Source: ____________________ Instrument Type: ____________________

Lot Number/Expiration Date: ____________________ Serial Number: ____________________

Concentration: ____________________ ____________________

| Instrument Number | Date | Time | Zero Cal. OK (Y/N) | Calibration Gas Reading | Comments | Calibration w/in 2% (Y/N)? | Alarms Set (Yes/No)? | User Initials |
|---|---|---|---|---|---|---|---|---|
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**THIS FORM MUST BE ENTIRELY COMPLETED PRIOR TO BEGINNING ANY INTRUSIVE WORK**

Project Name: North Albany Service Center  Start Date:

Project #: 30003953.00011  End Date:

*Utility markings valid for 15 days. Initiate clearance renewal 5 days prior to expiration for ongoing work*

**PRE-FIELD WORK REQUIREMENTS**

DigSafe 811 notified 48-72 hrs. in advance of work? ☐ DigSafe Ticket #:

Ticket Expiration Date: State Utility Laws: www.commongroundalliance.com/map

Ticket(s) Attached(Y/N)? ☐ List utility owners notified via DigSafe 811 & response status:

List addt'l. utilities requiring notification not included in DigSafe811 Notice:

*Review task details w/ private utility location subcontractor. ID work areas, clearance equipment needed, depth of clearance needed, types of features, utilities, anticipated/known/unknown. Verify DigSafe 811 markings to confirm public utility clearance.*

Private Utility Locator Name, if used: AUS onsite meeting (Y/N)? ☐

**FIELD WORK REQUIREMENTS**

*This portion of the checklist must be completed on site. AUS staff must have a minimum of one year of field experience in identifying utilities to complete the checklist. Field staff will review the completed checklist with PM or designee prior to beginning intrusive work.*

*Heavy equipment/mechanized intrusive work w/in the Arcadis Tolerance Zone (utility or structure present within 30-in. of point of work) REQUIRES pre-approval by Corporate H&S prior to working at all such locations. STOP WORK if the Arcadis Tolerance Zone work has not been approved.*

List work type & locations for utility location and clearance as applicable to this checklist:

*3 Reliable Lines of Evidence are REQUIRED for EACH INTRUSIVE LOCATION prior to starting any subsurface intrusive work. Check corresponding boxes below to document utility clearance efforts.*

☐ OneCall/DigSafe 811 Public Utility Locate (required by State law for subsurface work)

*811 is only reliable as a Line of Evidence when working in/adjacent to a public ROW or easement.*

Marking type: ☐ Paint ☐ Pin Flags/Stakes ☐ Other: ☐ None

☐ Client provided maps/drawings (Y/N)? ☐ Maps/drawings not provided (Y/N)?

☐ Client Clearance (Y/N)? Name(s)/Affiliation(s):

☐ Interviews (Y/N)? Name(s)/Affiliation(s):

☐ Specific subsurface feature types and depths provided by person interviewed (Y/N)?

Details provided:

☐ Site Inspected (Y/N)? (document on Pg. 2.) Photo Document Marked Utilities & Structures

☐ Public records/Client Dwgs/As-Builts (Y/N)? Type:

List private locator tools used: ☐ Radio Freq. Detection ☐ Electromagnetic ☐ GPR

☐ Metal Detector ☐ Acoustic Pipe Locator ☐ Downhole sonde Other:

☐ Soft Dig Methods used (Y/N)? ☐ Hand auger ☐ Probing ☐ Hand tools (shovel/rake)

☐ Air knife ☐ Hydro Knife ☐ Potholing/Vacuum extraction

☐ Other soft dig tools used (Y/N)? If Yes, list here:

**ALL BOXES BELOW MUST BE COMPLETED BEFORE PROCEEDING**

*Site inspection also requires investigating vicinity outside of the work area for structures and utilities.*
*Noting "YES" requires addt'l. investigation. Utilities must be field marked prior to intrusive work.*

| Is the utility present (Y/N)? | | Utility Color Code |
|---|---|---|
| | Utilities entering/exiting structures? | No Color |
| | Intrusive work area marked out? | White |
| | Structural features above or below? | White |
| | Public natural gas line or meter? | Yellow |
| | Private natural gas laterals/feeders? | Yellow |
| | Public electrical service? | Red |
| | Conduit from meter or on wall? | Red |
| | Conduit from poles into ground? | Red |
| | Poles/devices w/ no visible lines? | Red |
| | Overhead electrical lines? | Red |
| | Solar arrays or wind turbines? | Red |
| | Public water line(s)? | Blue |
| | Private water line(s) or lateral(s)? | Blue |
| | Water meter onsite? | Blue |
| | Fire hydrants/post indicator valves? | Blue |
| | Irrigation system control box/valve? | Blue |
| | Sprinkler heads, drip lines, vaults? | Blue |
| | Water dispensers, fill stations? | Blue |
| | Telecomm. overhead or buried? | Orange |
| | Telecomm. ground box or relays? | Orange |
| | Telecomm./security CCTV devices? | Orange |
| | Public sanitary sewer pipes? | Green |
| | Combined sanitary/storm pipes? | Green |
| | Private sanitary laterals/clean outs? | Green |
| | Restrooms, kitchens, wash bays? | Green |

| Is the utility present (Y/N)? | | Utility Color Code |
|---|---|---|
| | Evidence of stormwater network? | Green |
| | Curb drains/catch basins/manholes? | Green |
| | Stormwater culverts, outfalls? | Green |

ABOVEGROUND Features Present?

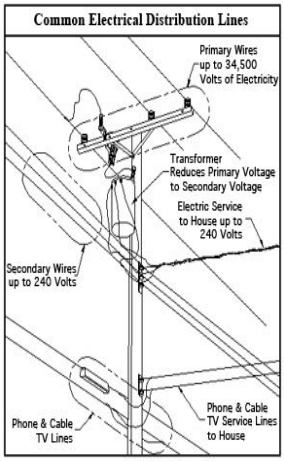
| | | |
|---|---|---|
| | Transportation tunnels/structures/markers present? | |
| | Overhead electrical lines? | Red |
| | < 50 kV w/in 10 ft of work area? | Red |
| | >50-200 kV w/in 15 ft of work area? | Red |
| | >200-350 kV w/in 20 ft of work area? | Red |
| | >350-500 kV w/in 25 ft of work area? | Red |
| | >500-750 kV w/in 35 ft of work area? | Red |
| | >750-1000 kV w/in 45 ft of work area? | Red |
| | Aboveground fire suppression? | Blue |
| | Aboveground communications? | Orange |
| | Aboveground chases/racks/trays? | Orange |
| | Private/Remediation system lines? | Various |
| | Unclassed utilities/anomalies? | Pink |
| | Warning signs/stakes/markers present? | |
| | Heavy Equipment: Mark travel route for overhead, next to route, and/or under route (e.g. crush risk) utilities. | |

Signs of other utilities/ground disturbance

| | |
|---|---|
| | Signs of asphalt or concrete disturbance/repair? |
| | Any ground subsidence or change in vegetation? |
| | Unknown manholes or valve covers in work area? |

Tips for Thorough Utility Location (HSS Section 5.6):

1. Don't forget to look up for utilities
2. Be on-site with Private Utility Locators.
3. Ask Private Locators to "confirm" other's markings.
4. Also clear alternate/backup locations
5. Mark all known utilities.
6. No hammering, no pickaxes, no digging bars, no shortcutting.
7. No excessive turning or downward force of hand tools, especially hand augers.
8. Utilities may run in or directly under asphalt/concrete
9. Heavy equipment may damage shallow utilities. Especially during clearing and grubbing.
10. Use spotter for heavy equipment near aboveground utilities?




☐ Utilities & Structures Checklist reviewed by the PM or Designee (Y/N)? *If no, STOP WORK call PM*

PM or Designee Name: _____

Name and Signature of person completing the checklist: _____

Date of checklist review / update: _____

*ALL SUSPECT UTILITY STRIKES REQUIRE CORPORATE H&S NOTIFICATION WITHIN 24 hrs. OF KNOWLEDGE OF STRIKE WITH A CONFIRMED RESPONSE FROM CORPORATE H&S.*

## Arcadis Weekly Vehicle Inspection Form (Revised 9/28/2022)

ARCADIS

**Vehicle # / License Plate #** _____ **Lease Plan # / Last 6 of Vin #** _____

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Inspection Date** | | | | | | | | | | | | |
| | **Odometer reading** | | | | | | | | | | | | |
| | **Driver / Inspector Name** | | | | | | | | | | | | |
| | *Check the appropriate box and enter repair date for identified repairs:* | OK | Needs Repair | Repair Date | OK | Needs Repair | Repair Date | OK | Needs Repair | Repair Date | OK | Needs Repair | Repair Date |
| **Interior** | Horn operational | | | | | | | | | | | | |
| | Door Locks operational | | | | | | | | | | | | |
| | Seat Belts in good repair | | | | | | | | | | | | |
| | Seats and Seating Controls | | | | | | | | | | | | |
| | Steering Wheel - No Excessive Play | | | | | | | | | | | | |
| | Interior Lights and Light Controls | | | | | | | | | | | | |
| | Instrument Panel/Gauges | | | | | | | | | | | | |
| | Wiper Controls operational | | | | | | | | | | | | |
| | Heat/Defrost/Air Conditioning working | | | | | | | | | | | | |
| | Rear View Mirror present | | | | | | | | | | | | |
| | Backup Camera/Sensors working | | | | | | | | | | | | |
| | Jack and Lug Wrench present | | | | | | | | | | | | |
| **Exterior[1]** | Lights and Signals operational | | | | | | | | | | | | |
| | ires properly inflated/good tread depth | | | | | | | | | | | | |
| | Spare Tire properly inflated | | | | | | | | | | | | |
| | Doors operational | | | | | | | | | | | | |
| | Windows Not Cracked/Damaged | | | | | | | | | | | | |
| | Side View Mirrors | | | | | | | | | | | | |
| | Body Panels and Bumpers | | | | | | | | | | | | |
| **Engine & Brakes** | Engine Start & Running Smoothly | | | | | | | | | | | | |
| | Fluid Levels, No Noticeable Leaks | | | | | | | | | | | | |
| | Belts tight, no cracks | | | | | | | | | | | | |
| | Brakes operational, no squeaking | | | | | | | | | | | | |
| **Emergency Equipment[2]** | First Aid Kit, inspected weekly | | | | | | | | | | | | |
| | Fire Extinguisher properly secured | | | | | | | | | | | | |
| | Fire Extinguisher inspected weekly | | | | | | | | | | | | |
| | range/Yellow emergency warning light | | | | | | | | | | | | |
| | Roadside Assistance Information | | | | | | | | | | | | |
| | Recommend spotter cones available | | | | | | | | | | | | |
| **Cargo** | Cargo Secure and Properly Distributed | | | | | | | | | | | | |
| | Securing Devices in Good Condition | | | | | | | | | | | | |
| **Registration** | License Plate /Tags | | | | | | | | | | | | |
| | Registration and Insurance | | | | | | | | | | | | |
| | City/State Inspection Decal | | | | | | | | | | | | |
| | Lease Plan information/Fuel Card | | | | | | | | | | | | |

[1] **Note all damages to the vehicle on the back of this page**

[2] **Emergency Equipment required per Motor Vehicle Standard ARC HSGE024**

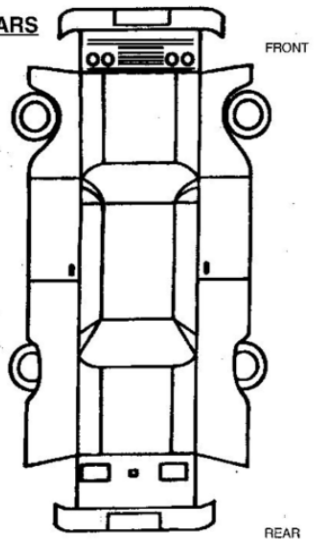
## Note All Vehicle Damage Below

**All Vehicle Damage must be reported to ANA_insuranceinquiries@arcadis.com, Zach Mongan (EF H&S), and Susan Atwood (EF Fleet Manger)**

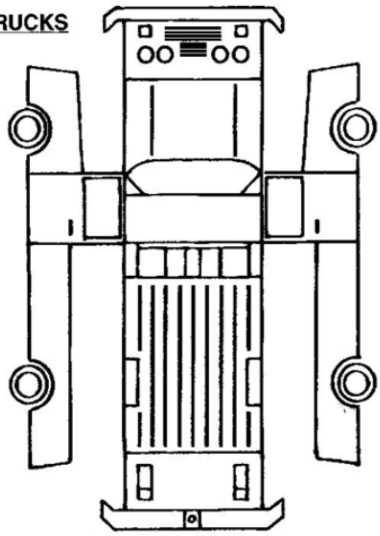
**CODES:**

B-BENT
BR-BROKEN
BU-BULGE
C-CHAFED
CH-CHIPPED
CPM-COVERED WITH PROTECTIVE MATERIAL-UNABLE TO DETERMINE DEFECTS IF ANY
CSA-CHAFED AND SCRATCHED ALL OVER
CR-CRACKED
D-DENTED
DMC-DUST AND MUD COVERED UNABLE TO DETERMINE OTHER DEFECTS IF ANY
G-GOUGED OR CUT
GC-GLASS CRACKED
HS-HAIRLINE SCRATCH
M-MISSING
P-PUNCTURED
R-RUSTY
S-SCRATCHED
SC-SCRAPED
SM-SMASHED
ST-STAINED AND/OR SOILED
T-TORN

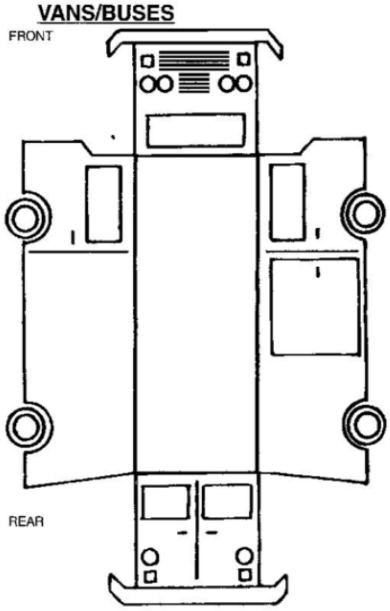
**CARS**




**TRUCKS**



**VANS/BUSES**




-INDICATE ON DIAGRAM-
-GIVE DIMENSIONS-
-CIRCLE WHERE APPLICABLE-

Notes:

Tread guide: If a tread gauge is not available coins may be used to determine remaining tread. 2/32” is the minimum by law in most states (top of Lincoln’s head on penny), 4/32” is minimum recommended for wet surfaces (top of Washington’s head on quarter), 6/32” is minimum recommended for snowy surfaces (top of Lincoln Memorial on penny).Vehicle tires should be replaced if the tread depth is less than 6/32”.



2/32” remaining  4/32” remaining  6/32” remaining

**Reference JSA 10907 For Weekly Vehicle Inspection**

Control Number: TSM- 30003953.00011

*TSM + project number plus date as follows: xxxxxxxx.xxxx.xxxxx - dd/mm/year*

# TAILGATE HEALTH & SAFETY MEETING FORM

| **Project Name:** | | | **Project Location:** |
|---|---|---|---|
| **Date:** | **Time:** | **Conducted by:** | **Signature/Title:** |

**Issues or concerns from previous day's activities:**

**Task anticipated to be performed today:**

☐ Additional permits/checklists attached

**USE TRACK! Evaluate the hazards (h) for the tasks being performed today and rank as Low (L), Medium (M) or High (H). Use relevant JSAs, FHSHB, permit or other work standard to communicate controls (c) to be used to eliminate or mitigate identified hazards.**

| | | |
|---|---|---|
| ☐ Gravity (i.e., ladder, trips) (L M H)<br>h:<br>c: | ☐ Motion (i.e., traffic, machinery) (L M H)<br>h:<br>c: | ☐ Mechanical (i.e., augers, motors) (L M H)<br>h:<br>c: |
| ☐ Electrical (i.e., utilities) (L M H)<br>h:<br>c: | ☐ Pressure (i.e., gas cyl., wells) (L M H)<br>h:<br>c: | ☐ Environment (i.e., heat, cold) (L M H)<br>h:<br>c: |
| ☐ Chemical (i.e., fuel, acid, paint) (L M H)<br>h:<br>c: | ☐ Biological (i.e., ticks, poison ivy) (L M H)<br>h:<br>c: | ☐ Radiation (i.e., alpha, sun, laser) (L M H)<br>h:<br>c: |
| ☐ Sound (i.e., machinery) (L M H)<br>h:<br>c: | ☐ Personal (i.e. alone, night) (L M H)<br>h:<br>c: | ☐ Driving (i.e. car, ATV, boat) (L M H)<br>h:<br>c: |

☐ Refer to the attached Hazard Analysis Sheet(s) or JSA

**Comments:**

**Signature and Certification: I have read and understand the project specific HASP for this project.**

**SSE Employee***

**Non-Life Threatening Injury or Illness**
**Call WorkCare 1-888-449-7787**

| | Printed Name/Signature/Company | Sign In Time | Sign Out Time |
|---|---|---|---|
| | | | |
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***Short Service Employee (SSE) working for Arcadis <1 year.**

**I will STOP** the job any time anyone is concerned or uncertain about health & safety or if anyone identifies a hazard or additional mitigation not recorded in the site, project, job or task hazard assessment.

**I will be** alert to any changes in personnel, conditions at the work site or hazards not covered by the original hazard assessments.

If it is necessary to **STOP THE JOB,** I will perform **TRACK**; and then amend the hazard assessments or the HASP as needed.

**I will not assist** a subcontractor or other party with their work unless it is absolutely necessary and then only after I have done TRACK and I have thoroughly controlled the hazard.

All site staff should arrive fit for work. If not, they should report to the supervisor any restrictions or concerns.

In the event of an injury, employees will call **WorkCare at 1.888.449-7787** and then notify the field supervisor.

Utility strike, motor vehicle accident or 3rd party property damage - field supervisor will immediately notify the Project or Task Manager

Control Number: TSM- 30003953.00011

ARCADIS

*TSM + project number plus date as follows: xxxxxxxx.xxxx.xxxxx - dd/mm/year*

# TAILGATE HEALTH & SAFETY MEETING FORM

| **Project Name:** North Albany Service Center | | | **Project Location:** |
|---|---|---|---|
| **Date:** | **Time:** | **Conducted by:** | **Signature/Title:** |

**Issues or concerns from previous day's activities:**

**Task anticipated to be performed today:**

**The following was used to communicate H&S information in this briefing (check all that apply):**

- ☐ HASP (*including THA*)
- ☐ JSAs (*specify JSA #s*): _____
- ☐ Permits (*specify type or #*): _____
- ☐ Traffic Safety Plan
- ☐ FHSHB (*specify sections*): _____
- ☐ H&S Standard (*specify number*): _____
- ☐ H&S checklist (*specify type*): _____
- ☐ Activity specific hazard analysis:

Activity: _____

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biological | | Chemical | | Driving | | Electrical | |
| Environmental | | Gravity | | Mechanical | | Motion | |
| Personal Safety | | Pressure | | Radiation | | Sound | |

Controls required to be used:

**PPE Required (If not using JSA or Permit with PPE requirements):**

- ☐ Hard hat
- ☐ Safety glasses
- ☐ Face shield
- ☐ Safety goggles
- ☐ Steel/composite toe boots
- ☐ Traffic vest (*specify II or III*): _____
- ☐ Life Vest (*specify type*): _____
- ☐ Protective Suit (*specify type*): _____
- ☐ Protective gloves (*specify type*): _____
- ☐ Other (*specify*): _____

**Signature and Certification: I have read and understand the project specific HASP for this project.**

**Non-Life Threatening Injury or Illness**
**Call WorkCare 1-888-449-7787**

| SSE Employee* | Printed Name/Signature/Company | Sign In Time | Sign Out Time |
|---|---|---|---|
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**I will STOP** the job any time anyone is concerned or uncertain about health & safety or if anyone identifies a hazard or additional mitigation not recorded in the site, project, job or task hazard assessment.

**I will be** alert to any changes in personnel, conditions at the work site or hazards not covered by the original hazard assessments.

If it is necessary to **STOP THE JOB,** I will perform **TRACK**; and then amend the hazard assessments or the HASP as needed.

**I will not assist** a subcontractor or other party with their work unless it is absolutely necessary and then only after I have done TRACK and I have thoroughly controlled the hazard.

All site staff should arrive fit for work. If not, they should report to the supervisor any restrictions or concerns.

In the event of an injury, employees will call **WorkCare at 1.888.449-7787** and then notify the field supervisor.

Utility strike, motor vehicle accident or 3rd party property damage - field supervisor will immediately notify the Project or Task Manager

***Short Service Employee (SSE) working for Arcadis <1 year.**

**What You Need to Know**

| | | | |
|---|---|---|---|
| *Emergency Phone:* | 911 | *WorkCare Phone:* | 1-888-449-7787 |
| *Your nearest hospital:* | Albany Memorial Hospital, 600 Northern Boulevard, Albany, NY 12204, , , 518-471 | | |

| | | | |
|---|---|---|---|
| *H&S Specialist for this project:* | Alec MacAdam | *Cell Phone:* | 720-454-0948 |
| *Project Site Safety Officer:* | To Be Decided | | |
| *Nearest assembly area(s):* | 0 | | |
| *Nearest storm shelter(s):* | 0 | | |

Confirm the following PPE is on site: hard hat, safety glasses, boots with protective toe and shank, traffic vest Class II, hearing protection, Nitrile gloves. Applicability of PPE to a particular work task is specified in the JSA or permit.

Confirm the following supplies and equipment are on site: first aid kit, fire extinguisher, eyewash (bottle), drinking water, sunscreen, traffic cones. Applicability of supplies and equipment to a specific task is specified in the JSA or permit and must be reviewed in the safety briefing.

Review applicable JSA or permit for the task being performed in the safety briefing.

You must remain at least 25 ft from the railroad track unless your job requires you to perform a task within 25 ft of the track. You must be On Track Safety Trained in accordance with client or host railroad requirements.

Confirm traffic controls in place are consistent with the project NON-ROW TSP for the parking lot or other non-right-of-way location.

You must stop work and contact Corporate H&S, CIH or a CSP if you exceed 4.6 PID units for volatile organics during work.

One or more shipping determinations apply this project. Review of the shipping determination(s) is required during initial safety briefing for project.

Due to the tick hazards associated with this project, review of the HASP Tick and Poisonous Plant section is required for specific controls to prevent tick hazards. These controls must be discussed in the safety briefing.

Due to the poisonous plant hazards associated with this project, review of the HASP Tick and Poisonous Plant section is required for specific controls to prevent tick hazards. These controls must be discussed in the safety briefing. See FHSHB for addtional description information.

SDSs for this project are attached to this HASP.

Contractors on this project are anticipated to use materials subject to the HAZCOM Standard under OSHA (or state OSHA) regulations. Contractor SDSs are not required for this project.

This project will not be utilizing materials subject to the HAZCOM Standard in bulk storage. In this HASP, bulk storage means any material stored on the project site in a bulk packaging >119 gallons (> 450 L) liquid capacity or a palletized quantity of a material in packagings ≤119 gallons (≤450 L) liquid capacity.

**Attachment E**
H&S Reference

# UNITED STATES EMPLOYEE FIELD HEALTH & SAFETY HANDBOOK

January 2025

# United States Employee Field Health & Safety Handbook

**Prep**ared by:
Arcadis U.S., Inc.
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Revision Date:
January 31, 2025

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# Version Control

| Date Issued | Description | Reviewed by |
|---|---|---|
| May 2020 | New template, significant document revisions. | G. Mason, D. Balcer |
| December 2021 | Annual Review | G. Mason |
| October 2022 | Annual Review and edits; inclusion of sewer work; inclusion of vacuum truck work | G. Mason |
| January 2025 | Opening and closing gates; added material relating to cold stress and excavation safety; added what to do if someone seems under the influence | G. Mason |
| | | |
| | | |

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ANSI | American National Standards Institute |
| ASDP | Arcadis Scientific Diving Program |
| ATM | automatic teller machine |
| ATV | all-terrain vehicle |
| °C | degrees Celsius |
| CAA | Civil Aviation Authority |
| CFR | Code of Federal Regulations |
| CGA | Compressed Gas Association |
| CNG | compressed natural gas |
| COC | constituent of concern |
| COPC | constituent of potential concern |
| CPR | cardiopulmonary resuscitation |
| CRZ | Contamination Reduction Zone |
| DCB | Diving Control Board |
| DEET | N,NN, N-diethyl-meta-toluamide |
| DOT | Department of Transportation |
| DSM | Diving Safety Manual |
| EMS | Emergency Medical Services |
| EZ | Exclusion Zone |
| °F | degrees Fahrenheit |
| FAA | Federal Aviation Administration |
| FRA | Federal Railroad Administration |
| GAWR | gross axle weight rating |
| GFCI | ground fault circuit interrupter |
| GPS | global positioning system |
| H&S | Health and Safety |
| handbook | Arcadis Health and Safety Field Handbook |
| HASP | Health and Safety Plan |

| | |
|---|---|
| HAZWOPER | Hazardous Waste Operations and Emergency Response Standard |
| HBV | hepatitis B virus |
| JSA | Job Safety Analysis |
| kV | kilovolt(s) |
| LEL | lower explosive limit |
| LO/TO | lockout/tagout |
| LPG | liquid petroleum gas |
| MOHUV | Multipurpose off-highway utility vehicle |
| MSHA | Mining Safety and Health Administration |
| NEC | National Electrical Code |
| NFPA | National Fire Protection Association |
| NIOSH | National Institute for Occupational Safety and Health |
| OSHA | Occupational Safety and Health Administration |
| PEL | permissible exposure limit |
| PFD | personal flotation device |
| PHSM | project health and safety manager |
| PM | project manager |
| PPE | personal protective equipment |
| PSM | Process Safety Management |
| ROPS | rollover protective structure |
| SDS | safety data sheet |
| SS | Site Supervisor |
| SSW | short-service worker |
| SSO | site safety officer |
| SZ | Support Zone |
| TSP | Traffic Safety Plan |
| TM | task manager |
| USEPA | United States Environmental Protection Agency |
| UST | underground storage tank |

# 1 Introduction

## 1.1 Purpose of this Handbook

This Arcadis Health and Safety Field Handbook (FHSHB, Handbook) provides our employees with minimum Arcadis workers with minimum Arcadis workplace health and safety (H&S) expectations and best practices. It is to be used as a supplement to Arcadis H&S standards (HSSs), project specific H&S Plans (HASPs), and job safety analyses (JSAs) and summarizes many of the Arcadis H&S procedures and standards.



Did You Know? Arcadis Standard ARC HSFS010 “Health & Safety Plans” includes requirements for completing and utilizing HASPs for all field work.

At Arcadis, we strive to achieve zero incidents to ensure the health, safety and well-being of our workers and stakeholders. We have the responsibility to keep the well-being of our workers central in all we do. For that reason, H&S is embraced by our workers who are guided at home and at work by the following six Fundamental Principles:

1. Demonstrate H&S Stewardship daily
2. Use TRACK
3. Exercise Stop Work Authority
4. Practice “If not me, then who?”
5. Undertake H&S Planning
6. Report injuries and incidents immediately

Additionally, we integrate H&S into our client solutions to manage risk and bring the best outcomes for our clients and workers, demonstrating our best-in-class H&S culture and performance.

Arcadis workers are expected to understand and use this handbook and apply the H&S best practices contained herein when performing their daily work activities. Where they require more prescriptive and protective control requirements, the Arcadis Health and Safety Standards, the project HASP and/or the project specific Job Safety Analyses (JSAs) will take precedence to this Handbook. This handbook does not replace or substitute the need for reviewing established Arcadis H&S procedures, regulatory and client requirements, and associated forms and work permits.

The following Arcadis company intranet site provides access to the most current and up-to-date Arcadis H&S standards and associated forms and permits:

https://arcadiso365.sharepoint.com/sites/Intranet-ANA-Health-Safety/SitePages/Home.aspx

## 1.2 Using the Handbook

This handbook covers many of the workplace hazards and work activities typically encountered during Arcadis operations.

It is not the definitive guide to safe work practices and procedures nor is it wholly applicable under every circumstance, or jurisdiction. Review and apply appropriate government regulations, company-specific and client work practices and requirements, and equipment manufacturers' instructions with due diligence. If situations arise that are not adequately covered in this handbook or other reference manuals, seek assistance from your local or project H&S contacts.

The handbook includes essential and nonessential language that conforms to Arcadis' H&S governance. Sentences with essential requirements contain the verb "must," "shall," or "will," which means the requirement is mandatory. Words that imply or suggest non-essential, discretionary requirements include "recommend," "might," "should," or "may."

The Project Manager, the project Site Supervisor and/or site safety officer (SSO) will use this handbook as part of the overall hazard assessment/control process for all projects.

This handbook provides general H&S information and control recommendations for workers working in the U.S. While much of the information contained herein could be used by non-U.S. Regions, work outside the U.S. may have different hazards and regulatory requirements. If there are questions about any hazards or regulatory requirements, please contact Corporate Health and Safety (Arcadis H&S).

Local regulatory requirements, Arcadis' Health & Safety Standards, Arcadis' project specific HASPs, and Arcadis project specific JSAs generally take precedence over the material in this handbook.

# 1.3 Arcadis Global H&S Vision and Policy Statement




**Figure 1-1 Health & Safety Commitment**

# 1.4 TRACK




At Arcadis, the acronym TRACK is a tool to we use help workers probe day-to-day operational and procedural activities to proactively identify hazards and control risks at all levels and stages of work planning and execution. Often the use of TRACK helps to identify hazards that may have been overlooked while planning a project or task. These hazards may develop after the job or task started, or may exist due to a lack of procedure, training, equipment/process modification, or because of site-specific changes in weather, location, traffic, or other circumstances. TRACK can be documented but not always. It fully depends on the stage of the work to which TRACK is applied. Each person performs the process or communicates it to all workers affected by the hazard, whether it is a last-minute risk assessment in the field, or a comprehensive project planning workshop before the work is ready to begin.

**ANA H&S App** is provided within Microsoft Power Apps. This app links to the Arcadis US H&S Dashboard and allows users to enter Safety Captures, Document Stewardship Activity, Hazards, Close Calls, Unsafe Behavior and record Personal Observations made outside of work hours.

The second step in TRACK, Recognize the hazards, is the cornerstone of the Arcadis H&S program. “R” is the most important step in TRACK because you must identify and recognize a hazard to appropriately control it. Our Hazard Recognition program challenges us to look at every site, project, job, or task and identify potential hazards from 12 hazard categories. Instead of identifying an object or activity as a hazard, we look at the sources of the potential hazards associated with that object or activity (see **Table 1-1**).

**Table 1.1 Hazard Source Categories**

| Hazard Source | Definition | Examples |
|---|---|---|
| Mechanical | Of or relating to machines or tools or mechanical systems, such as rotating parts or vibration in a machine. | A rotating auger, motors, compressed springs, moving belts, closing a step ladder, sharp objects, or edges. |
| Electrical | Presence or flow of electrical charge. | Power lines, electrical cords, transformers, batteries, static electricity. |
| Pressure | Energy applied to compress something, such as a liquid or gas. | Compressed gas cylinders, pneumatic, or hydraulic lines or equipment, tanks, well heads, heated vessels. |

| Hazard Source | Definition | Examples |
|---|---|---|
| Environment | The circumstances or conditions that surround a person or object. | Weather, hot or cold surfaces, fire, sunlight, lighting, water bodies. |
| Chemical | Substances that inherently, or through reaction, have the potential to create a physical or health hazard to people, environment or equipment. | Flammable vapors, reactive hazards, carcinogens or other toxic compounds, corrosives, pyrophorics, combustibles, oxygen-deficient atmospheres, welding fumes, dusts. |
| Biological | Relating to, caused by or affecting life or living organisms. | Insects, plants, animals, medical wastes, spoiled food, blood-borne pathogens, viruses, bacteria, molds. |
| Radiation | Emission and propagation of energy in the form of rays, waves or particles. | Radioactive materials, lasers, infrared or ultraviolet sources, microwaves, radio waves, light waves, sun exposure, Naturally Occurring Radioactive Materials (NORM). |
| Sound | Vibrations transmitted through the air with frequencies capable of being detected by the ears. | Equipment noise, impact noise, vibration, high-pressure release. |
| Gravity | The natural force of attraction between a body of mass and the Earth. | A falling object, a body tripping or falling, a collapsing trench wall or crane. |
| Motion | The act or process of an object changing position or place. | Flowing liquid, a rolling vehicle, wind moving an object, bending over, lifting an object. |
| Personal Safety | Those situations that endanger a person through criminal activity, isolated areas, or working alone. | Working at night, working in a wilderness area, working in a high-crime area. |
| Driving | Operation of a vehicle on or off road, on water, or in the air. | Automobile or truck operation, all-terrain vehicle (ATV) operation, boating, charter aircraft. |

## 1.5 Behavior-Based H&S

As part of Arcadis' overall H&S program, we acknowledge the importance of promoting a strong behavior-based H&S culture. In addition to the other tools presented in this handbook (e.g., HASPs, medical surveillance exams, respiratory protection program), our behavior-based H&S system also provides tools that include:

- TRACK
- STOP WORK
- Task/job safety analysis
- Workplace/jobsite H&S observations
- Incident investigations using proper root-cause analysis

- Corrective and preventive actions and supervisory follow-up with lessons learned via Safety Shares and Alerts
- Stewardship at all levels

All Arcadis workers complete behavior-based H&S training as part of their on-boarding process and they are expected to use the tools appropriately.

**Before every task, STOP and…**

| | |
|---|---|
|  | **Think through the task**<br>Do more than list major subtasks, brainstorm with the people involved to understand the work that will be done and how to get it done. |
|  | **Recognize the hazards**<br>Identify all the hazards by using the 12 hazard source categories. Provide detail for each hazard – who, what, when how |
|  | **Assess the risks**<br>Determine the level of risk by analyzing the likelihood it will occur, the possible consequences, and the frequency of the exposure to the hazard. |
|  | **Control the risks**<br>Use the hierarchy of controls to determine the most effective controls for each hazard: elimination, substitution, isolation, engineering, administrative, and personal protective equipment (PPE). |
|  | **Keep health and safety first in all things**<br>Do not start work until all the risks are appropriately controlled |

**Figure 1-2 TRACK**

# 2 Health and Safety Administration

## 2.1 Arcadis Responsibilities

Arcadis shall:

- Develop, implement, and maintain a current and effective H&S program (aligned with corporate objectives and policies, and compliant with government regulations)
- Continually improve H&S processes and procedures
- Provide the programs, procedures, policies, and tools to protect the H&S of workers and the public
- Inform workers of any known or potential hazards
- Confirm that supervisors and workers are informed of new or revised requirements related to H&S
- Provide new-hire and project-/site-specific orientation on H&S issues
- Update Arcadis policies, practices, and guidelines, as required, to reflect changes in regulations, client requirements, or industry standards
- Develop best practices and operating procedures for work activities and review periodically for effectiveness
- Confirm that workers are adequately trained, competent, and equipped to perform their work safely
- Report and investigate workplace hazards and incidents (including near misses) in a timely manner, and develop and implement solutions to prevent recurrence
- Share lessons learned from near misses and incidents
- Conduct hazard assessments, including inspections and conformance assessments, of Arcadis project sites
- Maintain company and workers H&S records, statistics, and audits; and
- Purchase and distribute H&S equipment (e.g., fire extinguishers, first-aid supplies) and personal protective equipment (PPE)



Did You Know? Arcadis Standard ARC HSMS009 “Conformance Assessment” assists trained workers with completing thorough safety audits.

## 2.2 Employee Responsibilities

As an Arcadis worker, you must:

- Understand that you have the authority, right and responsibility to Stop Work as warranted per the conditions, situations, behaviors, and other factors that may place people or property in jeopardy.
- Be fit for duty or notify a person in authority if you are not. You must be physically and mentally fit to safely perform your work. Impairments that could affect your performance include, but are not limited to:
    - Fatigue or inadequate rest
    - Medical conditions
    - Physical disabilities
    - Emotional state
    - Effects of:
        - Prescriptions
        - Over-the-counter medicines
        - Supplements
        - Illegal substances
- Notify your supervisor if you are taking any prescribed or over-the-counter medication that could impair your work performance.
- Notify your supervisor of any coworker that you or anyone you suspect is impaired or under the influence of medications or other substances while at work, or not performing within normal and expected workplace behavior.
- Protect your H&S as well as that of others at Arcadis offices and project sites;
- Follow all company operating procedures, codes of practice, and safe work practices;
- Wear or use all PPE required by Arcadis and our clients;
- Follow JSAs, HASP, and other instructions;
- Comply with government regulations or client requirements;
- Operate all vehicles and other equipment in a defensive, safe manner and within their rated capacity;
- Report to your supervisor, in a timely manner, any unsafe practices, hazards, conditions, or dangerous acts that may come to your attention.
- Report to your supervisor, in a timely manner, all incidents including near misses, injuries, or illnesses, and property damage.

- Know emergency response and rescue procedures applicable to the project site and found in this handbook or in other site- or location-specific documents;
- Know where emergency equipment, alarms, and emergency response numbers are located, and how to evacuate when working at facilities or project sites;
- Attend all applicable H&S meetings and training courses;
- Consult a supervisor if there is any doubt about the job procedure or H&S requirements before proceeding with an assigned task;
- Assist your supervisor and any H&S representative with inspections and investigation of accidents, incidents and workplace hazards;
- Share lessons learned resulting from near misses or incidents with others; and,
- Prior to wearing a respirator or any PPE, make certain you are trained on its use and that it will be effective in the work environment. Make certain you have been medically cleared to wear a respirator and that PPE fits you.

## 2.3 Visitors

All visitors to Arcadis project site areas must check in with the Site Supervisor (SS),Site Safety Officer (SSO), or other designated worker. Visitors will receive a site orientation about hazards they may encounter and controls that will mitigate those hazards.

Visitors who request to observe work must wear appropriate PPE, as designated in the HASP, prior to entering the project site, and must have the appropriate training and medical clearances. If visitors who wish to enter a project site that requires the use of a respirator they must have a current medical clearance and be respirator-trained and fit-tested for a respirator, all within the past 24 months.



Did You Know? Arcadis Standard ARC HSSP006 “Powered Industrial Trucks (Forklifts)” includes requirements and recommendations for operating a forklift.

## 2.4 Communications

With the potential for many hazards on a project site, clear communication is vital. Arcadis supervisors, workers, and contract workers must exchange information on a regular basis. Everyone at the project site must be aware of the work to be performed, all hazards and the control measures to take, and the correct procedures to follow.

Arcadis supports, encourages, and documents site safety meetings, requires morning tailgate meetings, and recommends after-lunch tailgate meetings to promote safety awareness and hazard mitigation.

## 2.5 Hazard Identification, Risk Assessment, and Risk Control Process

Arcadis uses systematic approaches to identify, assess, control, and manage H&S hazards and associated risks. These approaches (including TRACK) serve as the foundation for identifying hazards in the Arcadis U.S. work environment, assessing H&S risks posed by the hazards, and identifying the means and methods of control for those risks. Hazard identification, risk assessment, and risk control apply to all routine and nonroutine activities completed by or overseen by Arcadis U.S workers. All workers must use these processes and associated risk tools wherever hazards require classification as low, medium, and high to help determine the appropriate hazard control. Use hazard recognition, risk assessment, and risk control processes in H&S planning, JSA development, project planning, during the TRACK process, in tailgate safety meetings, and as part of any other process where hazards require identification, assessment, and control.



Did You Know? Arcadis Standard ARC HSMS002 “Hazard Identification, Risk Assessment and Risk Control” includes guidance on how to systematically identify and control risk.

## 2.6 Near Miss, Incident Reporting, and Investigation

Arcadis will report and complete an investigation following any work-related incident. A work-related incident includes any of the following types of events that occur during the completion of Arcadis work activities:

- Injuries and illnesses, including those needing only first aid;
- Near misses/incident;
- Spills or leaks;
- Equipment and property damage;

- Motor vehicle accidents;
- Regulatory inspections and/or violations;
- Fires;
- Business interruptions; and,
- Utility strikes (aboveground or below ground)

See the 4-Sight database on the Arcadis company intranet site for more information.

It is your responsibility to notify your supervisor or Project Manager, as appropriate, of any incident as quickly as possible. Your Supervisor, Project Manager or designee will then make the necessary calls to the appropriate corporate services groups, based on the incident. (Refer to the Arcadis Incident Reporting Health and Safety Standard for more information and see descriptions below.) If you are unable to make the call, then a coworker must do it as soon as possible.

In the event of a non-emergency injury, call WorkCare (1 888 449 7787) and then contact your field supervisor and project manager, who will notify Corporate H&S. In an emergency, another worker will make the necessary calls if the injured worker is unable to do so.



Did You Know? Arcadis Standard ARC HSMS010 “Incident Reporting and Investigation” includes guidance on Arcadis’ incident notification and investigation process.

## 2.7 Stop-Work Authority

All Arcadis workers are empowered to stop work if they feel their safety or the safety of their coworkers, clients, subcontractors, or the public is compromised.

**STOP WORK** if you feel unsafe or suspect that something is not safe. Throughout the day (at work and home), step back and use TRACK to assess your work. Look around. Is there anything that could hurt you or someone else? If so, STOP and address the issue. If you don't know how to make a situation safe, seek help from others including the Site Supervisor, the project manager, or Arcadis H&S.

### Arcadis Stories



*Arcadis Resilience Environment East employee, Sarah Sexton (Matteson), was assisting a project team with the advancement of soil borings in a remote part of a client property. Sarah, who is a Geologist, didn't have a good feeling with the three lines of evidence and voiced concerned with the project team. The project team initially felt, based on the history of the site, previous site work and surrounding land usage, utilities were not located in the area they were working. However, the team recognized the concern and Sarah conducted a walk around the area as an additional line of evidence. While searching for utilities, Sarah identified a gas line marker. A 3rd party utility contractor later determined one of the proposed borings was very close to or perhaps directly above a high-pressure gas line. Sarah's use of stop work may have saved lives. She received a health and safety award for her actions.*

## 2.8 Short-Service Worker Program

Workers new to Arcadis, work locations, and projects are considered short-service workers (SSWs) for a period of one year. The requirements also apply to any existing Arcadis worker who is inexperienced in the task being completed outside of any office setting. SSWs may be at greater risk because they are unfamiliar with tasks, the location, and safety or security procedures. These employees will be provided mentoring, coaching, or paired with other staff until they can work safely on their own. Based on established procedures, SSW H&S Standard (ARC HSGE019), or client requirements, SSWs may be assigned a field mentor along with other minimum requirements to assist them to understand safety considerations for project tasks and procedure implementation.

As required, Arcadis will comply with client-specific SSW requirements including identification/ designation markings, work-alone limitations, and work-team SSW maximum head-count requirements. Refer to the site-specific HASP and/or client-specific H&S requirements for additional details.



Did You Know? Arcadis Standard ARC HSGE019" includes guidance on implementing Arcadis' Short-Service Workers Program.

## 2.9 Workplace Violence and Harassment

Threats or acts of violence are strictly prohibited. Workers must not engage in intimidation, threats or hostile behaviors, physical abuse, vandalism, arson, sabotage, use of weapons, carrying weapons onto Company property, or any other act, which, in management's opinion, is inappropriate for the workplace. In addition, workers must refrain from making bizarre or offensive comments regarding violent events and/or behavior. Workers are expected to report any prohibited conduct to management. Workers should directly contact proper law enforcement authorities if they believe there is a serious threat to the health and safety of themselves or others. Refer to the Arcadis Human Resources Policies Handbook and the Arcadis Weapons in the Workplace H&S Standard (ARC HSGE025) for more information.

The Company strives to maintain a work environment free of harassment. In doing so, the Company prohibits harassment because of race, color, religion, sex, genetic information, national origin, ancestry, marital status, veteran status, age, sexual orientation, physical or mental disability, or any other basis prohibited by law. Unlawful harassment includes verbal or physical conduct that has the purpose or effect of substantially interfering with an individual's work performance or creating an intimidating, hostile, or offensive work environment. Actions based on an individual's race, color, national origin, religion, disability, or any other legally protected characteristic will not be tolerated. Prohibited behavior includes, but is not limited to, the following:

- Written form, such as cartoons, email, posters, drawings, or photographs;
- Verbal conduct, such as epithets, derogatory comments, slurs, or jokes; and,
- Physical conduct, such as assault, or blocking an individual's movements

Any worker who believes that they have been the subject of harassment is responsible for reporting the alleged act immediately to the HR director or worker relations staff in the HR department. There will be no discrimination or recrimination against any worker for making a report of harassment. All reports of harassment will be thoroughly investigated Refer to the Arcadis HR Policies Handbook for more information.

## 2.10 Weapons in the Workplace

All company workers and subcontractors are prohibited from carrying a weapon while performing their work for the company, whether they are on company property, and regardless of whether they are licensed to carry a weapon or firearm. Workers may not carry a weapon covered by this policy while performing any task on the company's behalf. The only exceptions to this policy will be persons who have been given written consent by the company i.e. by the company President, Vice President (Operations), or Director of Health & Safety to carry a weapon while performing specific tasks on the company's behalf (e.g. a wildlife monitor). Such exception request shall be made in writing and indicate the basis for the exception.

Arcadis clients may have weapons in the workplace policies that are more stringent than the Arcadis requirements. When working for these clients, Arcadis staff (including contract and temporary workers) must comply with the client-specific requirements.



Did You Know? Arcadis Standard ARC HSGE025 "Weapons in the Workplace" includes weapon prohibitions in Arcadis workplaces and Client Sites.

## 2.11 Drug and Alcohol Awareness

The following information is from the HR Policies Handbook. (For most current requirements, always refer to the most recent version of the HR Policies Handbook.)

Arcadis is committed to providing a safe environment for all workers, contractors and visitors. This alcohol and drug policy is intended to prevent incidents/accidents due to impaired performance arising from prescription drugs, nonprescription drugs and / or alcohol use. The company will take every reasonable precaution for the protection of its workers, subcontractors and visitors. All Workers must be fit to safely perform their duties free from impairment when working or scheduled to work.

As part of its health & safety program, Arcadis implements drug and alcohol testing in the following circumstances:

- where the company has reasonable cause to believe that an worker or subcontractor worker is impaired from using prescription/ nonprescription drugs or alcohol in the workplace ("Reasonable Cause");
- when an worker, or subcontractor worker is involved in a significant work-related incident to investigate whether the incident was caused in whole or in part by impairment by prescription/ nonprescription drugs or alcohol ("Post-Incident");

- as part of an overall safety program, when an worker is in a safety sensitive role (Bona Fide Occupational Requirement);
- as a follow-up to a worker's treatment for prescription/ nonprescription drugs or alcohol addiction, in accordance with applicable law ("Return to Work").

The entire HR Drug and Alcohol Policy is available in the Arcadis HR Policies Handbook posted on the ANA intranet site. Violation of this policy may result in discipline up to and including termination.

If you experience someone at an office or project site who appears to be under the influence of drugs or alcohol, please do the following:

- Use your stop work authority and get you both to a safe and private place;
- Share your observations with the person, ask them any applicable questions: are they ok, are they under the influence of drugs or alcohol, do they need immediate medical attention;
- Remember, some medical conditions can seem like a person is intoxicated, such as a diabetic with low blood sugar. These can also be signs of exhaustion. It's important not to make assumptions.
- Reach out to Employee Relations (employeerelations.ana@arcadis.com) and copy your People Business Partner, your Region Director, and the employees line manager (or your line manager, if you are the employees line manager). Employee Relations will assist you from there (after hours reach out to your Health & Safety Manager on duty.)
- Record your observations: did you see them drink, do you smell alcohol, did they say they were drinking, other indications like: low inhibition, uncoordinated, slurred speech, glassy eyes, slow reaction. Record any witnesses to these observations.
- Next steps may include: sending the employee for medical help, drug and alcohol testing, sending the employee home, etc.
- Drive the employee to the medical facility, testing facility, and/or home (or to their hotel).

## 2.12 Emergency Action Planning

Every Arcadis project must include an Emergency Action Plan that addresses prevention and response procedures for each type of anticipated emergency and must address:

- The types of emergencies that could reasonably occur
- Methods of prevention as applicable
- Evacuation routes
- Site contact numbers
- Location of all emergency telephone numbers, alarms, and response equipment, as applicable

- Procedures to be followed in the event of an emergency.

Prior to the start of daily operations, Site Supervisors will evaluate the work area and project site for potential for the development of emergency situations. These situations may include, but are not limited to, fire, spills, weather events, or other natural disasters.



Did You Know? Arcadis Standard ARC HSMS008 “Emergency Response and Fire Safety” includes requirements and recommendations relating to emergency planning and fire safety.

## 2.13 WorkCare

WorkCare must be called for ALL non-emergency injuries. For emergency-type injuries (e.g., severe bleeding, unconsciousness, not breathing, obvious fracture), a call to WorkCare is not required.

WorkCare is available 24 hours a day, 365 days a year. This service provides professional medical assistance over the telephone for nonemergency injuries or illnesses. The WorkCare nurse or doctor assesses the injury or symptoms, advises the worker on the appropriate care, and assists in identifying a medical facility, if a clinic visit is deemed necessary.

**WorkCare**
1 888 449 7787 (US)
***NOTE**: Seek emergency medical treatment when needed.*

## 2.14 Subcontractors

All Arcadis subcontractors are responsible for assigning specific work tasks to their workers; providing qualified workers; allocating enough time, materials, and equipment to safely complete assigned tasks; and equipping their workers with any required PPE.

Arcadis considers subcontractors to be experts in all aspects of the work operations which they are tasked to provide. Each subcontractor is responsible for complying with any regulatory requirements that are applicable to the services being provided. Subcontractors must develop JSAs in consultation with the Arcadis Site Supervisor or follow the Arcadis JSA specific to the services they are providing.

Arcadis workers must continue to be vigilant in H&S requirements onsite and to exercise appropriate STOP WORK authority with our subcontractors when warranted

If a subcontractor's procedures/requirements conflict with requirements specified by Arcadis, they will adopt the more stringent guidance after discussion and agreement between the subcontractor and Arcadis project H&S workers. Revised procedures must be formally recorded in project health and safety documents.

Subcontractors are responsible for the H&S of their workers at all times and have the authority to stop work if unsafe situations arise. All Arcadis workers have the authority to stop the Arcadis subcontractor's operations. The PM or Site Supervisor have the authority to remove the subcontractor or subcontractor worker from the site for failure to comply with established H&S procedures or for operating in an unsafe manner.

## 2.15 Regulatory Inspections

If a compliance officer from a regulatory agency arrives at an Arcadis project site, the Site Supervisor at the site will, as soon as possible, contact Arcadis H&S for guidance and advice on following Arcadis procedures for managing these events.

The Regulatory Agency Inspections Standard provides guidance on the process for appropriately managing a H&S inspection by a regulatory agency (e.g., Occupational Safety and Health Administration [OSHA], Department of Transportation [DOT], Federal Aviation Administration [FAA], or similar agency) of Arcadis or at a site on which Arcadis is working.



Did You Know? Arcadis Standard ARC HSGE013 "OSHA and Other Regulatory Agency Inspections" includes requirements for managing a regulatory inspection.

## 2.16 Recordkeeping and Postings

Arcadis offices and projects with field offices will maintain required Arcadis and OSHA Regulatory postings and records. State OSHA and workers compensation requirements may also require postings. Field office must post:

- Occupational Health and Safety Legislation and Regulations;
- Joint Health and Safety Members lists;
- Joint Health and Safety Meeting Minutes;
- Arcadis Global H&S Vision and H&S Policy poster;
- Workplace Violence and Harassment Policy (Respect in the Workplace)
- H&S Commitment Poster and the Six Fundamental H&S Principles;

- OSHA Job Safety and Health : It's the Law poster;
- OSHA 300A log, as directed by the Corporate H&S, from February to March of each year;
- List of Designated First Aid Trained Workers;
- Any state required postings;
- Arcadis TRACK poster;
- Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDSs) applicable to the site;
- Incident Reporting Process;
- Emergency Action Plan.
- Emergency phone numbers and other information required by the project HASP or JSA; and,
- Arcadis STOP WORK Authority poster.

The project HASP and relevant JSAs must be readily available on-site. Likewise, other H&S forms such as tailgate meeting minutes, specialized checklists, incident and near miss investigations, and work permits, also must be available on-site. Other project H&S records, such as training documentation, must be available for review. Depending on the project, training records may be kept on site or be immediately accessible from project management, HR, or worker files when requested.

# 3 General Field Health and Safety Requirements

***NOTE:*** *Most of the regulatory agencies referenced in this handbook are U.S. based (e.g., OSHA, FAA, American National Standards Institute [ANSI], National Fire Protection Association [NFPA], National Institute for Occupational Safety and Health [NIOSH], United States Environmental Protection Agency [USEPA]). Work in Canada will be required to follow, as a minimum, those requirements as outlined by provincial occupational H&S regulations. For Arcadis work, governmental requirements to the country where the work is performed are always the minimum standards to follow. Where this handbook or the project HASP specifies more stringent requirements, those requirements must be followed.*

## 3.1 Daily Safety Meetings/Tailgates

Arcadis requires that the Site Supervisor conduct at least one (1) safety meeting (tailgate meeting) daily before work begins for the day. A second tailgate meeting is recommended after lunch. Tailgate meetings should cover the work to be accomplished, the anticipated hazards, the PPE, measures and procedures required to minimize those hazards, and site emergency procedures. The pre-work shift tailgate meeting is mandatory.




Daily safety meetings are an integral part of identifying and communicating site hazards and managing risk.

Did You Know? Arcadis Standard ARC HSGE001 “Daily Tailgate Meeting” includes requirements and recommendations for completing an effective daily safety meeting.

No one may begin working before the daily tailgate meeting. If new tasks or new hazards arise, the Site Supervisor must hold another tailgate meeting that day. Workers and, when applicable, visitors that arrive at

project sites after the daily safety meeting, must be briefed on elements of the meeting applicable to their work or visit. The process for conducting these meetings follows the TRACK process and must include use of the Arcadis tailgate meeting form unless the client's work requirements require the use of a different form. The Arcadis tailgate meeting minute form includes important elements that are required for regulatory compliance, such as a prompt to specify required PPE and to inspect it prior to use.





**Fulcrum** is an app that allows Arcadis to create digital forms that be completed and synchronized while in the field. A popular app within Fulcrum is the H&S Tailgate Meeting Form (Tier 1).

# 3.2 Respiratory Protection

Arcadis workers occasionally work in environments requiring respiratory protection. Respirators will be provided by Arcadis to any worker who will or may be exposed to harmful vapors, dusts or oxygen-deficient atmospheres as part of their work duties at no cost to the worker. Respirator selection and use must comply with the Arcadis Respiratory Protection Standard. Prior to beginning tasks that require respirator use, a Level C Supplement must be completed and incorporated in the project HASP.



Did You Know? Arcadis Standard ARC HSGE017 "Respiratory Protection" includes requirements and recommendations for wearing a respirator.

## 3.2.1 Qualifications to Wear a Respirator

### 3.2.1.1 Training

Training will be provided prior to using the respirator the first time, when changes in the workplace or the respirator make the training obsolete, when inadequacies are found in the worker's knowledge or use of their respirator, or any other situation in which retraining appears necessary, and generally every two (2) years. Training records will be kept by the individual worker with copies of such certificates forwarded to Arcadis HR Operations for retention of the worker's training records.

#### 3.2.1.2 Medical Clearance

Employees must have received an initial and annual medical examination in accordance with the Arcadis Medical Surveillance Program HSS (ARC HSGE010) prior to fit testing. Evidence of medical clearance to wear respiratory protection or physician authorization must be provided for review to the individual conducting the fit test (fit test administrator). Any medical examination required as part of the fit testing process will be in accordance with the Medical Surveillance Program HSS. The evaluation will be confidential, convenient, understandable, conducted during normal working hours, and at no cost to the employee. The employee will be given a chance to discuss the results with the examining physician or another licensed healthcare professional.

Results of medical surveillance examinations will be maintained by WorkCare, the designated medical provider, in compliance with 29 CFR 1910.1020 (Access to employee exposure and medical records).

#### 3.2.1.3 Fit Testing

A respirator fit test will be completed on all workers that wear or may wear a respirator to ensure the respirator provides a seal against the worker's face and provides adequate respiratory protection.

Fit tests must be completed annually by a qualified fit tester. Each respirator that a worker is expected to use (e.g., half-faced, full faced, supplied air, etc.) must be fit tested separately.
Fit Test Administrators are responsible for conducting qualitative fit testing for employees in their locations unless the location elects to use WorkCare to coordinate testing at a clinic or Corporate H&S.

Fit test records will be maintained by the employee who is fit tested per 29 CFR 1910.134 (m)(2)(11) and, where utilized, the designated medical provider. In addition, records for those employees fit tested by a Fit Test Administrator will be sent to the Arcadis Corporate H&S Department (anacorphs@arcadis.com) and kept electronically in a central and confidential location. In accordance with 29 CFR 1910.134(m)(2)(ii), OSHA requires that Arcadis retain the fit test records for respirator users until the next fit test is administered.

# 3.3 Transportation Safety

## 3.3.1 Dangerous Goods Shipping and Transportation

Dangerous goods are materials having a safety concern when shipped or transported by ground, air or on water. These materials include, but are not limited to, explosives, compressed or liquefied gases, flammable liquids and solids, oxidizers and organic peroxides, toxic liquids or solids, corrosive liquids or solids, and miscellaneous items such as batteries, hazardous wastes, dry ice, etc.

Shipping determinations are required whenever transporting dangerous goods. Dangerous goods shipments (including those transported by Arcadis) must be packaged and transported in accordance with all federal,

provincial, territorial and carrier requirements. To ensure safety and compliance, Arcadis requires all samples (hazardous or not), liquids, powders, gases, biohazard materials, batteries, and equipment containing radioactive or magnetic materials to be evaluated for dangerous goods classification using the Arcadis shipping determination process.

Workers performing or approving shipping determinations, preparing/reviewing/approving waste profiles, collecting materials described above, preparing containers, selecting packaging, preparing packaging, marking and labeling the package, and preparing shipping papers for the transportation of dangerous goods (TDG) must be properly trained in accordance with Arcadis TDG requirements. This requirement applies to all sample collection activities whether the samples collected are considered to be dangerous goods.

## 3.3.2 Commercial Motor Vehicles

A commercial motor vehicle (CMV) is any vehicle alone or in combination (has a trailer attached) with a gross vehicle weight rating (GVWR) of 10,001 lbs. or more or any vehicle transporting placard able quantities of dangerous goods Arcadis requires any worker operating a truck or a truck and trailer combination greater than or equal to 10,001 lbs. to be enrolled and actively participate in the Arcadis CMV Program.

## 3.3.3 Remotely Piloted Aircraft Systems (RPAS) / Drones

There are special requirements associated with the operation of unmanned aerial vehicles (also referred to as drones). Only Federal Aviation Administration (FAA) licensed operators are permitted to operate a drone for occupational purposes. Contact the Arcadis Director of Transportation Safety or consult the Transportation Safety Program Standard ARC DOT-501, “Drone System Safety” for more information.

## 3.3.4 Temporary Traffic Safety Planning

If project work will be conducted in the public right-of-way (ROW) or parking lot, a Traffic Safety Plan (TSP) developed in accordance with applicable provincial or territorial regulations is required. The Arcadis Traffic Safety Handbook details typical temporary work zone scenarios and includes information relating to completion of the TSP. The Traffic Safety Handbook can be accessed through the Arcadis Health and Safety SharePoint site under the Transportation Safety Program. It should be noted that where there are differences between the guidance provided in the Arcadis Traffic Safety Handbook and the regulations, the requirements of the regulations shall prevail. The TSP may be prepared using an Arcadis TSP template or an alternate format as approved by an Engineer. The only requirements for TSPs are they:

- Must be written (text, pictures, drawings, pictograms either alone or in combination)

- Must be provided to the field staff expected to implement and/or work in the ROW, or other areas with recognized vehicular traffic hazard
- Be approved by an engineer when required by the Arcadis Traffic Safety Handbook - DOT Fact drawing “M1” note or by the TSP Plan Template
- It is recommended that the implementation of TSPs within public ROWs be subcontracted to traffic control specialty contractors who will have the required signage, barricades and crash trucks to properly implement the TSP.

For work involving on-site traffic and/or pedestrian controls, [i.e. not within the public ROW] a TSP is still required. Preparation of a Non-ROW TSP is similar to ROW TSP preparation. However, a non-ROW TSP may be approved by a HASP Reviewer instead of an engineer.

The Arcadis TSP template is designed to accommodate both ROW and non-ROW elements. Please refer to the Traffic Safety Handbook, accessed through the Arcadis Health and Safety SharePoint site under the Transportation Safety Program.

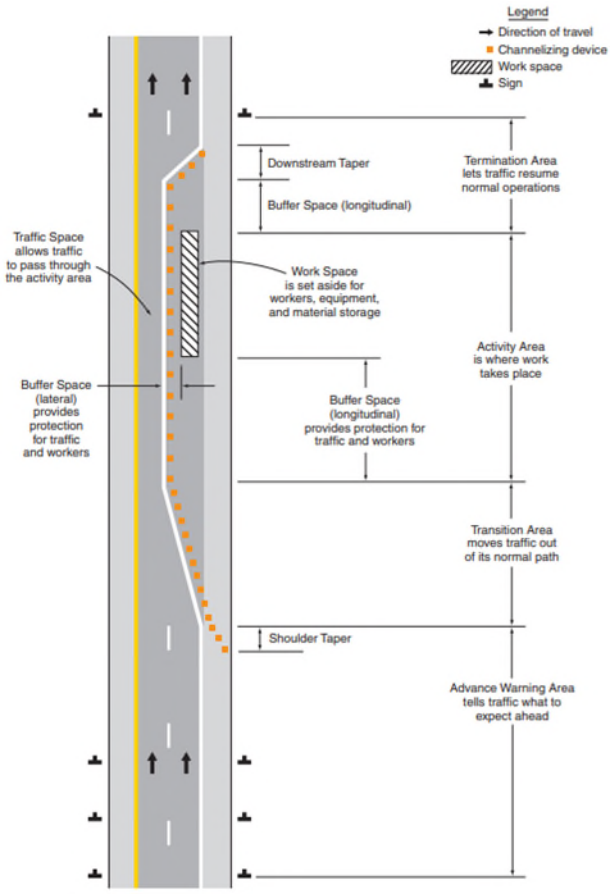



**Figure 3-1 Example traffic safety diagram**

# 3.4 Motor Vehicle Safety

This section contains information for transportation and vehicle safety on public and private ROWs and off-road.



Did You Know? Arcadis Standard ARC HSGE024 “Motor Vehicle Safety” includes requirements and recommendations for operating motor vehicles.

## 3.4.1 Vehicle Safety Inspection

All company owned, leased or rented vehicles will be maintained in safe operating condition. To ensure vehicles are properly maintained, a daily pre-trip visual inspection must be completed prior to operating the vehicle. The pre-trip inspection should include, but is not limited to:

- Seat belts
- Doors and door locks
- Lights
- Mirrors
- Horn
- Back up alarms, if equipped
- Parking brake
- Instrument panel
- Steering
- Window
- Windshield wipers
- Tires
- Emergency equipment

A more comprehensive documented weekly inspection (daily if required by the client, or if vehicle is operated in harsh environments) is also required. Rental vehicles operated by Arcadis for more than one week must use the documented weekly inspection process. Inspections are required to be documented on the Weekly Vehicle Inspection Checklist, in Arcadis approved software, or through a client approved equivalent form or software.

Motor vehicle inspections for vehicles identified as a CMV in the Arcadis CMV Program will be inspected in accordance with the relevant Federal, Provincial, and Territorial requirements for CMV inspections.

**Verizon Reveal Driver** is an app that is part of the Verizon Telematics system utilized by Arcadis. Operators of fleet vehicles and long-term rentals have the ability to access their driver scorecard utilizing the app.

## 3.4.2 Driving

All Arcadis workers, temporary agency workers, and contract workers driving for Arcadis business shall:

- Wear seat belts always
- Operate and license the vehicle in accordance with applicable laws
- Drive defensively as learned through training, education, and experience
- Exercise caution when taking any prescription or over-the-counter medication that may cause drowsiness or altered mental state
- Have headlights on at all times, even during daylight hours
- Not use controlled substances, illegal drugs, or alcohol while driving for Arcadis business
- Not drive in a manner that could be deemed reckless or aggressive by other drivers
- Not use radar detectors; and
- Remember and continually utilize the Smith System® Driving Keys®:
  - Aim High in Steering®
  - Get the Big Picture®
  - Keep Eyes Moving®
  - Leave Yourself an Out®
  - Make Sure They See You®

Arcadis drivers should avoid distractions while they operate motor vehicles, and the vehicle is moving. These distractions include such things as eating, drinking, reading maps or other information, operating and adjusting the radio.

The Arcadis Motor Vehicle Safety Program H&S Standard (ARC HSGE024) presents policies concerning the use of cell phones and other electronic devices while operating a motor vehicle. This H&S standard prohibits use of cellular phones and other devices, including when in hands-free mode, while driving any vehicle for Arcadis. Phones used as a GPS device or actual GPS devices may be used but must be mounted in the vehicle either permanently or with a temporary mount. Several navigation apps provide user-reported traffic hazards and allow for vehicle operators to update others based on current conditions. Arcadis expects drivers to remain focused on driving and avoiding interacting with navigation apps while the vehicle is in motion.

**Waze** is a popular navigation app that provides driving directions, anticipated delays based on historical and current traffic congestion. It also provides user-reported traffic hazards. Navigation apps are tremendously useful but please read the important message above.

### 3.4.2.1 Driving Off Road

When operating a vehicle off-road, the following information provides some techniques for safe driving:

- When approaching a hill, survey the hill for obstacles and the safest route prior to attempting to climb the hill in a vehicle.
- When climbing a hill, use as high a gear as the vehicle will "pull" comfortably. If the gear selected is too low, the tires may spin. If the gear is too high, there may not be enough power to climb the hill. (The general rule of thumb is 3rd gear up and 1st gear down with an automatic transmission; 2nd gear up and 1st gear down with a manual transmission; all in low range. If this doesn't work, high range is recommended.)
- Line up your vehicle so it has a straight approach to a hill. If possible, try to keep the vehicle parallel with the slope of the hill, so the vehicle's weight is equally distributed, providing equal traction to all four wheels. Apply power at the bottom of the hill, and ease off the throttle when you go over the top to keep the vehicle under control.
- If parking on a hill, turn off the engine, leave it in gear with a manual transmission (or in park with an automatic transmission and while maintaining application of the brakes, apply the emergency brake). Place chocks, rocks, or logs under the wheels to provide additional braking assistance.
- If the vehicle stalls going uphill, the following is recommended for safe descent down the hill:
    - Apply the brakes
    - Put the vehicle in reverse
    - Release the clutch (if applicable) and brake pedal gently and simultaneously to fully engage the reverse gear; and,
    - Descend back down the hill using only the engine to keep the descent slow. Remember that visibility is limited when braking downhill, steering is much quicker, and steering kickback is more violent. Do not attempt to turn around on a steep hill, as the vehicle may roll.

Recommendations for hidden obstacles:

- Always check water, snow, high grass, and mud crossings for hidden obstacles, such as logs, rocks, and holes.
- When approaching obstacles, such as a ditch, stop and inspect the ditch to identify an appropriate route to cross, preferably at an angle, so that only one tire enters the ditch at a time when crossing. This leaves the other three tires on solid ground to provide traction. Avoid entering a ditch squarely because the entire axle could lose traction, and this may also cause difficulty when attempting to exit the ditch.
- Before driving over large objects, consider whether a ramp in front of and behind any rock is needed to reduce potential of vehicle grounding out; and
- Because the underside of the vehicle has many fragile and vital components (e.g., differentials, drive shafts, transmission, transfer case, oil pan, exhaust, gas tank), it's best to drive over an obstacle by placing one tire on it, then gently driving over it, rather than trying to take it down the center.

**Driving in Deep Sand, Snow, or Mud**

- When driving through deep sand, snow, or mud, deflate your tires slightly to increase the tire's footprint and provide better traction. However, remember that deflated tires will decrease your ground clearance.
- Remember to inflate your tires before going on-road again.
- Use a steady momentum to carry you through. Keep your speed up and use higher gears. Do not spin your tires and do not stop until the vehicle is out of the deep sand, snow or mud. If your wheels start to spin, ease off the throttle just a bit and allow the tires to slow down and regain traction. If you lose traction and the vehicle is barely moving, turn the steering wheel quickly from side to side in short strokes to allow the front tire walls to find extra grip.
- If muddy conditions force you to drive in the ruts, know where your front wheels are always pointed. Your vehicle will follow the ruts, even with the wheels turned to the right or left. If you encounter a dry spot with the wheels turned, then the front wheels can regain traction and suddenly throw the vehicle out of the ruts, resulting in a loss of control and possible damage.
- Remember that hard snow crossed in the early morning can be impassably soft in the afternoon when temperatures may be higher. The same is true for frozen soil environments during cold weather where afternoon thawing of frost may make soil soft and impassable.

**Rules for Off-Road Driving**

1. Only four-wheel drive or all-wheel drive vehicles should be taken off-road
2. Steering should be precise.
3. The brakes should be used as little as possible.
4. Apply the throttle smoothly and release it slowly to keep the tires from spinning on acceleration and from locking on deceleration.
5. Each obstacle along the route should be attempted as slowly as possible but as fast as necessary.
6. Remember to put the vehicle in 4-wheel drive before needing it and shift to low range early to reduce the strain on the vehicle.
7. When unsure of the surface, select low range.
8. Never change gears in the middle of a water crossing, hills (ascent or descent), or sand crossing.
9. Do not drive with your thumbs on the inside of the steering wheel, as the rough terrain could result in serious bruising or dislocation of your thumbs.

**Crossing Water**

1. Determine how deep the water is and how smooth the bed of the crossing will be before entering the water body
2. Do not attempt to cross floodwaters. The depth of the water is not always obvious. Moving water has tremendous power. Six inches of moving water has the potential to knock you off your feet, and a foot of water can sweep a vehicle—even a large SUV—off of the road. Visit the National Weather Service (NWS) Turn Around Don't Drown® program for more information.
3. If your vehicle is trapped in rapidly moving water, stay in the vehicle.
4. If water is moving at a high velocity and is rapidly rising in the vehicle, exit the vehicle immediately, seek refuge on the roof of the vehicle, and signal for help.
5. If your vehicle stalls, leave it immediately (unless water is moving at a high velocity) and move to higher ground. Rapidly rising water can engulf the vehicle and its occupants, sweeping them away.
6. The U.S. Bureau of Reclamation calculated flood danger to passengers in vehicles as varying combinations of flood water depth and velocity. According to their calculations, flood water depths of 3 feet and 0 (zero) flood water velocity pose a high danger to nearly all passenger vehicles. If flood water velocity is 9 feet per second, then flood water depths of approximately 2 feet pose a high danger, and if flood water velocity is 16 feet per second, then flood water depths of slightly more than 1 foot can pose a high danger.
7. Water weighs 62.4 pounds/cubic foot and typically flows downstream at 6 – 12 miles per hour. Furthermore, 2 feet of water is sufficient to float a standard automobile and 500 pounds of lateral force are applied to a car for each foot the water rises.

## 3.4.3 Trailer Safety

The use of a trailer to haul vehicles, machinery, or equipment is a necessary component of many Arcadis projects. These articulated vehicles are helpful due to the flexibility of the moving parts, time in which it takes to couple and uncouple the parts, and the smaller turning radius allowing tighter turns and better maneuverability. Care needs to be taken when operating this equipment as property, personal safety, and the safety of others are at stake. Proper maintenance of the equipment and correct loading and unloading procedures will provide for the safety of workers using the equipment, avoid costly repairs for damages, and prolong the life of the equipment.

### 3.4.3.1 Trailer Use

There are four (4) types of trailer hitches that are commonly used:

- Receiver type hitches using a conventional ball and hitch coupler;
- A fifth wheel type hitch;
- A gooseneck ball type hitch; and,
- A pintle type hitch.

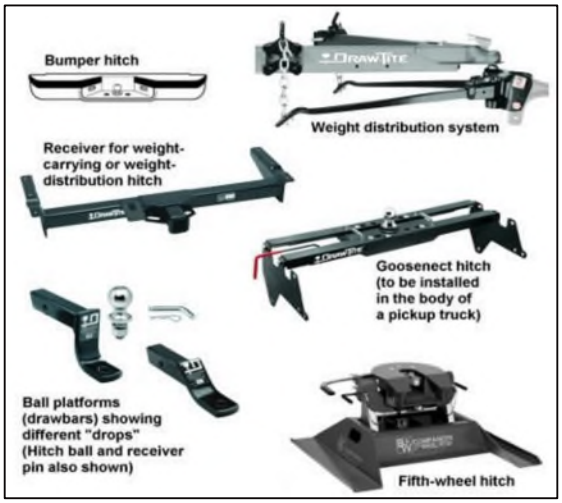



**Figure 3-2 Types of Trailer Hitches**

Arcadis vehicles are typically equipped to tow conventional ball and hitch trailers.

Before loading a trailer, know the gross vehicle weight rating GVWR and gross axle weight rating (GAWR) of the trailer. The latter is the maximum load-bearing capacity of the trailer's axles. The weight of the load should not exceed the GVWR or GAWR. The GVWR and GAWR can be found on the trailer certification label, which is usually near the front of the trailer.

**Loading**

Loading is a critical time when weight-bearing objects are added onto the trailer. Before this occurs, the trailer should be firmly fastened to the truck hitch using the following steps:

**Hitching Trailer**

1. Provide ample lighting for night-time operations.

2. Verify hitch, receiver, and ball are appropriately sized and rated for the loaded weight of the trailer.
3. Elevate the trailer tongue so the ball coupler will clear the towing vehicle's ball;
4. Using a spotter, back up the truck until the ball coupler is directly over the ball of the towing vehicle, taking caution not to back the truck into the trailer;
5. Put the vehicle in park and engage the parking brake of the vehicle;
6. Make sure the coupler latch is in the unlocked position and ready to engage;
7. Confirm that the hitch coupler is free of obstructions to allow proper engagement to the ball;
8. Lower the tongue of the trailer onto the truck hitch making sure it is fully seated onto the hitch ball;
9. Depress the coupler latch so it is securely seated and insert the safety pin; and,
10. Cross and attach the two safety chains from the trailer onto the truck and firmly shake the trailer to confirm proper connection.

***Note**: Use of a spotter when backing is recommended.*

**Loading Trailer**

Loading is a critical time when weight-bearing objects are added onto the trailer. Before this occurs, the trailer should be firmly fastened to the towing vehicle using the steps above. Once the trailer has is confirmed to be properly fastened to the towing vehicle, following steps:

1. Properly align the trailer with the towing vehicle, preferably on flat solid ground;
1. Trailer should be positioned in a straight manner directly behind towing vehicle to avoid stress to the coupling.
2. Be sure the load is evenly distributed throughout the trailer with 60% of the load in front of or over the trailer axles. Do not rear-load the trailer with the majority of the weight near the rear.
3. Avoid overloading the trailer. Know the weight limits of the vehicle and understand how to calculate the weight of material that is being loaded.
4. Tie down your load on using tie-down locations, on the load and on the trailer; and,
5. Be sure the tailgate of the trailer is securely in place and fastened with a strap or rope to prevent tailgate loss.

**Unloading Trailer**

1. Maneuver the vehicle and trailer fully out of right-of-way and preferably on flat ground;
2. If necessary, rearrange or clear areas to provide easy access to unloading areas and to provide a flat and safe place to unload;
3. Unstrap the tailgate of the trailer and place the ramp squarely against the back of the trailer, confirming that the ramp is fully seated against the back of the trailer;

4. Unhook the load and clear straps from underneath the load and trailer so that nothing gets caught on the load while unloading.
5. Provide ample lighting for night-time operations.

**Maintenance**

Proper maintenance of the trailer and its accessories will prolong the operational life of the equipment and provide for the safety of workers using the trailer. Take simple steps (summarized below) before, during, and after you use the trailer to safely transport the trailer and the load.

Before departure, perform a six-point inspection to confirm that:

1. Load is secure, not projecting over the edge of the trailer, and there are no flapping accessories;
2. Tie downs are not frayed, hooks are in place, and straps are tight;
3. There is adequate tire pressure for the load and a spare tire is available;
4. The cup of the trailer is fastened down on the trailer hitch, the latch is fully depressed with a safety pin installed, and safety chains are crossed and hooked;
5. The electrical attachment for taillights/brake lights is firmly in place; and,
6. The breakaway braking mechanism is properly functioning (when equipped).

***NOTE**: Double check items 4 through 6 above*

**During Use:**

- While enroute to destination, confirm that the load is secure when entering or exiting dirt roads. Based on conditions of the dirt road, you should stop frequently and check load security;
- When backing, performing 3-point turns, or turning tight corners with the trailer, be sure the inside angle of the trailer to the truck does not become less than 40 degrees. Angles that become overly acute will cause the trailer to jackknife against the truck, possibly causing equipment damage and trailer and/or hitch failure;
- In the event of a flat tire on the truck or trailer, minimize the weight of the load on the vehicle or trailer by off-loading, if possible. By reducing the weight in the vehicle or trailer, it will minimize the stress placed on the jack during changing of the tire.
- If a flat occurs to the truck with no load while towing a loaded trailer, simply unhitch the trailer, place chocks or blocks under the wheels of the trailer to prevent run-away and change the truck tire according to manufacturer guidelines.

**After Use:**

- To prevent trailer run away, always chock/block the tires when the trailer is not in use;
- Inspect and repair axle and wheel damage;
- Lubricate pins, bearings and bushings for smooth operation;
- Inspect and repair hitch and clamp components if damaged or worn;
- Confirm that cup of hitch is free of obstructions to allow proper engagement to the ball.

### 3.4.3.2 Safety Tips for Driving with a Trailer

Take time to practice before driving on main roads and never allow anyone to ride in or on the trailer. Before leaving, remember to check routes and restrictions on bridges and tunnels. Consider the safety tips listed below each time you drive with a trailer.

**General Handling:**

- Use the driving gear that the manufacturer recommends for towing;
- Drive at moderate speeds. This will place less strain on the tow vehicle and trailer. Trailer instability (sway) is more likely to occur as speed increases;
- Avoid sudden stops and starts that can cause skidding, sliding, or jackknifing;
- Avoid sudden steering maneuvers that might create sway or undue side force on the trailer;
- Slow down when travelling over bumpy roads, railroad crossings, and ditches;
- Make wider turns at curves and corners because the trailer's wheels are closer to the inside of a turn than the wheels of your tow vehicle, they are more likely to hit or ride up over curbs; and,
- To control swaying caused by air pressure changes and wind buffeting when larger vehicles pass from either direction, release the accelerator pedal to slow down, and keep a firm grip on the steering wheel.

**Braking:**

- Always use early braking and allow considerably more distance for gradual stopping;
- If equipped with an electric trailer brake controller and excessive sway occurs, activate the trailer brake controller by hand. Do not attempt to control trailer sway by applying the tow vehicle brakes because this will generally worsen sway; and,
- Always anticipate the need to slow down. To reduce speed, shift to a lower gear and press the brakes lightly.

**Acceleration and Passing:**

- When passing a slower vehicle or during lane changes, signal well in advance and provide extra distance to clear the vehicle before pulling back into the lane;
- Pass on level terrain with plenty of clearance. Avoid passing on steep upgrades or downgrades;
- If necessary, downshift for improved acceleration or speed maintenance; and,
- When passing on narrow roads, be careful not to go onto a soft shoulder. This could cause the trailer to jackknife or go out of control.

**Downgrades and Upgrades:**

- Downshift to assist with braking on downgrades and to add power for climbing hills;
- On long downgrades, apply brakes at intervals to keep speed in check. Never leave brakes on for extended periods of time as they may overheat; and,
- Some tow vehicles have specifically calibrated transmission tow-modes. Be sure to use the tow-mode recommended by the manufacturer.

**Backing Up:**

- Place hand at the bottom of the steering wheel. To turn left, move your hand left. To turn right, move your hand right. Back up slowly. Because mirror visibility is limited when backing up, use a spotter, whenever possible.
- Use slight movements of the steering wheel to adjust direction. Exaggerated movements will cause greater movement of the trailer. If having trouble during backing, pull forward and realign the tow vehicle and trailer, and start again.

**Parking:**

- Avoid parking on grades. If possible, use a spotter during parking activities. Once stopped, but before shifting into park, have someone place chocks or blocks on the downhill side of the trailer wheels. Apply the parking brake, shift into park, and then remove your foot from the brake pedal. Following this parking sequence is important to make sure your vehicle does not become locked in park because of extra load on the transmission. For manual transmissions, apply the parking brake and then turn the vehicle off in either first or reverse gear.
- When uncoupling a trailer, place chocks or blocks at the front and rear of the trailer tires so the trailer does not roll away when the coupling is released.

- When parking with a trailer in an off-road situation, plan the egress route prior to parking so the truck and trailer with any added load while parked can safely egress the location. Always consider ground conditions and slope when planning the egress route.

## 3.4.4 Specialty Vehicle Operation (ATVs, UTVs, and Snowmobiles)

Specialty vehicles include, but are not limited to, all-terrain vehicles (ATVs), utility task vehicles (UTVs), and snowmobiles. Arcadis defines specialty vehicles as follows:

- An ATV is a motorized, off-highway vehicle designed to travel on four low-pressure tires, having a seat designed to be straddled by the operator, and handlebars for steering control. ATVs are subdivided into two types, as designated by the manufacturer: Type I ATVs are intended by the manufacturer for use by a single operator and no passenger; Type II ATVs are intended by the manufacturer for use by an operator and a passenger and are equipped with a designated seating position behind the operator.
- A UTV is a vehicle with four or more wheels, a steering wheel, non-straddle seating (has side-by-side seating for passengers), maximum speeds between 40 km/hr and 80 km/hr (25 mph and 50 mph), foot controls for throttle and braking, occupant restraints, rollover protective structures, and typically a bed or other type of cargo storage area. UTVs include recreational off-road vehicles (ROVs) and multipurpose off-highway utility vehicles (MOHUVs). For the purposes of this standard, the term also includes small “snowcat” vehicles (designed for one to four occupants), golf carts, and “Cushman” type carts used in manufacturing facilities.
- A snowmobile is an open vehicle manufactured for travel on snow for one or two persons with steerable skis on the front and an endless belt at the rear.



Did You Know? Arcadis Standard ARC HSFS001 “Specialty Vehicle (ATV, UTV, etc.)” includes requirements and recommendations for operating specialty vehicles on project sites.

### 3.4.4.1 General Operating Requirements

The following applies to the use and operation of specialty vehicles:

- Operators must be trained in the operation of the specialty vehicle that they are operating;
- Operators must operate the specialty vehicle in a manner consistent with the following:
  - Manufacturer’s recommendations. Confirm the presence of the instruction/operator’s manual;
  - At a speed safe for the conditions in which the specialty vehicle will be operated. If speed conditions appropriate for the environment cannot be reasonably ascertained, the following default maximum speed limits will be used:

  - 10 mph for traffic, pedestrian-congested areas, or off-road use; and
  - 15 mph for all other areas;
  - Will not use the specialty vehicle in a manner consistent with recreational use. Stunt driving and horseplay with specialty vehicles is strictly prohibited;
  - Will wear personal protective equipment consistent with this Handbook, the project HASP, or relevant JSA;
  - Will wear occupant restraints (seatbelts) while the vehicle is in motion, if the vehicle is equipped with occupant restraints; and,
  - Not operate the specialty vehicle on a public roadway unless equipped with equipment required for roadway use (e.g., headlights, taillights, brake lights) and operation is permitted by local jurisdiction. The project team operating the specialty vehicle on a public roadway will verify and obtain, with assistance from Arcadis Procurement, any required titling, registration, and/or insurance necessary to operate the vehicle.

- Non-Arcadis workers working in the interest of Arcadis may operate a specialty vehicle owned, leased, or rented by Arcadis with the written approval of the Arcadis project manager (email communication is acceptable). Non-Arcadis workers operating a specialty vehicle owned, rented, or leased by Arcadis must adhere to the requirements of this Handbook.
- Only Arcadis workers are permitted to ride as passengers in a specialty vehicle operated by an Arcadis driver, except in certain situations. If approved by the project manager, an authorized client, temporary agency worker, government agency representative, property owner, or contractor may ride as a passenger in a specialty vehicle operated by an Arcadis driver.
- Occupants will only ride in a manufacturer approved seat and will wear any seatbelts or other restraining device with which the vehicle is equipped; and,
- The operator will confirm the presence of the instruction/operation manual.

#### 3.4.4.2 Specialty Vehicle Inspection and Maintenance

Operators of specialty vehicles are responsible for conducting inspections of the specialty vehicle prior to use. Inspections must be documented on the Arcadis ATV/UTV Inspection Form or equivalent.

Routine maintenance requiring the use of a vendor will be arranged by the project team. All routine maintenance will follow the manufacturer's recommended service schedule. All maintenance activities must be documented in the vehicle's maintenance log.

If a deficiency is identified that is beyond the control of the operator to correctly repair, the vehicle will be taken out of use and visible tagged on the steering mechanism near the ignition switch of the vehicle. The repair of the specialty vehicle will be arranged by the project team. Costs associated with maintenance or repair of specialty vehicles will be assigned to the project where the vehicle is assigned/operated or to the business unit overhead.

### 3.4.4.3 Personal Protective Equipment

**PPE for Off-Road Operation**

Operators of specialty vehicles (also includes operators of UTV's, ATVs and snowmobiles in on-road applications) must wear required personal protective equipment (PPE). At a minimum, specialty vehicles used in off-road applications require the following PPE:

- DOT-approved helmet with face shield (use ANSI-approved goggles if face shield is not integrated with the helmet);
- Long pants;
- Long-sleeved shirt;
- Steel- or composite-toed protective boots, and
- Protective gloves.

Additional PPE may be required for use in extreme off-road operation or when driving through heavy vegetation. This additional PPE may include leg, torso, and arm protection. Specific PPE requirements for specialty vehicle operation must be detailed in the project-specific HASP or JSA.
Approved helmets must meet one or more of the following specifications:

- DOT: conformance with the Federal Motor Vehicle Safety Standard No. 218; Motorcycle helmets (United States of America);
- Snell M2005, M2010 or M2015: certification in accordance with the Snell Memorial Foundation 2005, 2010 or 2015 Standard for Protective Headgear for Use with Motorcycles and Other Motorized Vehicle;
- ECE: approved in accordance with the United Nations Economic Commission for Europe (ECE) Regulation No. 22; and,
- British Standards Institute and shall have affixed thereto the certificate of the British Standards Institute.

**PPE for On-Road Operation**

Minimum PPE requirements for on-road specialty vehicle use are generally the same as for off-road use. Some jurisdictions offer exceptions to the requirement for helmet use where the vehicle is equipped with occupant roll-over protection and seatbelt assemblies and occupants are using the seatbelts. Check the legislation for the jurisdiction in which the specialty vehicle will be used to determine if helmets are required.

#### 3.4.4.4 Operation of Specialty Vehicles in Special Conditions

**Night Operation**

Specialty vehicles operated at night must be equipped with functioning headlights and taillights. The specialty vehicle must also have all manufacturer supplied marking lights, reflectors, and/or retroreflective tape in good condition.

**Operation in Vicinity of Heavy Equipment**

All specially vehicles used in a construction setting must be equipment with an amber warning light. Low-profile specialty vehicles used in construction applications must be equipped with at least one orange flag with a minimum height of 2 m to increase visibility to operators of heavy equipment.

## 3.4.5 Backing Safety

Always avoid backing by your vehicle by using pull-through parking when permitted by law and the parking area is configured in a manner that permits pull-through parking. Backing a vehicle on project sites and in parking lots can be risky. As with the Smith System®, Five Keys® for driving forward, there are Five Keys for backing:

- Key 1 AIM HIGH IN STEERING®
  - Avoid backing situations (use pull through parking when available and permitted);
  - Identify relevant objects; and,
  - Plan backing and parking activities
- Key 2 GET THE BIG PICTURE®
  - Use GOAL (Get Out and Look);
  - Never guess or assume the backing area is clear;
  - Evaluate conditions in all directions (horizontally and vertically); and,
  - Use a spotter, if available
- Key 3 KEEP YOUR EYES MOVING®
  - Keep eyes moving (checking mirrors, rear windows, blind spots); and,
  - Keep speed appropriate to maintain visual surveillance of surroundings (2 to 5 km per hour)
- Key 4 LEAVE YOURSELF AN OUT®
  - Select locations with the fewest backing hazards;
  - Maintain space cushion (1 m minimum) while driving at slow speeds (backing, parking, around stationary objects, etc.); and,
  - Back no further than you must
- Key 5 MAKE SURE THEY SEE YOU®
  - Establish eye contact with other drivers and pedestrians when parking;
  - Use horn in a positive manner to communicate; and,
  - Use flashers or other communication method when backing

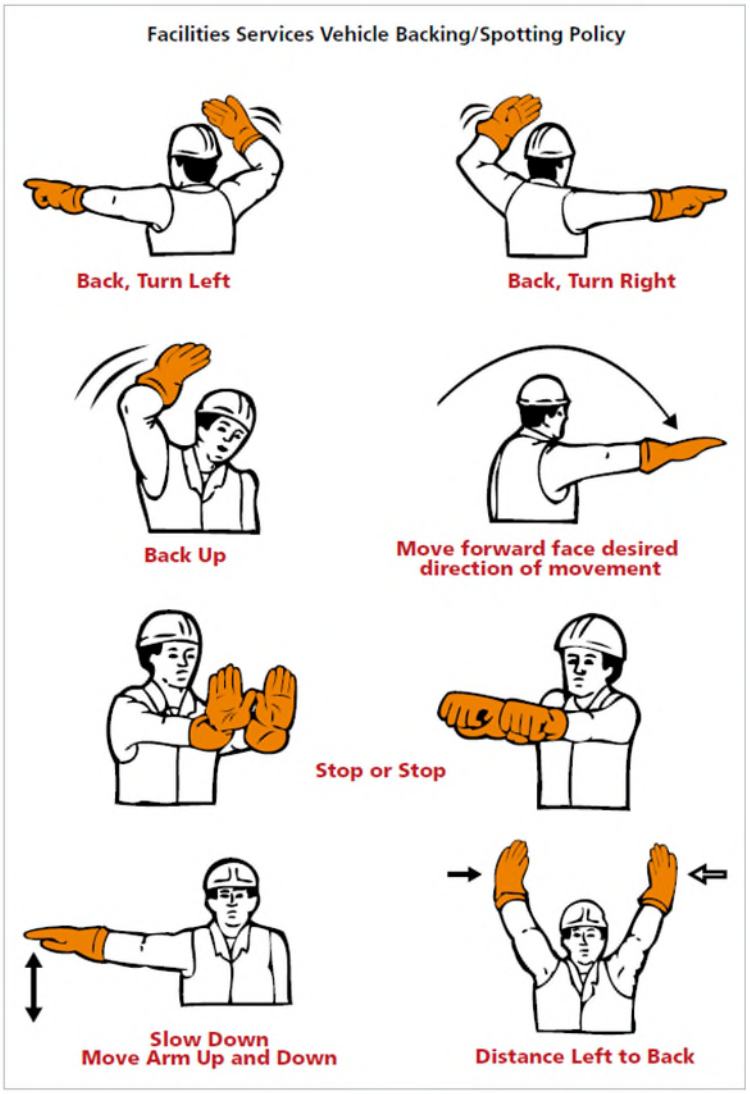



**Figure 3-3 Backing Safety Hand Signals**

If using technology to facilitate backing (e.g., backup camera), do not fixate on the backing screen and maintain 360 degrees of awareness, paying attention to the front of the vehicle when backing and turning simultaneously.

### 3.4.5.1 The Spotter's Responsibilities

- The spotter is there to direct the driver while backing up the vehicle;
- The spotter needs to be constantly aware of the surroundings while performing this function;
- The spotter needs to be constantly looking and listening for other vehicles and people that may enter the path of the vehicle that is backing up;
- The spotter must either stop the oncoming hazard or stop the vehicle being backed up;
- The spotter must be aware of objects and direct the driver safely around them;
- The spotter must not only look at ground level for obstructions, but also LOOK UP for overhead hazards (e.g., tree branches, wires, signs, canopies, ladders);
- The spotter shall always maintain visual contact with the driver;
- The spotter always needs to be in the line of sight of the mirrors of the vehicle being backed up;
- At night, the spotter should use a flashlight to help the driver see him/her. DO NOT point the flashlight directly in the mirror of the driver;
- The spotter shall use hand signals to direct the driver. These hand signals should be somewhat exaggerated so that the driver can be clear as to what the spotter is signaling in the mirror;
- Voice communication between the spotter and driver is also good, but the driver may not hear the spotter over the noise of the vehicle and other background noise;
- The use of portable radios to communicate between the spotter and driver may prove beneficial in certain circumstances;
- In congested or tight areas, more than one spotter may be necessary;
- In congested or tight areas, one spotter may be needed at the rear and one at the front of the vehicle being moved either forward or backward; and,
- Spotters should also be used when going forward in tight areas to avoid hitting any objects. Especially during the winter when snowbanks tend to push parked cars farther into already narrow streets.

### 3.4.5.2 Driver Responsibilities

- Bring the vehicle to a complete stop;

- Roll window down completely;
- Make visual and verbal contact with the spotter. If you cannot see or hear the spotter, do not backup!;
- Driver and spotter must always maintain and eye contact using vehicle mirror(s);
- Drivers must have a thorough knowledge of spotter hand signals;
- The spotter must signal to the driver indicating it is safe to begin backing; and,
- The driver must give a two-blast warning on the horn just prior to backing.

# 3.5 Travel Safety–Domestic and International

## 3.5.1 Prevention Strategies During Travel

The following strategies may prevent or mitigate the potential for encountering dangerous situations when traveling:

- Identify your route prior to leaving;
- Inspect the vehicle before leaving;
- Carry a cell phone;
- Avoid traveling after dark, when possible;
- Avoid poorly lit streets at night;
- Always keep vehicle doors locked and windows up;
- Park only in well-lit, high-visibility areas;
- Avoid parking near dumpsters, retaining walls, and other such structures;
- Park in attended lots, if possible;
- Park away from intersections and under streetlights if parking on the street;
- Always have your keys ready when getting into the vehicle;
- In unfamiliar areas, if unsure of destination of in need of directions, stop at the most populated areas for assistance;
- Scan surroundings prior to getting out of the vehicle for potentially threatening conditions;
- Avoid having valuables in the vehicle or make sure valuables are hidden or covered in the vehicle;

- Always try to stay in the aisles of parking lots or garages and avoid walking in between cars; and,
- Report all threatening situations to the office, H&S Coordinator or the police, if necessary.

## 3.5.2 Prevention Strategies for Automatic Teller Machines

### 3.5.2.1 Walk-up ATMs

When using walk-up automatic teller machines (ATMs), the following strategies may reduce the potential for being victimized:

- Only use ATMs during daylight hours;
- Use ATMs in high-visibility areas;
- Have your ATM card ready when you approach the machine;
- Have coworkers with you when withdrawing money.

### 3.5.2.2 Drive-up ATMs

When using drive-up ATMs, the following strategies may reduce the potential for being victimized:

- Use drive-up ATMs in locations as described for walkup ATMs;
- Keep vehicle doors locked;
- Pull as close to the ATM as possible;
- Keep the vehicle running;
- Place your vehicle in park (or neutral with parking break on) while operating the ATM;
- Be aware of your surroundings; and,
- Immediately drive off if a potentially threatening situation exists.

## 3.5.3 Hotel and Motel Safety Considerations

When selecting hotels and motels, consider the following:

- Stay in an interior room (e.g., no direct outside access) or a room as close to the office as possible;
- Stay on the lower floors, particularly below the 7$^{th}$ floor, when possible. Most 100’ aerial fire trucks will reach the 7$^{th}$ floor.
- Stay at facilities that have electronic room locks;

- Stay at facilities with double locks (one a dead bolt) and a peephole;
- Stay at facilities equipped with fire sprinklers and smoke detectors in the rooms and hallways;
- Secure locks on windows and adjoining doors;
- Stay at facilities with well-lit hallways, stairwells, parking structures, and grounds;
- Stay at facilities that limit access to only facility guests;
- Stay at facilities that have a reception/concierge desk near the front entrance and/or elevators;
- Stay at facilities that keep doors to the outside locked from the outside;
- Stay at facilities where access to/from the parking garage is limited to the lobby;
- Stay at facilities where security is available for escorts to rooms and auto;
- Stay at facilities which are located in a safe areas (not a high-crime-rate area);
- Use only monitored exercise areas;
- Park in well lit areas and try to park in a location monitored by security cameras;
- Do not leave valuables in vehicles;
- If desk clerk audibly gives your room number, request a new room; and,
- Consult with the local Arcadis office for suggested hotels.





**Crime and Place** is an app that identifies crime risk for your current location or searched location based on historical personal and property crime data. You can program it to alert you when you are entering a high crime area.

## 3.5.4 Air Travel Guidelines

- Arrive early for your flight. Plan to arrive at least 2 hours before domestic flights and 3 hours before international flights;
- Report directly to the gate inside the security area after checking luggage;
- Listen to all safety briefings while on the aircraft and be aware of all emergency exit locations;
- While in flight, keep seat belt fastened to mitigate injury resulting from unexpected turbulence;

- Wear casual, unrestrictive, natural fiber, loose-fitting clothing to allow for less restricted movement;
- Place sensitive or valuable materials in carry-on luggage and use sturdy luggage with covered tags (preferably with a business address but no company name or logo);
- After deplaning, leave the airport as soon as possible. Disturbances are more likely to occur in a public airport;
- Minimize time spent in the airport; do not sit or stand near supporting columns or glass windows; and,
- Do not engage strangers in conversation.

## 3.5.5 International Travel

### 3.5.5.1 International Project Go/No Go

When a potential international opportunity occurs (including client development, prospecting, and project activities), please enter this opportunity into the International Opportunity Portal to initiate the opportunity pursuit approval process. Complete as much information as you can in the International Opportunity Form. Upon submittal of the form, the worker, worker's supervisor, the market sector leader and the International Opportunity Review Team will receive a confirmation email to kick off the review process. The International Review Team will reach out to workers via email if any additional clarification is needed.

Once reviewed, the International Team will approve/disapprove the request which will trigger a final email to the worker notifying them of the decision made.

### 3.5.5.2 International Travel

All international business travel must be booked through an Arcadis-authorized Travel Management Company (TMC). Arcadis maintains a partnership with International SOS, the world's leading medical and travel security risks services company to provide medical and travel security information and expertise before your trip and while traveling (internationally and domestically) to help safeguard your personal health and security.

**International SOS** is a travel safety app that focuses on essential information relative to security and health alerts. It is particularly beneficial to international travelers, however, information regarding many US cities is included. The Arcadis portal ID is: 11BYCA679423.

International SOS offers Arcadis:

- A presence in 1,000 locations in 92 countries across 5 continents.

- 27 Assistance Centers positioned globally;
- More than 11,000 workers and 92 offices;
- 99 languages supported;
- Access to 1,400 doctors;
- 56 international clinics;
- 200 full-time security specialists; and,
- 5 Regional Security Control Centers.



Did You Know? Arcadis Standard ARC HSGE022 “International Travel Safety” includes requirements and recommendations for completing international travel.

#### 3.5.5.2.1 Pre-trip Advisory

For international travel booked through an authorized TMC, the traveler will receive an automated Pre-trip Advisory (PTA) email. This PTA contains useful health, safety, and security information about the intended international destination, such as specific location intelligence, global travel tips to keep you safe, and links to other online tools commonly used by travelers. The PTA also contains links related to your travel, such as a link to the Arcadis Portal of the International SOS website, information on the International SOS Mobile app, and a pretravel checklist to help you fully prepare for your travel.

Included in the PTA is relevant information and advice, for example:

- Security concerns, such as terrorism or civil unrest;
- Health topics covering medical care, vaccination requirements, and the quality of food and water; and,
- Logistical matters ranging from transportation to cultural issues

The PTA also lists your itinerary and – most importantly – contact details for assistance. If an event unfolds which may affect you, either close to or during your trip, you will be kept informed by email alerts relevant for your trip. As an international traveler, you will also receive “Alerts” relevant to your travel, which will be sent to you before and during your travel, as well as health alerts that are sent during your travel and, in some instances, for up to 30 days after your return.

#### 3.5.5.2.2 International SOS Assistance App

Medical and travel security information, advice available in one click through the International SOS Mobile app. The International SOS Mobile app allows you to:

- Obtain essential medical and security information before departure or while travelling
- Call instantly the closest International SOS Assistance center for immediate support; and,
- Receive alerts for countries of your choice

You are strongly encouraged to download the International SOS app that is accessible to all staff and (available in IOS, Android, Windows Phone, and Blackberry) via the Arcadis Portal. You will use the email that you provided for your travel booking to download the app. If your email does not work, use the Arcadis International SOS membership number: 11BYCA679423.

Download the International SOS app onto your smart phone or device using your personal Arcadis email that is used to book your travel. Here are examples of some of the situations for which you would call the International SOS Assistance Center through your app:

- People are rioting outside of your hotel;
- There has just been an earthquake or other natural disaster where you are travelling;
- A colleague you are travelling with is missing;
- You are overseas and have lost your passport;
- Your laptop has been stolen; and,
- You have sustained an injury and need medical attention.

#### 3.5.5.2.3 Check-in Feature

The Check-in Feature on the app allows you to “check in” so International SOS can more easily find you in an emergency. Use the check-in feature at points along your route to improve the accuracy of your location. To use the Check-in Feature, click on the “Check-In” icon, then click “Check-In.” When using the function for the first time, you will be asked to enter your contact details.

#### 3.5.5.2.4 Live Chat

The International SOS app offers English-speaking travelers the option to Live Chat directly with a medical and security specialist any time of the day or night. Live Chat allows you to connect to the Assistance Center over Wi-Fi and maintains your privacy in public. You can send photos and images over Live Chat, and you can source answers to questions in seconds. Once you have downloaded the International SOS app on your smart phone,

the icon for Live Chat will appear. When you touch the Live Chat link, you will be asked to create a PIN and then you can start chatting.

## 3.6 First Aid

First-aid information in this handbook outlines commonly accepted practices associated with typical injuries and may not be applicable for every situation. It is the policy of Arcadis to comply with OSHA's Medical Services and First Aid Standard as it relates to the work we do. Accordingly, Arcadis will confirm the "ready availability of medical personnel," but how this is implemented is dependent on the circumstances of each place of work.

The Medical Services and First Aid Standard applies to all Arcadis offices that designate or expect employee(s) to act as First-Aid Responders at the office location and/or a job site. Employees who are not designated or expected to act as a First-Aid Responder may render first aid voluntarily if they are trained in first aid, but their actions are not covered under the OSHA standard. If the office or job site is in near proximity to medical services, employees do not need to be designated or expect to act as First-Aid Responders unless required to do so by an OSHA standard or client requirement. However, if the office or job site is not in near proximity to medical services, at least one person will be designated and trained to render first aid/ cardiopulmonary resuscitation (CPR).

**Red Cross First Aid** is an app that provides basic steps for rendering first aid based on injury type. Includes videos as a learning tool

OSHA has long interpreted the term "near proximity" to mean that emergency care must be available within no more than 3-4 minutes from the workplace. When interpreting "near proximity" OSHA recognizes that a somewhat longer response time of up to 15 minutes may be reasonable in workplaces, such as offices, where the possibility of such serious work-related injuries is more remote. In addition, each site shall maintain adequate first-aid supplies to treat personnel. The size and number of first-aid kit is available in the project HASP. Depending on proximity to a treatment facility (local work vs. remote or wilderness work), the site's H&S supervisor will determine transport options before the start of field work and document such in the Emergency Action Planning section of the HASP. If moving an injured person from the scene of the incident will aggravate the injury and he/ she is not in an area of imminent hazard, avoid moving the injured person until professional help arrives, but provide first aid and/or CPR as appropriate, consistent with your training. For non-life-threatening injuries, use the following guidance to provide first aid.



Did You Know? Arcadis Standard ARC HSGE004 “First Aid/CPR” includes requirements and recommendations when administering first aid and CPR.

## 3.6.1 General First-Aid Guidance

In the event of a serious or life-threatening emergency, call 911. For all other injuries and illnesses, call WorkCare (1 888 449 7787) for guidance. The information herein is to assist in determining the severity of the incident and basic care if EMS is unavailable. First aid for exposure to chemicals is found in Section 4 – First-Aid Measures of the chemical Safety Data Sheets (SDS).

If an accident occurs in the field, the project team is responsible for handling the situation by considering the following actions:

- Decide if the patient needs care beyond first aid at a medical facility. If so, call 911 if adequate transportation cannot be provided by project team. If necessary, contact WorkCare to help with this decision;
- Remain calm and provide the patient with quiet, efficient first-aid treatment;
- Keep the patient warm and lying down. Do not move an injured person until you have discovered the extent of their injuries;
- Call 911 immediately if the injured person is not breathing. Begin chest compressions if you are trained to do so;
- Stop any bleeding;
- Watch carefully for signs of shock;
- Check for cuts, fractures, and breaks
- If the head, neck, or spine are suspected to be injured, call 911;
- Do not allow people to crowd the injured person; and,
- Do not remove clothing unless it is imperative.

### 3.6.1.1 Inhalation First Aid

Remove any workers complaining of symptoms of chemical overexposure from the project site and transport them to the designated medical facility for examination and treatment, if necessary, or as directed by WorkCare. If available, refer to Section 4 of the chemical’s SDS for treatment information.

### 3.6.1.2 Ingestion First Aid

Call Emergency Medical Services (EMS) and consult a poison control center for advice. If available, refer to Section 4 of the SDS for treatment information. If victims are unconscious, keep them on their side and clear their airway if vomiting occurs.

### 3.6.1.3 Skin Contact First Aid

Project workers who have had skin contact with contaminants will, unless the contact is severe, proceed to the wash area. Workers will remove any contaminated clothing and then flush the affected area with water for at least 15 minutes. (Refer to Section 4 - First Aid Measures of the SDS for treatment information.) Unless the contact results in a severe reaction, call and follow the advice of WorkCare.

If workers are working around injurious corrosive materials, a portable or fixed emergency shower or drench hose may be required based on the potential for injury. Contact Corporate Health and Safety for guidance.

### 3.6.1.4 Eye Contact First Aid

Project workers who have had contaminants splashed in their eyes, or who experience eye irritation, must immediately proceed to the portable or fixed eyewash station. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing or equipment is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes or as specified in Section 4 of the chemical's SDS. Arrange prompt transport to the designated medical facility, upon advice from WorkCare.

If workers are working around injurious corrosive materials, a portable or fixed eyewash station may be required based on the potential for injury. Eyewash bottles may suffice in some situations. Contact Corporate Health and Safety for guidance.

### 3.6.1.5 Shock

Shock is a depression of all body processes and may follow any injury, no matter how minor. Factors, such as hemorrhage, cold, and pain, will increase the likelihood and severity of shock, the patient will feel weak and may faint. The skin becomes cold and clammy, and the pulse becomes weak and rapid. Shock can be more serious than the injury itself.

If you suspect the injured person is in shock, you must call emergency services (911) or other numbers as required by the site.

To prevent and control shock, follow these recommendations:

1. When treating injuries:

a. restore breathing;

b. stop bleeding;

c. treat breaks and fractures;

2. If there are no head or chest injuries, place the patient on his or her back with the head and chest lower than the legs. This will help blood circulate to the brain, heart, lungs, and other major organs;
3. If severe head and chest injuries are present, elevate the upper body. If chest injuries are present, elevate the injured side to help the functioning of the uninjured lung;
4. If the injured person becomes unconscious, place him or her in a face-down position to prevent choking on blood, vomit, or the tongue; and,
5. Keep your patient warm and under shelter.

### 3.6.1.6 Stopped Breathing

If the injured person has stopped breathing, begin cardiopulmonary resuscitation. Place the patient on his or her back and follow these steps:

1. Call 911 or instruct someone nearby to call 911.
2. Give 30 compressions at a rate of at least 100 to 120 per minute and a depth of at least 2 inches. Let the chest come back to its normal position.
3. Open the airway by tilting the head back and lifting the chin.
4. While holding the airway open, pinch the nose closed.
5. Place your mouth completely around the victim's mouth and blow, giving two breaths and watching for chest expansion.
6. Repeat sets of 30 compressions and two breaths until medical attention arrives.

### 3.6.1.7 Bleeding

To control bleeding, elevate the wounded area above the heart and apply pressure using gauze, or a clean cloth. If the bleeding doesn't stop, continue to apply pressure.

After bleeding has been controlled, wash the wounded area with disinfectant and apply a dressing and bandages.

### 3.6.1.8 Fractures

There are two types of fractures: simple (closed) or compound (open). The following are signs of a possible fracture:

- There is pain in the affected area;
- The area may be deformed;
- The victim is unable to place weight on the area without experiencing pain; and,
- You or the patient feel or hear a grating sensation or sound during any motion of the injured area.

If a fractured bone is suspected, call 911. If EMS is not available, the following treatment is advised:

1. If in doubt, treat the injury as a fracture.
2. Splint joints above and below the fracture.
3. If the fracture may penetrate the skin, cover with a clean, moist dressing only.
4. Pad the splint(s).
5. Check splint ties frequently to be sure they do not hinder circulation.
6. Cover an open wound with a clean dressing before splinting.

### 3.6.1.9 Dislocation

Dislocation happens when the ligaments near a joint tear, allowing movement of the bone from its socket. It is unwise to treat a dislocation unless you are a trained professional, as permanent damage may occur. Support the affected extremity with a sling or other device and seek medical attention.

### 3.6.1.10 Sprains

Treat sprains by applying cold to the area for the first 24 hours. When swelling has subsided, let the sprain sit for a day. Apply heat the following day to aid in the healing process. Splint the sprain to make it immobile until the pain has completely disappeared.

### 3.6.1.11 Concussions

Concussion symptoms may include convulsions, unresponsiveness of the pupils, or headache and vomiting. All injured parties with head injuries must see a physician immediately.

## 3.6.1.12 Burns

**Chemical Burns**

Call 911 or other designated emergency number and seek medical aid as soon as possible, following guidance in the chemical SDS for appropriate emergency care.

**Electrical Burns**

1. Care for life-threatening emergencies first;
2. Call 911 and/or seek medical aid;
3. Cover burns loosely with clean, dry cloth; and,
4. Expect shock and treat for it accordingly.

**Heat Burns**

1. If a significant burn injury occurs, call 911 or other applicable emergency number per the client site and location and seek medical aid as soon as possible;
2. Stop the burning process by whatever means are available. If possible, apply large amounts of water to cool the burn;
3. Bandage with a clean, dry dressing; and,
4. Do not break a blister if one forms. DO NOT use ointments or remove embedded clothing.

## 3.6.1.13 Choking

If the victim can speak or cough forcefully and is getting enough air, do not interfere with their attempts to cough an obstruction out of the airway. If the victim cannot speak or is not getting enough air, instruct someone to call 911 while you perform abdominal thrusts, as follows:

1. Stand behind the victim and wrap your arms around the waist;
2. Make a fist with one of your hands and place it just above the victim's navel and below the ribs, with the thumb and forefinger side toward you; and,
3. Grab this fist with your other hand and pull it quickly toward you and slightly upward. Repeat until the victim can breathe or becomes unconscious.

If the victim is unconscious or becomes unconscious, do the following:

1. Lay the victim on his or her back;

2. Check for objects in the victim's mouth. Try to sweep any obstruction out of the victim's throat;
3. Even if you are not successful, tip the head back and attempt rescue breathing;
4. If rescue breathing is not working due to the obstruction, sit straddling the victim's thighs and give the victim up to five abdominal thrusts (i.e., pushing into the victim with the heel of the hand just above the belly button); and,
5. Repeat the steps above, as needed, until you clear the obstruction.

### 3.6.1.14 Convulsions/Seizures

Signs of convulsions or seizures include jerking movements, bluish face and lips, rolled-back eyes, clenched teeth, and frothing at the mouth. Convulsions usually end safely in less than 30 seconds, after which the victim enters a phase of unconsciousness or drowsiness. If an individual experiences a convulsion, take the following measures:

1. Try to keep the victim from hurting himself or herself during the convulsion, but do not restrain the victim;
2. Do not place any object between the victim's teeth;
3. Do not give the victim anything to eat or drink;
4. If the victim stops breathing, administer CPR and rescue breathing;
5. After the convulsion, place the victim on his or her side in the recovery position and monitor breathing; and,
6. Call 911 or seek medical aid as soon as possible.

### 3.6.1.15 Drowning

1. If possible, use a long pole, ring buoy, or boat to rescue the victim. Never attempt a swimming rescue unless you are trained to do so;
2. If the victim has a pulse but is not breathing, begin rescue breathing;
3. If the victim is not breathing and has no pulse, begin CPR;
4. Call 911 or other appropriate number for the site or seek medical aid as soon as possible; and,
5. Take steps to prevent shock.

### 3.6.1.16 Fainting

1. Fainting typically victims regain consciousness almost immediately;

2. Lay the victim down on his or her back and provide plenty of fresh air;
3. Call 911;
4. Reassure the victim and apply a cold compress to his or her face; and,
5. If the victim vomits, roll to his or her side and keep the victim's airway clear.

#### 3.6.1.17 Poisoning

**Swallowed**

1. Look for open bottles, a poisonous smell on the breath and symptoms, such as pain in the throat or stomach, drowsiness, vomiting, and unconsciousness;
2. Call the Poison Control Centre or 911;
3. Follow the exact directions of the Poison Control Centre;
4. Keep the suspected poison and/or a sample of any vomit with you; and,
5. Do not give the victim anything by mouth unless directed by the Poison Control Centre.

**Inhaled**

1. Get the victim to fresh air, preferably outdoors. Be careful not to breathe in fumes yourself;
2. If the victim has a pulse but is not breathing, begin rescue breathing;
3. If the victim is not breathing and has no pulse, begin CPR; and,
4. Call the Poison Control Centre or 911 as soon as possible.

## 3.7 Bloodborne Pathogens

Unless you take proper precautions, an injured individual can transmit viruses and bacteria to you when you provide first aid, especially if there is severe bleeding. Other bodily fluids may also be infected, so avoid contact with all fluids. Infected blood and body fluids may contain human immunodeficiency virus (HIV), hepatitis B virus (HBV), and others. The following program will help reduce the risks associated with transmission of these blood-borne pathogens. Workers will employ universal precautions when handing these substances, such as:

- Persons trained in first aid/CPR will also be trained in blood-borne pathogens management;
- Prior to rendering first aid, don PPE to prevent direct contact of skin or mucous membrane to bodily fluids. PPE will include, at a minimum, new gloves (latex or nitrile) and safety glasses;

- If rescue breathing/CPR is performed, use a protective mask or other protective barrier designed for mouth-to-mouth resuscitation;
- Clean any object or surface contaminated with bodily fluids. Decontaminate the affected surface by cleaning the area with a commercially available disinfectant or a mixture of household (5%-6%) bleach and water at a ratio of 1:10;
- If cleaning materials, PPE, or other objects cannot be decontaminated, place in a closed leak-proof container, clearly marked “BIOHAZARD” for later disposal, in accordance with local, state, and federal regulations;
- Upon completion of first-aid activities, if skin and/or mucous membranes are contaminated with bodily fluids, immediately clean exposed areas with soap and water and with a disinfectant. In addition, clean your hands, forearms, and face even if these areas were covered by PPE;
- The bloodborne pathogens standard defines regulated waste as liquid or semi-liquid blood or other potentially infectious material (OPIM); contaminated items that would release blood or OPIM in a liquid or semi-liquid state if compressed; items that are caked with dried blood or OPIM and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or OPIM [29 CFR 1910.1030(b)]. A Band-Aid or wound dressing that has visible dried blood on it may not meet the definition of a regulated waste. When in doubt, contact Arcadis Corporate Health and Safety.



Did You Know? Arcadis Standard ARC HSGE005 “Bloodborne Pathogens” includes requirements and recommendations for preventing exposure to bloodborne pathogens.

## 3.7.1 Hypodermic Needles

Used hypodermic needles are occasionally observed at project sites, typically lying on the ground. When a single hypodermic needle is identified, it is best to Stop Work and place cones or similar materials around the needle (being careful to not make contact with the needle). If the needle is on public property, local governments may have a needle removal service. Contact the local municipality to determine if this is an option. Additionally, companies that specialize in needle/sharps removal may be contracted if the needle(s) must be removed. Contact Corporate H&S for information on companies that provide needle removal services.

Keep in mind that specialized PPE, tools and receptacles are needed to safely remove and dispose of needles.

## 3.8 General H&S Rules and Safe Work Permits

General safety rules for site activities include, but are not limited to, the following:

- A copy of this handbook, along with any applicable HASPs, JSAs, Traffic Safety Plans (TSPs) – Right of Way (ROW) and Non-Right of Way (NROW), or other project H&S documents, must be present onsite and readily available for review by each worker;
- All project workers will review applicable portions of this handbook and other project H&S documents prior to the morning tailgate meeting;
- Food, beverages, chewing gum, and tobacco products will be consumed only in clean area;.
- Workers must wash their hands before eating, drinking, smoking, or using toilet facilities;
- Workers will wear all PPE as required, use STOP WORK, and replace damaged PPE immediately;
- When applicable, workers will secure disposable coveralls, boots, and gloves at the wrists and legs, and confirm closure of the suit around the neck;
- Workers will report all injuries, illnesses, near misses, property damage, utility strikes, and other incidents or unsafe conditions or work practices to the Site Supervisor as soon as possible;
- Workers must obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so;
- Workers will use, adjust, alter, and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer's directions;
- Maintain the integrity of all safety devices;
- Workers will use, adjust, alter, and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer's directions;
- Workers will perform only tasks for which they have been properly trained and will advise their supervisor if they have been assigned a task for which they are not trained;
- The presence or consumption of alcoholic beverages or illicit drugs during the workday is strictly prohibited. Workers will not take prescription or over-the-counter drugs may impair judgement or have side effects that create an unsafe work condition;
- Workers will remain upwind of site contaminants or waste during site activities whenever possible;
- Upon skin contact with materials that may be impacted by constituents of potential concern (COPCs), remove contaminated clothing, wash the affected area immediately and don clean clothing (if appropriate).

Immediately report any skin contact with materials potentially impacted by COPCs to the Site Supervisor. If needed, seek medical attention and/or call WorkCare;

- Workers will practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COPCs, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination;
- Remove PPE as required to limit the spread of contaminated materials;
- At the end of each shift or as required, dispose of all single-use coveralls, soiled gloves, and respirator cartridges in designated receptacles;
- Do not remove soil containing site COPCs from protective clothing or equipment using compressed air, by shaking, or by any other means that disperses contaminants into the air;
- Inspect all non-disposable PPE for contamination in the contamination-reduction zone (CRZ). Any contaminated PPE must be decontaminated or disposed of properly;
- Workers will recognize emergency signals (e.g. evacuation, injury, fire);
- Mobile devices, laptops, cameras, and other commercially available electronic devices may not be allowed at hazardous locations. Staff must know the locations where these devices are not permitted at the project site. Work with the client to identify these locations, and obtain necessary client permits or equipment to maintain communication in the event of emergency in these hazardous locations;
- Workers will use the “buddy system” during all operations requiring Level C PPE or higher, and, when appropriate, during Modified Level D operations. Field workers must inform their partners or fellow crew members if they are experiencing symptoms of exposure to toxic materials. The symptoms of such exposure may include, but are not limited to:
  - Headaches;
  - Dizziness;
  - Nausea;
  - Blurred Vision;
  - Cramps;
  - Irritation of eyes, skin, or respiratory tract;
- If PPE or noise levels impair communications, pre-arranged hand signals must be used for communication. Workers must stay within line of site of another team member; and,
- Headphones or ear buds are that are not required for project activity (i.e., radio communication) are not allowed to be worn on any project site.




OSHA Safety is an app that includes all OSHA regulations in an easy to read, searchable format. General industry, construction, agriculture, and maritime regulations are included.

## 3.8.1 Safe Work Permits

A Safe Work Permit may be required for high-hazard work, such as confined space entry, working at heights, excavation, and trenching, energized electrical work and for other hazardous activities. Safe Work Permits are designed to address specific activity hazards and to provide a written record that authorizes specific work, at a specific location, for a specific period. The permit itemizes correct procedural sequences and necessary controls so that all foreseeable hazards have been considered and that appropriate precautions are defined before work commences. Safe Work Permits may be issued by Arcadis or the client. This may vary by site.

The Safe Work Permit is an agreement between the permit issuer (designated by Arcadis) and the permit receiver (workers) and identifies the following:

- All potential hazards associated with the job (including adjacent work areas) and the measures taken to control or eliminate the hazards;
- Conditions (e.g. equipment preparation, atmospheric testing, waste disposal) under which work can proceed;
- Required safety equipment (e.g. PPE, rescue equipment, self-contained breathing apparatus) to complete the work safely; and,
- Names of all workers assigned to complete the job.

The Safe Work Permit will aid in identifying and controlling hazards at the project site, but it will not by itself make the job safer.

Examples of circumstances where Safe Work Permits are issued are presented below:

- Lockout/Tagout: Permits work involving the control of hazardous energy sources;
- Hot Work: Permits work involving open flames, sparks, or other sources of ignition that could create a fire or explosion hazard;
- Vessel Entry/Confined Space Entry: Permits entry into spaces with restricted access or egress, or meets the definition of confined space (see **Section 3.23**; e.g., fuel tanks, pipelines, pumping stations, process vessels, septic tanks, sewage digesters, manholes, vats, and pits);
- Ground Disturbance: Permits excavations and other ground disturbance activities;

- Maintenance Work: Permits work for general maintenance on equipment or facilities where potential hazards may exist (e.g. energized electrical equipment, hydrogen sulfide, or pressure);
- Vehicle Entry: Permits and controls the access of vehicles and heavy equipment into hazardous locations. This permit can also be issued in combination with the above Safe Work Permits;
- Non-intrinsically Safe Equipment: Ask the SS if use of nonhazardous-location-rated electronic equipment (e.g. cellular phones, cameras, defibrillators, pagers, flashlights, laptops, mobile devices, remote starters) is permitted; and,
- Refer to Arcadis H&S Standards (e.g. Work at Heights, Confined Space, etc.) for task-specific work permit requirements.

## 3.9 General Housekeeping, Personal Hygiene and Field Sanitation

Workers will be made aware of the appropriate method to dispose of waste and will observe good housekeeping practices at Arcadis offices and project sites. Such practices include, but are not limited to, the following:

- Maintain project sites in an orderly fashion and clean up after each job has been completed and at the end of a worker's shift. Equipment, tools, extension cords, materials, and supplies must be stored in a safe and orderly manner;
- Keep project sites clean and free of oil, grease, mud, and other slippery materials to prevent slip, trip and fall hazards; post signs to warn others of slippery floors;
- Make sure that aisles and walkways, entrances and exits, and access to firefighting and first-aid equipment are kept clear of obstructions;
- Secure equipment and vehicles if left unattended or overnight at a project or work location;
- Cover, demarcate, or barricade, as appropriate, any excavations, pits, or other hazards;
- Collect and properly dispose of hazardous wastes, according to Arcadis waste control practices and regulatory and client requirements;
- Avoid placing monitoring equipment on a potentially contaminated surface, including the ground surface;
- Keep building entrances, exits, platforms and stairwells free of snow and ice;
- Never set tools or materials on raised areas where they might fall and strike another worker;
- Remove all sharp objects when noticed, including scrap metal, broken glass, nails in wood, scrap welding rods, reinforcing steel, and tin;

- Leave washing and toilet facilities in good sanitary condition for others;
- Report any safety hazards that cannot be quickly remedied.

During site activities, workers will regularly observe project sites to identify excess trash and unnecessary debris. Workers will collect excess debris and trash and store it in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Additionally, project equipment and supplies will be kept in an orderly manner to avoid creating a trip hazard.

## 3.9.1 Personal Hygiene

Proper personal hygiene practices are extremely important when handling or working near hazardous materials. Arcadis workers will use the following personal hygiene practices to minimize or eliminate exposures:

- Always wash hands, face, and exposed skin surfaces with soap and water after working with chemicals or hazardous materials. Always wash before eating, drinking, chewing, smoking, or when using toilet facilities, even if you have been wearing gloves. Washing must be repeated at the end of the shift. The use of hand sanitizers or wipes is not a substitute for washing with soap and water;
- If facilities are available and it is practical, the workers will consider changing clothes before leaving work to avoid bringing hazards home;
- Wash work clothes regularly and clean boots daily;
- Never eat, drink, or smoke in restricted or hazardous work areas;
- Practice good housekeeping habits and leave the washroom and toilet facilities in a condition that is acceptable for use by other workers;
- Regularly inspect and maintain PPE that has been exposed to chemicals.

## 3.9.2 Sanitation

Site sanitation will be maintained according to appropriate provincial, territorial, federal, and local requirements and the guidance provided below:

- Break Area: Breaks must be taken in approved areas away from the active work area. The client may specify areas where breaks may be taken, or the Arcadis Site Supervisor may specify break locations;
- Potable Water: The following rules apply to all field operations:

- Provide an adequate supply of potable water at each project site. Potable water must be kept away from hazardous materials or media, and contaminated clothing or equipment;
- To dispense drinking water, use only portable containers that can be tightly closed, and equipped with a tap dispenser. Water will not be consumed directly from the container (drinking from the tap is prohibited) and may not be removed from the container by dipping;
- Clean and sanitize portable water dispensers/containers weekly;
- Clearly mark containers used for drinking water and use these containers for drinking water only;
- If individual serving containers are not used, provide disposable drinking cups. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required;

- Sanitary Facilities: Access to facilities for washing before eating, drinking, or smoking, or alternate methods, such as waterless hand cleaner and paper towels, will be provided; and,
- Lavatory: If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided.

This requirement does not apply to mobile crews or to normally unattended site locations if workers at these locations have transportation immediately available to nearby toilet and hygiene facilities.

# 3.10 Site Security, Work Zones and Decontamination for HAZWOPER Sites

## 3.10.1 General Site Requirements

Workers must properly secure project sites against theft, acts of vandalism, or entry by wildlife, livestock, or unauthorized persons and vehicles. Entry onto project sites must be arranged prior to field activity by contacting the property owner or representative.



Did You Know? Arcadis Standard ARC HSFS012 “Hazardous Waste Operations and Emergency Response (Hazwoper)” includes requirements and recommendations when completing tasks defined under OSHA 29 CFR 1910.120 regulations.

## 3.10.2 Work Zones and Decontamination for Contaminated Sites Work

For contaminated sites work, the Site Supervisor will establish work zones to accommodate work operations. The work zones shall be clearly communicated to all project workers.

A site map should be developed with enough detail included to adequately identify the zones in relation to other site features. The work zones are defined as:

- Exclusion Zone (EZ) is an area where contaminated materials exist;
- Contamination Reduction Zone (CRZ) is an area where decontamination procedures are performed; and,
- Support Zone (SZ) is an uncontaminated area designated with Access Control Points for entry/exit into and out of work operations.

The hotline is the line of demarcation where the EZ ends and the CRZ begins. The area that lies outside of the CRZ is the SZ and is considered uncontaminated for the purposes of workers performing support duties there. The Site Supervisor will determine the extent of each zone and will communicate that information to workers during tailgate briefings. Physical demarcation of work zones onsite will be determined by the Site Supervisor using a variety of methods including, but not limited to, signs, tape, and flags.

## 3.10.3 Work Zones

### 3.10.3.1 Authorization to Enter

Only workers with the appropriate training will be allowed to work at the project site. The Site Supervisor will maintain a list of authorized persons; only workers on the authorized persons list will be allowed to enter the project site.

### 3.10.3.2 Site Orientation and Hazard Briefing

No person will be allowed at the project site during site operations without first completing a site orientation and hazard briefing. This orientation will be presented by the Site Supervisor and will include a review of the HASP. This review must cover the chemical, physical, and biological hazards; protective equipment; safe work procedures; and emergency procedures for the project. Following this initial meeting, tailgate safety meetings will be held each day before work begins. All people entering the project site, including visitors, must be briefed on the contents of the project HASP, review the daily tailgate safety meeting minutes, and document their understanding of these documents by signing them in the appropriate locations.

### 3.10.3.3 Certification Documents

Training records and where required, medical clearance records/certification, will be readily available and accessible for every project. Specialty training, such as first-aid/CPR certificates, as well as current medical clearances for all project field workers required to wear respirators, will be readily accessible, and ideally maintained on the project site. All Arcadis and subcontractor workers must provide required training and medical documentation to the Site Supervisor prior to starting work, if requested.

### 3.10.3.4 Entry Log

The Site Supervisor will maintain a log-in/log-out sheet at the site. Workers must sign in and out on the log sheet as they enter and leave the project site, and the Site Supervisor may document entry and exit in the field notebook. The tailgate meeting acknowledgement form may be a substitute for this sheet.

### 3.10.3.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed at any Arcadis project site unless they are wearing the minimum required PPE which includes work boots, high visibility shirt/jacket, protective eyewear, gloves suited to the task.

### 3.10.3.6 Emergency Entry and Exit

The Site Supervisor will notify emergency response workers who must enter the project site of any hazards present in the area. All activities will cease in the event of an emergency. People exiting the project site because of an emergency will gather in a designated safe area for a head count. In the event of an emergency, the Site Supervisor will confirm that all people who entered the project site have exited.

### 3.10.3.7 Exclusion Zone (EZ)

An EZ may consist of a specific work area or may be the entire area of potential contamination. This is typically the area with actual or potential contamination and the highest potential for exposure to hazardous substances. All workers entering an EZ must use the required PPE and must have appropriate training and where required, medical clearance (e.g. respirator clearance) Cones, caution tape, or a site diagram will identify the location of each EZ.

### 3.10.3.8 Contamination Reduction Zone (CRZ)

CRZs are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas. The CRZ or transition area will be established, if necessary, to perform decontamination of workers and equipment. All workers entering or leaving the EZ will pass through this area to prevent

contamination spread. Tools, equipment, and machinery will be decontaminated in a specific location as required. All workers will be decontaminated onsite, as required. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

#### 3.10.3.9 Support Zone (SZ)

The Support Zone is the area of the site that is free from contamination (at least at surface) and that may be safely used as a planning and staging area. Smoking may be permitted in the SZ, subject to site requirements.

#### 3.10.3.10 Posting

Work areas will be prominently marked and delineated. This may be completed using cones, caution tape, delineators, signs, etc.

### 3.10.4 Workers Decontamination

On contaminated sites, all workers wearing Modified Level D or Level C protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The workers decontamination area will consist of the following stations at a minimum:

- Station 1: Workers leaving the contaminated zone will remove gross contamination from their outer clothing and boots;
- Station 2: Workers will remove their outer garment and gloves and dispose of them in properly labelled containers. Workers will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution and will carry these items to the next station; and,
- Station 3: Workers will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and placed in a clean plastic bag. Example CRZ setups and decontamination steps are provided in **Figure 3-3.**

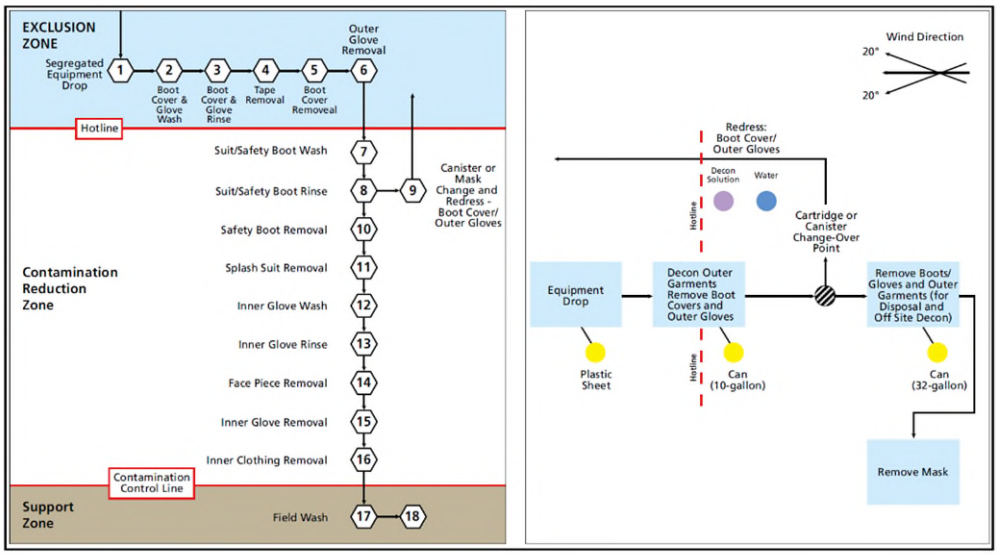



**Figure 3-4 Contaminated Sites Control Zones**

### 3.10.4.1 Equipment Decontamination

All vehicles that have entered the EZ will be decontaminated at the decontamination pad prior to leaving the zone. If the level of vehicle contamination is low, decontamination may be limited to rinsing tires and wheel wells with water. If the vehicle is significantly contaminated, steam cleaning, or pressure washing of vehicles and equipment may be required. The contaminated wash and rinse solutions will be managed as appropriate.

### 3.10.4.2 PPE Decontamination

Where and whenever possible, single-use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labelled containers. Reusable protective clothing will be rinsed at the site with detergent and water. The reinstate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves, and covers must be thoroughly cleaned at the end of each work shift and ready for use prior to the next shift.

When the cleaner used does not contain a disinfecting agent and the respirator is not individually assigned, the respirator components should be immersed for two minutes in one of the following:

- Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter (mL) of household bleach to one liter (L) of water at 43º C (110º F); or,

- Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 (mL) of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 $cm^3$ of 45 percent alcohol) to 1 L of water at 43º C (110º F); or,
- Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer;
- Rinse components thoroughly in clean, warm (43º C [110º F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed;
- Components should be hand-dried with a clean lint-free cloth or air-dried;
- Reassemble face piece, replacing filters, cartridges, and canisters where necessary;
- Test the respirator to make sure that all components work properly.

## 3.11 Personal Safety and Other Unique Site Conditions

If personal safety issues exist at a project site, resources, such as the client, local law enforcement officials, Park or Wildlife Service, and Animal Control, will be used, as necessary, to provide the safest possible work environment. Some general guidelines are provided here, but each situation is different, and actions must be taken based on the specifics of each situation.

If a project site is in an area where an workers' personal safety may be at risk from potential criminal acts, the PM or Site Supervisor will work with the client and local law enforcement officials to evaluate the risk and determine what steps can be taken to minimize the risk. For example, can local law enforcement be present or make frequent visits while the work is being conducted? Should outside security (e.g., private security or paid duty officer) be hired? Should work only occur during certain times of the day? Or should work not proceed at all?

When risks to personal safety are identified at a project site, workers will not work alone and will have the ability to communicate with local law enforcement and the PM through cell phones or 2-way radios. Project teams will check in with the PM (or other specific individual) at predetermined times throughout each workday, and if project teams do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify local law enforcement.

If, while on the project site and despite precautions set forth above, an worker feels their personal safety is at risk from potential criminal acts, the worker should leave the site immediately.

### 3.11.1 Project Site in Isolated Area and Workers Working Alone

At no time, will workers work alone in high hazard/dangerous situations, described as situations where the risk from falling, burning, loss of consciousness, fire, electrocution, intoxication, suffocation, personal security issues, and serious injury.

- Whenever possible, workers will use the buddy system in isolated areas. If the isolated area involves hiking/walking into areas that are unmarked or if there is potential to become directionally disoriented (e.g., no trails, unmarked trails, forested, or highly vegetated areas), workers will be trained on the use of a compass and/or global positioning system (GPS) and trail/topography maps, and, if necessary, will take wilderness safety training. The PM or Site Supervisor will work with the local park/Wildlife Service on what emergency planning is necessary (e.g., unexpected weather, animal attack, and search/rescue).
- Where workers will work alone, a communication plan will be established prior to initiating work that will specify that workers will check in with the PM (or other specific individual) at predetermined times throughout each workday and if workers do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify the appropriate authorities and, where international travel is involved, International SOS. If communication is not possible during the day, the workers will check in with the PM at the start and end of each workday. A Lone Worker Plan template is available in the Arcadis HASP.
- Communication through cell phones or 2-way radios will be used whenever possible. Where a cellular network is not available, and radio communication is not possible, a satellite phone may be a preferred option. A transponder or GPS locator device can also be carried as a means to locate a lost worker; and,
- If workers will be travelling within isolated areas, a schedule and route should be established identifying:
  - Start and finish locations for each day;
  - Start and finish times for each day; and,
  - Routes that will be followed throughout each day.

Workers will not deviate from this schedule without first contacting the PM. It may also be appropriate and necessary to notify the client, law enforcement, or local Park/Wildlife Service officials of these schedules.

### 3.11.2 Work in Public Areas

Two primary H&S issues are associated with working within public areas, including parking lots: traffic-related and personal safety.

Workers using parking lots at any Arcadis location should:

- Watch for pedestrians;

- Not cut through empty spaces and lanes. Be watchful of other motorists who may do this;
- Obey pavement directional arrows, crosswalk markings, posted speed limits and “yield” or “stop” signs;
- Drive slowly and use turn signals;
- Use seat belts;
- Pull through parking spaces where possible to increase visibility upon leaving; and,
- Not occupy more than one space.

For personal safety, all Arcadis workers are encouraged to:

- Watch for cars cutting diagonally across lots;
- Display proper body language to show awareness of any suspicious situations and people;
- Always hide valuables and do not leave personal information displayed in the vehicle;
- Park in well-lit areas. Report an inadequately lit parking lot to the facility or lot manager;
- Ask a fellow worker (that is known) or security (if available) to walk them to their car if they do not feel safe;
- Walk in groups;
- Close all car windows and lock car doors;
- Always have keys ready when approaching your car and check the back seat before getting in;
- When entering your car, lock all the doors and turn on headlights. This will allow the driver to see anyone outside in the dark;
- Start the vehicle and drive to another location that is well lit before making any necessary phone calls. Limit the amount of time spent idle in the car;
- If you think you are being followed, drive, walk or run quickly to a lighted store, police station, fire station or where crowds of people can offer help. Know where to go for help (e.g., police station, fire station) and do not go home;
- If approached or if you feel threatened, do something to draw attention (e.g., scream, yell, blow a whistle, honk the car horn).

### 3.11.3 Hunter Awareness

During certain times of the year, hunters may be present in or around project sites. During hunting season, in applicable areas, workers will wear high-visibility, hunter orange vests and hats and, if appropriate, other high-

visibility clothing. During low light conditions, work may be restricted or planned as appropriate. Workers should talk loudly or carry a noise maker (air horn, broadcast radio, whistle, etc.) so they are not mistaken for an animal. During certain times of the year, there may be hunters in areas adjacent to the site or trespassing onsite. A telltale sign of hunters is an empty vehicle parked along the side of the road. Team members should verify the current hunting season at the time of site activity. If shots are heard that appear to have been fired from a nearby location, shout in the direction of the gunfire to let hunters know of your presence. Immediately return to your vehicles and stop work until the area is clear of the hunters. Workers will immediately report to the Site Supervisor any on-site evidence of hunters (e.g., spent shell casings, tree stands, trails that have not been established by Arcadis, animal feeding stations, salt licks, etc.).

### 3.11.4 Workers Working Late/Early Hours

Whenever possible, workers will not work before dawn or after dusk, and work will be completed before dark. If this is not possible, workers will wear appropriate reflective apparel and have appropriate lighting, such as portable lights, flashlights, or headlamps, as appropriate for the activity being conducted. Personal security will be assessed, and measures taken as discussed above, if appropriate.

Often, travel to/from Arcadis work sites takes place early in the morning and in the evening during low light conditions. Extra vigilance is required during low light conditions as it is at these times that wild animals are frequently found on and adjacent to roadways. Furthermore, drivers are prone to drowsiness at these hours. Ensure you are well rested and fit to drive before setting out on your journey.

### 3.11.5 No or Limited Cell Phone Service

The PM will assess if any other type of communication, such as 2-way radios, is appropriate for the area. The project team must plan start and estimated finish times and require check-ins, as appropriate. If employees are unable to check in daily because of project location and 2-way radios do not work, a transponder or GPS locator device may be used to locate the team if necessary.

If employees will be moving from area to area within a day or over several days, each time the crew moves, the team will:

- Establish beginning and ending locations,
- Plan start and estimated finish times, and
- Plan routes that will be followed throughout the period.

Employees will not deviate from the schedule or planned route without first contacting the PM. It may also be appropriate and necessary to notify the client, law enforcement, or local Park/Wildlife Service officials of these schedules and routes.

### 3.11.6 Potentially Dangerous Wildlife

The project team will identify any potentially dangerous wildlife that may reside in or around the project site. All workers working at wilderness or rural sites should have bear/wildlife awareness training. The most common dangerous animals that may be encountered include black, grizzly, and polar bears, cougars, moose and deer. Racoons, fox, rats and other rodents, while not predatory to humans, can carry rabies and other diseases and should be avoided. Other smaller animals such as wolves, coyotes, badgers, wolverines, and lynx, can also pose a hazard but are rarely encountered. Venomous snakes and spiders such as rattlesnakes, black widow spiders, and brown recluse spiders can also be encountered in much of the United States. Where contact with dangerous wildlife is likely, the project HASP should provide recommendations for avoiding contact and if contact is made, how to react appropriately. If the chance for contact with predatory wildlife such as bears or cougars is high, it may be necessary to arrange for a wildlife monitor to be present onsite while work is being performed, and/or to have workers receive additional training on avoiding and reacting to the particular animal(s). Wildlife monitors should be considered when working in known grizzly, cougar, or polar bear habitat. Non-lethal protection from wildlife can be offered by protection devices like bear bangers, bear bells, pepper spray, etc.

### 3.11.7 Guard or Wild Dogs

Domesticated dogs include animals used as guard dogs as well as pets. If the client or dog owner has guard dogs at the site or residence, the PM or Site Supervisor will work with the client each site visit to make sure that the dogs are unable to gain access to any area in which Arcadis workers will or could be working. For stray or wild dogs, see **Section 3.17 - Biological Hazards**.

## 3.12 Severe Weather

During threatening weather, the Site Supervisor will monitor radio weather forecasts and heed any warnings. In addition, in the event of lightning in the vicinity of the site, the Site Supervisor will stop all activities and have site workers take cover. Other severe weather, such as high winds, hail, or heavy rain, will be evaluated by the Site Supervisor and TM to determine how site activities should proceed.

### 3.12.1 Heavy Rain and Flooding

During JSA/HASP development, the project work area should be evaluated for the potential of flash flooding or rapid water rise during rain events. The Site Supervisor will monitor weather forecasts from the internet, weather

radio, commercial radio or client provided weather information for the advent of severe weather. Project work will generally be suspended during periods of heavy rain. The Site Supervisor will make the determination to suspend work and will designate the assembly area for site workers during heavy rain or flooding events. If weather forecasts indicate heavy rain, work in flood-prone areas should be suspended or delayed until the Site Supervisor determines the area is safe for work to be conducted. The Site Supervisor should also consider delayed effects of flooding in certain situations (work along riverbanks, etc.) before resuming work.

In heavy rain/potential flooding situations, in general, the following rules apply:

- Immediately evacuate to higher ground if a flood warning is issued for the area;
- Do not attempt to cross streams or flowing water that is over ankle deep;
- Do not attempt to drive over flooded roads; and,
- Immediately evacuate a vehicle stalled by water and seek higher ground.

Thunder is caused by lightning. NOAA advises that nowhere outside is safe when thunderstorms are in your area.



**NOAA recommends:** "When you Hear It Roar, Get Indoors". Their campaign for lightning safety is to shelter any time you hear thunder and to remain there 30 minutes since last.



## 3.12.2 Lightning

Lightning is a dangerous natural force, and results in death and serious (often permanent) injury in startling numbers around the world. Arcadis recognizes lightning as an occupational hazard and requires that precautions be taken to prevent worker exposure to lightning. Workers whose jobs involve working outdoors in open spaces, on elevated surfaces (e.g. ladders, platforms, scaffolding, rooftops, etc.), or near elevated structures have significant risk for lightning exposure.

Lightning is unpredictable and can strike outside rainfall areas from as far as 10 miles away. Many lightning victims are caught outside during a storm because they did not act promptly to get to a safe place, or they go back outside too soon after a storm has passed. Lightning hazards must be considered in job planning and included in the Job Safety Analysis of project Health and Safety Plans.

Arcadis requires the following for workers whose jobs involve working outdoors on elevated platforms, open fields, or any other outdoor activities:

- Include a written lightning safety protocol for outdoor workers in the HASP. Check NOAA (or similar) weather reports (including radar) prior to beginning field work, and frequently during work if hazardous weather is forecasted;
- Consider rescheduling jobs if it is likely that workers will be caught outside during hazardous weather conditions;

- When working outdoors, supervisors and workers should be on watch for hazardous weather conditions: Watch for darkening clouds and increasing windspeeds which can indicate developing thunderstorms. Also consider downloading weather apps with audible alarms for the development of severe weather and thunderstorms;
- Prior to the start of work, identify and communicate to the site workers the location of safe shelters for hazardous weather. Preferably this is a fully enclosed building with electrical wiring and plumbing, but it can also be a vehicle or trailer for less hazardous weather situations;
- Identify the mode of communication for lightning alerts and stop work situations;
- Determine response times necessary for all workers to reach safe shelters.
- If thunder is heard (even a distant rumble), elevated and outdoor work should cease immediately. Workers should shut down all equipment and seek shelter in designated locations; and,
- Work will not resume until weather radar indicates that there is no hazardous weather within 10 miles of the work area, and 30 minutes has passed since after the last thunder was heard.





**Weather Bug** is an app that provides an excellent lighting strike interface known as “Spark.” The app be set up to notify you of an approaching lightning storm that is beyond our range of hearing.

The above precautions are preemptive and should always be considered during the planning and startup of work. These measures should allow workers to avoid being caught outdoors in hazardous weather. However, if you find yourself in a situation where you are caught outdoors during a thunderstorm with no access to shelter, the following recommendations can decrease the risk of being struck:



**Vehicles as Shelter**: If safe building structures are not accessible, employers should guide workers to hard-topped metal vehicles with rolled up windows. Remain in the vehicle for at least **30 minutes** after hearing the last sound of thunder.

- Lightning is likely to strike the tallest objects in a given area—you should not be the tallest object;
- Avoid isolated tall trees, hilltops, utility poles, cell phone towers, cranes, large equipment, ladders, scaffolding, or rooftops;
- Avoid open areas, such as fields. Never lie flat on the ground;
- Retreat to dense areas of smaller trees that are surrounded by larger trees, or retreat to low-lying areas (e.g., valleys, ditches) but watch for flooding;
- Avoid water, and immediately get out of and away from bodies of water (e.g., pools, lakes). Water does not attract lightning, but it is an excellent conductor of electricity;
- Avoid wiring, plumbing, and fencing. Lightning can travel long distances through metal, which is an excellent conductor of electricity. Stay away from all metal objects, equipment, and surfaces that can conduct electricity;
- Do not shelter in sheds, pavilions, tents, or covered porches as they do not provide adequate protection from lightning;
- If you feel your skin tingle or your hair stands on end, squat low to the ground on the balls of your feet. Place your hands on your knees with your head between them. Make yourself the smallest target possible and minimize contact with the ground; and,
- If in a boat, get to land and find shelter.

## 3.12.3 High Wind and Tornadoes

Work should be suspended during periods of high winds. The Site Supervisor will determine the need to suspend work and evacuate to the designated shelter based on site observations and weather forecasts. The Site Supervisor will also determine when work should be resumed after high winds have diminished.

Tornado activity can occur during any month of the year. All work will be suspended, and site workers will immediately evacuate to the designated shelter, when a tornado warning is issued for the area. The Site Supervisor will determine where the designated shelter is located unless specified by the client.

Learn and know the difference between a tornado watch and a tornado warning:

**Tornado Watch:** Tornadoes are possible in and near the watch area. Review and discuss your emergency plans and check supplies in your shelter. Be ready to act quickly if a warning is issued or you suspect that a tornado is approaching. Watches are issued by the NOAA for counties where tornadoes may occur. The watch area is typically large, covering numerous counties or regional areas.

**Tornado Warning:** A tornado has been sighted or indicated by weather radar. There is imminent danger to life and property. Move to an interior room on the lowest floor of a sturdy building. Avoid windows. If in a mobile office, a vehicle, or outdoors, move to the closest substantial shelter and protect yourself from flying debris. Warnings are issued by your local forecast office. Warnings typically encompass a much smaller area (around the size of a city or county) that may be impacted by a tornado identified by a forecaster on radar or trained spotter/law enforcement who are watching the storm.

### 3.12.4 Heavy Snow or Ice

Project work will be suspended during periods of heavy snow or sleet as necessary. The SSO will make the determination to suspend work. The SSO will also monitor weather forecasts from weather radio, commercial radio, or client-provided weather information for the advent of severe snow or ice. If weather forecasts indicate heavy snow or ice, work should be suspended or delayed until the SSO determines the area is safe for work to be conducted. The SSO should also factor mobilization to and from the work site in evaluating whether to suspend work. Generally, if local highway patrol or police recommend keeping off roads due to snow or ice, work should be suspended or postponed until roadways are clear for safe driving.

## 3.13 Fire Prevention

Fire protection is a critical part of safe operations. Good housekeeping is essential in preventing fires. Fires can start anywhere and at any time; therefore, it is important to know which fire extinguisher to use and how to use it. Always keep fire extinguishers visible and easy to get at. Fire extinguishers should be inspected regularly.

**Ting Fire** is an app that continuously monitors your home for wiring issues, power surges and outages and notifies you. The app connects to a device that plugs in any outlet and is available for free from many insurance companies. Electrical issues result in over 50,000 residential fires each year.

Fire extinguishers must be properly maintained to do their job. Where temperature is a factor, take care to select the right extinguisher. You must receive training on the use of a particular type of fire extinguisher before you can use it. This training is required only if you are required to use the device.

## 3.13.1 Classification of Fires and Fire Extinguisher Use

Most common fires are classified as A, B, C and D. The following section identifies the fire class and appropriate extinguishing methods.

### 3.13.1.1 Classification of Fires & Extinguishing Agents

**Class A Fires:**

- Ordinary combustibles (e.g., wood, cloth, paper, and other organic materials).
- Extinguishing agent: most common is water or multipurpose dry chemical.

**Class B Fires:**

- Flammable liquids (e.g., petroleum products, paints, and varnishes) or substances that liquefy upon being heated (tars and some plastics).
- Extinguishing agent: dry chemical, carbon dioxide, or dense foam. Do not use water except to cool workers or equipment.

**Class C Fires:**

- Electrical fires in and around equipment (e.g., transformers, motors, generators, switch panels). A Class C fire may also become a Class A fire if surrounding material becomes ignited.
- Extinguishing agent: carbon dioxide or dry chemical. Do not use water.

**Class D Fires:**

- Combustible metals (e.g., magnesium, titanium, sodium, potassium).

- Extinguishing agent: cover with dry chemical (or sand) using a shovel. Do not use type A, B, or C fire extinguishing equipment.

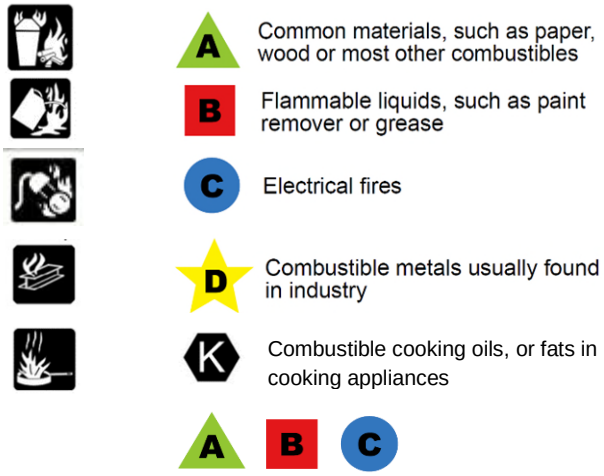
**Class K Fires:**

- Fires involving combustible cooking oils, or fats in cooking appliances; and,
- Extinguishing agent: wet chemical.

### 3.13.1.2 Identification of Fire Extinguishers

As presented below, fire extinguishers are marked to indicate the class of fires on which they may be used, for example:

- Black A on green square: Class A fires
- Black B on red square: Class B fires
- Black C on blue circle: Class C fires
- Black D on yellow star: Class D fires
- White K on black hexagon: Class K fires
- Fire extinguishers identified as multipurpose




### 3.13.1.3 Operating a Fire Extinguisher

Portable fire extinguishers are not designed to fight large or spreading fires. Fire extinguishers are useful under certain conditions but extreme care must be taken when attempting to extinguish any fire. Staff are not required to use a fire extinguisher. Escape or evacuation should be considered first before attempting to use a fire extinguisher. Only choose to stay and use an extinguisher if the fire is small and it is safe to do so. All fire extinguishers are required to be visually inspected monthly and evaluated by a licensed inspector yearly.

Avoid opening the hood of a motor vehicle if the engine compartment is one fire. These types of fire are particularly dangerous due to the potential for rupturing fuel or fluid lines, which have the potential to erupt violently.

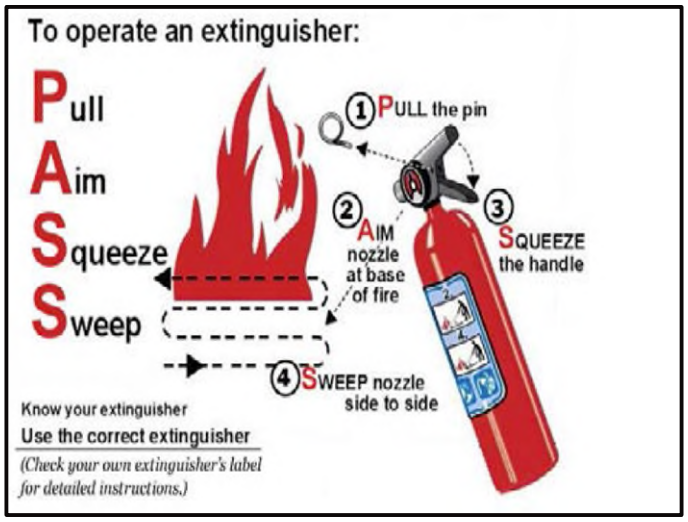



**Figure 3-5 Operating a Fire Extinguisher**

# 3.14 Hazard Communication

All site workers must have completed Workplace Hazardous Materials Information System (WHMIS) training within the previous two (2) years. All project-required chemicals will be handled in accordance with the WHMIS requirements of the state, municipality or authority having jurisdiction over the project site. The Site Supervisor will maintain a list of hazardous chemicals kept onsite together with the safety data sheets (SDS) for each chemical. SDSs will be maintained onsite and all workers working onsite will be informed of their location. It is acceptable to store SDSs electronically provided they are accessible to all workers. Provision of a computer that may be used by site workers to access the SDSs is acceptable. The Site Supervisor will communicate the location of the SDSs and will review the hazards associated with on-site chemicals with all site workers during daily tailgate meetings, as required. Only those chemicals to be used or encountered that day will be discussed at the tailgate meeting. The hazards associated with any new chemical will be discussed and its SDS will be obtained prior to use on-site.

The Site Supervisor will confirm that all containers of chemicals (e.g. drums, bags, pails, tanks, vessels) delivered to the site are properly labelled with WHMIS supplier labels containing the following information:

1. Product Identifier – the brand name, chemical name, common name, generic name or trade name of the hazardous product;
2. Initial Supplier Identifier – the name, address and telephone number of either the manufacturer or the importer*;
3. Pictogram(s) – hazard symbol within a red "square set on one of its points" that indicates the hazards associated with the product;

4. Signal Word – a word used to alert the reader to the most significant hazard and to indicate the severity of the hazard – there are two (2) signal words including Danger and Warning. Danger is used for high risk hazards. Warning is used for less severe hazards;
5. Hazard Statement(s) – standardized phrases which describe the nature of the hazard posed by a hazardous product;
6. Precautionary statement(s) – One or more standardized phrases that describe measures to be taken to minimize or prevent adverse effects resulting from exposure to a hazardous product or resulting from improper handling or storage of a hazardous product;
7. Supplemental Label Information – some supplemental label information is required based on the classification of the product. For example, the label for a mixture containing ingredients with unknown toxicity in amounts higher than or equal to 1% must include a statement indicating the percent of the ingredient or ingredients with unknown toxicity. Labels may also include supplementary information about precautionary actions, hazards not yet included in the GHS, physical state, or route of exposure. This information must not contradict or detract from the standardized information.

Chemicals that are not properly labelled will not be accepted or allowed on site.

The Site Supervisor will confirm that:

- All project workers have received WHMIS training;
- The PPE necessary for working with on-site hazardous materials is available; and,
- The project worker have been trained in its use. The PM will confirm that all project personnel have received Hazard Communication training as required in OSHA 29 Code of Federal Regulations (CFR) 1910.1200 (h).

If transferred to a secondary container, the new container will be labelled with a Workplace Label. Workplace labels require the following information:

- Product name (matching the SDS product name);
- Safe handling precautions, may include pictograms or other supplier label information;
- A reference to the SDS (if available).



Did You Know? Arcadis Standard ARC HSGE007 “Hazard Communication” includes requirements and recommendations for hazard communication, including the labeling of chemical containers and availability of Safety Data Sheets.

# 3.15 Noise

***NOTE**: This section of the handbook is not meant to replace requirements provided by the Arcadis hearing conservation health and safety standard (ARC HSIH008). This section of the handbook is meant as a quick reference only. The following information is applicable to U.S. and Canada operations only.*

A noise exposure assessment will be conducted if a worker is or is likely to be exposed to noise at a workplace in excess of 85 dBA as an 8-hour time-weighted average (TWA). Hearing protection devices will be available for staff to wear when exposed to noise levels that exceed an 8-hour TWA of 85 dBA or to a peak sound pressure level of 130 dBC for any amount of time. Hearing protection should have a noise reduction rating (NRR) of at least 19, when noise levels exceed 85 dBA for any exposure time. If an worker is exposed to noise at 85 dBA or higher for an 8-hr TWA, they may request to have audiometric testing. Audiometric tests will be scheduled by the third-party administrator for the Arcadis medical surveillance program (currently WorkCare).
As a general rule of thumb, if you must increase your voice (yell) to talk to someone, then the area is in excess of 85 dBA. In general, working around heavy equipment (e.g., drill rigs, generators) will require the use of hearing protective devices.



Did You Know? Arcadis Standard ARC HSIH008 “Hearing Conservation” includes requirements and recommendations for working in noisy environments.

Where work area noise levels exceed 85 dBA and it is feasible to do so, Arcadis shall require that noise hazard signs be posted. When noise levels exceed 105 dBA as an 8-hour TWA, it is recommended that staff use both ear plugs and earmuffs. Workers must not have “unprotected exposures” to noise levels in excess of 115 dBA.





The NIOSH Sound Level Meter app provides a sound level meter that can be used to assist workers in identifying areas where hearing protection might be required. It does not replace a stand-along sound level meter and is to be considered a reference tool.

# 3.16 Heat and Cold Stress

Exposure to heat during the summer and cold during the winter can result in stress to the body that, if not managed, can result in serious health effects. The guidelines outlined below are recommended best work practices that will help workers manage heat and cold stress on the job.

## 3.16.1 Heat Stress (Heat-Related Illness)

For more detailed information on how to prevent Heat Stress, refer to the Arcadis Heat Stress Prevention Health and Safety Standard (ARC HSIH013).

In general, an environment is “hot” if it is very humid and/or above 26.3 degrees Celsius [°C] (80 degrees Fahrenheit [°F]). Environmental factors of temperature, humidity, and air movement affect the body’s ability to dissipate heat. Combined with human factors (such as clothing, fitness, and body weight) and job factors (such as heat generation from work activity or types of required PPE), this can result in a heat imbalance thereby elevating the body’s core temperature and causing heat stress.



Did You Know? Arcadis Standard ARC HSIH013 “Heat Stress Prevention” includes requirements and recommendations for use when working in hot conditions..

### 3.16.1.1 Heat Stress Safety Precautions

The following actions can be taken to reduce the occurrence of heat stress:

- Avoid working in the heat when possible – this can be accomplished by avoiding work during the hottest parts of the day, working in cooled enclosures, or having cooling units provided in the work area. Severe heat conditions can be cause for stopping or not starting work;
- Workers should acclimate to working in a hot environment by following a graduated work schedule, increasing the duration of working in the heat each day;
- Drink plenty of fluids to replenish the fluids lost through perspiration and evaporation from the skin. Maintain hydration by drinking water and supplementing with electrolyte replacement drinks or "sports drinks" at a ratio of 3:1 water to sports drink. Avoid caffeine, alcohol, large amounts of sugar, and very cold drinks because these can cause cramps;
- Eat prior to work and then during the work rotation;

- Take rest/cooling breaks as appropriate for the work being done. If a worker is feeling faint, experiencing cramping, or becoming fatigued, the body is warning of potential heat stress. The worker must move to a cool area to rest (work/rest cycle);
- If workers will be working in an enclosed or confined area without natural air movement, provide specific personal equipment such as cooling vests or towels, and/or obtain fans or other means of ventilating the work area to provide cooling;
- Workers should recognize the following potential physical disorders possible from exposure to heat:
  - **Heat stroke:** total shutdown or failure of the body's thermal regulatory system (life threatening – red, hot, dry skin; sweating has stopped);
  - **Exertional heat stroke:** sweating is occurring but is unable to cool the body sufficiently, resulting in the core body temperature reaching 41.1°C (106°F);
  - **Heat syncope:** loss of consciousness due to overheating;
  - **Heat exhaustion:** excessive sweating, cool clammy skin, loss of salt from the body, and water imbalance;
  - **Heat cramps:** cramping, pain, or muscle spasms that most often occur in the abdomen, legs, and arms;
  - **Heat rash**: clusters of red bumps on the skin. Usually occurring on the neck, upper chest, groin, elbow creases, and under breasts;
  - **Heat stress** monitoring and work-rest cycle implementation for unacclimated workers should commence when the ambient temperature adjusted for humidity (i.e. the adjusted humidex temperature) exceeds 26.3°C (80 °F) for unacclimated workers in North America.

Screening criteria for heat stress exposure are described in **Table 3-1** and examples of activities within metabolic rate categories are provided in **Table 3-2**.

***NOTE:*** *The following tables are recommended guidelines as prescribed in the current version of the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value Booklet. These tables are developed and presented as guidelines to assist in the control of health hazards resulting from working in hot conditions. The potential health hazards from work in hot environments (and work while wearing impermeable PPE) depends strongly on level of worker acclimation. Detecting, assessing and monitoring for heat stress is critical.*



The OSHA-NIOSH Heat Safety Tool is a useful resource for planning outdoor work activities based on how hot it feels throughout the day. It has a real-time heat index and hourly forecasts specific to your location. It also provides occupational safety and health recommendations from OSHA and NIOSH.

The NOAA Heat Index chart (Table 3-3) and OSHA's summary table of Risk Levels and Associated Protective Measures (Table 3-4) provide additional information to help prevent heat-related illnesses.

**Table 3-1 Heat Stress and Rest Levels**

| | Acclimated | | | | Unacclimated | | | |
|---|---|---|---|---|---|---|---|---|
| **Work Demands** | **Light** | **Moderate** | **Heavy** | **Very Heavy** | **Light** | **Moderate** | **Heavy** | **Very Heavy** |
| 100% work | 87.8ºF (31ºC) | 82.4ºF (28ºC) | | | 82.4ºF (28ºC) | 77ºF (25ºC) | | |
| 75% work / 25% rest | 87.8ºF (31ºC) | 84.2ºF (29ºC) | 81.5ºF (27.5ºC) | | 83.3ºF (28.5ºC) | 78.8ºF (26ºC) | 75.2ºF (24ºC) | |
| 50% work / 50% rest | 89.6ºF (32ºC) | 86ºF (20ºC) | 84.2ºF (29ºC) | 82.4ºF (28ºC) | 85ºF (29.5ºC) | 80.6ºF (27ºC) | 77.9ºF (25.5ºC) | 76.1ºF (24.5ºC) |
| 25% work / 75% rest | 90.5ºF (32.5ºC) | 88.7ºF (31.5ºC) | 86.9ºF (30.5ºC) | 86ºF (30ºCvf) | 86ºF (30ºC) | 84.2ºF (29ºC) | 82.4ºF (28ºC) | 80.6ºF (27ºC) |

***Note**: Temperatures in the acclimatized and unacclimated sections are based upon wet globe bulb test (WBGT) testing results*

**Table 3-2 Examples of Activities Within Metabolic Rate Categories**

| Categories | Examples |
|---|---|
| Resting | • Sitting quietly<br>• Sitting with moderate arm movements |
| Light | • Sitting with moderate arm and leg movements<br>• Standing with light work at machine or bench while using mostly arms<br>• Using a table saw<br>• Standing with light or moderate work at machine or bench and some walking about |
| Moderate | • Scrubbing in a standing position<br>• Walking about with moderate lifting or pushing<br>• Walking on a level at 6 km/hr (3.7 mph) while carrying 3 kg (6.6 lbs) weight load |
| Heavy | • Carpenter sawing by hand<br>• Shovelling dry sand<br>• Heavy assembly work on a noncontinuous basis<br>• Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work) |
| Very Heavy | • Shoveling wet sand |

**Table 3-3 NOAA Heat Index**

***Note**: When working in direct sunlight, add 10ºF to the heat index rating.*

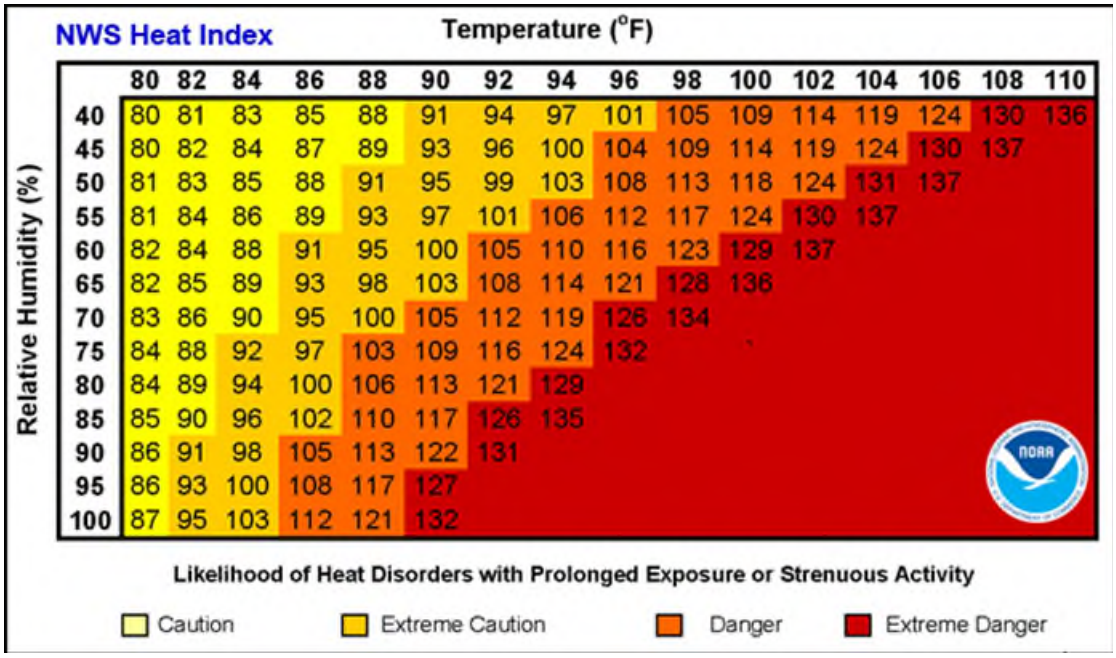


**Table 3-4** presents the risk level and recommended mitigation measures for a range of adjusted humidex temperatures.

**Table 3-4 Risk Levels and Associated Protective Measures**

| Adjusted Humidex Temperature | Risk Level | Recommended Mitigation Measures |
|---|---|---|
| <32.7 ºC<br>(<91 ºF) | Lower (Caution) | • Provide drinking water (1 L / hour; 250 mL every 15 minutes)<br>• Confirm that adequate medical services are available<br>• Worker heat safety training<br>• Encourage workers to wear sunscreen<br>• If workers must wear heavy protective clothing, perform strenuous activity, or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.* |
| 32.7 °C to 39.4 °C<br>(91 °F to 103ºF) | Moderate | In addition to the steps listed above:<br>• Instruct workers to drink water at a rate of four (4) 250 mL cups per hour and supplement with electrolyte replacement drinks (3:1)**.<br>• Review heat-related illness with workers: how to recognize heat stress, how to prevent it, and what to do if someone gets sick<br>• Schedule frequent breaks in cool, shaded area<br>• Acclimate workers<br>• Set up buddy system/instruct supervisors to watch workers for signs of heat-related illness<br>**If workers must wear heavy protective clothing, perform strenuous activity, or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness. ***<br>• Schedule activities at a time when the heat is lower<br>• Monitor workers closely |
| 39.4 °C to 46.1 °C<br>(103 ºF to 115 ºF) | High | In addition to the steps listed above:<br>• Alert workers of high-risk conditions<br>• Limit physical exertion (e.g. use mechanical lifts)<br>• Review work/rest schedules and increase frequency and duration of breaks<br>• Adjust work activities (e.g., reschedule work, pace/rotate jobs)<br>• Use cooling techniques<br>• Watch/communicate with workers at all times<br>**When possible, reschedule activities to a time when temperature is lower.** |

**Table 3-4 Risk Levels and Associated Protective Measures**

| Adjusted Humidex Temperature | Risk Level | Recommended Mitigation Measures |
|---|---|---|
| >46.5 °C<br>(>115 ºF) | Very High to Extreme | **Reschedule non-essential activity for days when heat is lower**<br>**Move essential work tasks to the coolest part of the work shift; consider earlier start times, split shifts, or evening and night shifts.**<br>**Strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protective clothing should not be conducted when the humidex adjusted temperature is at or above 46.5** °C (**115 °F).**<br>If essential work must be done, in addition to the steps listed above:<br>• Alert workers of extreme heat hazards<br>• Conduct physiological monitoring (e.g., pulse, temperature, etc.)<br>• Stop work if essential control methods are inadequate or unavailable |

*The humidex is a simple tool and a useful guide for employers making decisions about protecting workers in hot weather. It does not account for certain conditions that contribute to additional risk, such as physical exertion. Consider taking the steps at the next highest risk level to protect workers from the added risks posed by:

- Working in the direct sun can add up to 7.2 °C(13 °F) to the humidex adjusted temperature
- Wearing heavy clothing or protective gear (add 1 °C for Tyvek; 3 °C for heavy clothing; 11 °C for impermeable clothing)

**Under most circumstances, fluid intake should not exceed 6 x 250 mL per hour or 12 L per day. This makes it particularly important to reduce work rates, reschedule work, or enforce work/rest schedules.

### 3.16.1.2 First Aid for Heat-Related Illness – Heat Stroke/Heat Exhaustion

Heat stroke is life threatening. Heat stroke in the elderly and in individuals that are in hot environments and not hydrating sufficiently manifest with dry, hot, flushed skin; rapid pulse; unconsciousness; and lack of perspiration. However, workers who are completing strenuous activity in a hot environment may have a rapid increase in core body temperature because sweating is not effectively cooling the body. This is also heat stroke. In the latter scenario, the victim's skin feels unusually hot and they are often confused, irritable, combative, or unconscious. If these symptoms are present in a worker, take the following actions immediately:

- Get medical attention immediately – call 911. While waiting for medical services to arrive, get the victim out of the heat and into a cooler place;
- Use any means to cool the person: spray with a water hose, sponge with cold water, place ice packs or wet towels on the neck, armpits and groin.

Heat exhaustion signals include nearly normal body temperature; pale, clammy, cool skin; weakness; headache; nausea; dizziness; thirst; and cramps.

- Move the person out of the heat and in to cooler place.
- Lay the person down and elevate the legs and feet slightly.
- Remove tight or heavy clothing.
- If the victim is fully conscious and can tolerate it, give 125mL of water to drink every 15 minutes.

## 3.16.2 Cold Stress

In a cold environment, body heat must be conserved to maintain a core temperature at normal levels and to provide adequate blood flow to the brain and extremities. Environmental factors affecting conservation of body heat are temperature and wind chill. These environmental factors, combined with human factors (such as protective layers of clothing) and job factors (such as work activity), determine whether one is adequately protected from the extremes of cold weather.



Did You Know? Arcadis Standard ARC HSIH014 “Cold Stress Prevention” includes requirements and recommendations for use when working in cold conditions.

### 3.16.2.1 Cold Stress Safety Precautions

The following actions can be taken to reduce cold stress:

- Workers must adapt to working in the cold by pacing themselves until they become adequately acclimatized to the cold environment;
- Prior to working outside (including operating a snowmobile) or in unheated buildings, determine the wind chill index and check the weather forecast for possible changes;
- Confirm that a means of communication is available when working in a wind chill below -22°F, so that a rescue can be conducted in case of an accident;
- Plan work so that a heated location, such as building or vehicle, is available for warming up, if needed;
- Schedule rest breaks regularly so workers can warm up and replenish their fluids;
- Provide thermal cushioned insulation on tool handles;
- Workers should recognize the following potential health problems from working in cold environments:

  - Frostbite: freezing of the skin; loss of sensation; cold, pale, and waxy skin Trench foot/immersion foot: intense pain in the foot, with swelling. Discoloration of the skin may be caused by long immersion in cold water. Water temperature does not need to be near freezing to cause trench foot;
  - Hypothermia: cold extremities, which are numb and clumsy; severe shivering along with reduced mental alertness with irritability and lack of concentration. The normal shivering process stops in severe hypothermia;
- Personal protective approaches that can reduce cold stress include:
  - Use mittens and gloves with removable insulated liners. Liners that cannot be removed and dried every day will gradually absorb moisture, which will speed up the loss of body heat.
  - Wear insulated boots and or wool socks – avoid cotton socks. Wool fibers are hollow and insulating, providing a thin barrier of warm air between the foot and surface of the boot, which will be cold. Looser fitting boots with thicker wool socks is preferred in the cold temperatures.
  - Wear a cold-weather mask or woolen toque and scarf (secure loose ends to prevent entanglement with equipment) during severe wind chill conditions; check facial skin frequently for frostbite.
  - Have a spare change of clothing available during cold weather. Clothing that has become wet from perspiration or precipitation must be changed as soon as possible. If the worker has perspired heavily, the worker must exercise caution before removing outer clothing (while resting outdoors) to prevent chilling and possible hypothermia.
- A minimum of three (3) layers of clothing should be used for cold stress prevention:
  - A base layer, preferably made from silk, wool or synthetic materials (polypropylene) is best;
  - An insulating layer, which keeps a layer of air trapped around the body. Use wool, synthetic insulation, or down for thermal insulation;
  - The third layer protects the previous layers from dust, dirt, wind, and moisture. Although nylon and/or other synthetics are also suitable for thermal use, they can develop electrostatic charge and, therefore, fire-retardant outwear (Nomex) may still be required; and,
  - The potential for accidental exposure to severe cold must be included in plans to control exposures. If a worker complains of symptoms of cold stress, they must be removed from the exposure and assessed by appropriate medical workers.

The Wind Chill Index is an adjusted ambient temperature accounting for wind speed and the resulting advective heat loss. Strong winds will cause more heat loss to occur at a given ambient temperature than if there was no wind. **Table 3-5** presents the adjusted wind chill index temperature for a range of temperatures and wind speeds.

Generally, when planning for cold weather work, it is the adjusted wind chill index temperature that should be used.

**Table 3-5 Windchill Factor**

| Wind Speed (in mph) | Actual Temperature Reading (ºF) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 40 | 30 | 20 | 10 | 0 | -10 | -20 | -30 | -40 | -50 | -60 |
| | **Equivalent Chill Temperatures (ºF)** | | | | | | | | | | | |
| Calm | 50 | 40 | 30 | 20 | 10 | 0 | -10 | -20 | -30 | -40 | -50 | -60 |
| 5 | 48 | 37 | 27 | 16 | 6 | -5 | -15 | -26 | -36 | -47 | -57 | -68 |
| 10 | 40 | 28 | 16 | 4 | -9 | -24 | -33 | -46 | -58 | -70 | | |
| 15 | 36 | 22 | 9 | -5 | -18 | -32 | -45 | -58 | -72 | -85 | -99 | -112 |
| 20 | 32 | 18 | 4 | -10 | -25 | -39 | -53 | -67 | | | | |
| 25 | 30 | 16 | 0 | -15 | -29 | -44 | -59 | -74 | -88 | -104 | -118 | -133 |
| 30 | 28 | 13 | -2 | -18 | -33 | -48 | -63 | | | | | |
| 35 | 27 | 11 | -4 | -20 | -35 | -51 | -67 | -82 | -98 | -113 | -129 | -145 |
| 40 | 26 | 10 | -6 | -21 | -37 | -53 | -69 | | | | | |
| (Wind speeds greater than 40 mph have little additional effect.) | LITTLE DANGER<br>Maximum danger of false sense of security. | | | | INCREASING DANGER<br>Danger from freezing of exposed flesh within 1 minute. | | | GREAT DANGER<br>Flesh may freeze within 30 seconds. | | | | |

***Note**: Trench foot and immersion foot may occur at any point on this chart.*

### 3.16.2.2 First Aid for Frost Bite

- Move the person to a warm dry area. Do not leave the person alone;
- Remove any wet or tight clothing that may cut off blood flow to the affected area;
- Do not rub the affected area. Rubbing causes damage to the skin and tissue;
- It should be noted that experts advise rewarming in the field only when emergency help will take more than two hours to arrive and refreezing can be prevented;
- Do not rewarm the skin until you can keep it warm. Warming and then re-exposing the frostbitten area to cold air can cause worse damage;
- First line of rewarming should include bundling the affected area in warm dry clothing and blankets to utilize body heat to treat the affected area;

- Should the affected area not respond to body heat only, gently place the affected area into a luke warm water bath and slowly and gradually increase temperature, but do not exceed 40°C. Monitor the water temperature to slowly warm the tissue. Do not pour warm water directly on the affected area because it will warm the tissue too fast causing tissue damage. Warming takes about 25 to 40 minutes;
- After the affected area has been warmed, it may become puffy and blister. The affected area may have a burning feeling or numbness. When normal feeling, movement, and skin color have returned, the affected area should be dried and wrapped to keep it warm;
- Discuss with WorkCare whether blisters should be debrided (cleaned by removing foreign material) or simply covered with a dressing.
- Discuss with WorkCare whether the patient should be given over the counter medication to combat inflammation;
- The key to prehospital treatment is to avoid partial thawing and refreezing, which releases more inflammatory mediators and makes the injury substantially worse. If there is a chance the affected area may get cold again, do not warm the skin;
- In the case of severe frost bite, seek medical attention as soon as possible.

#### 3.16.2.3 First Aid for Hypothermia

When the temperature of your body falls to a level at which your vital organs can no longer function, you are experiencing hypothermia or exposure sickness. Hypothermia will develop rapidly and is caused by cold, wet, and/or windy weather that chills the body at a rate faster than the body can produce heat. A lack of energy-producing food and proper clothing will heighten the speed at which hypothermia will affect you. Always bring extra food and clothing. Work at the pace of the slowest member of your party, take frequent breaks, and keep a close watch for members experiencing signs of fatigue. Hypothermia generally occurs at temperatures of less than 10 °C (50 °F).

Early symptoms of hypothermia are easily recognizable and can rapidly progress to more severe symptoms. Treating hypothermia as soon as possible after the initial on-set is critical to avoid progression to what can be a life-threatening condition. Symptoms of hypothermia include, in the normal order of presentation:

- Feeling cold and constantly exercising to keep warm;
- Uncontrollable shivering and numbness;
- Violent shivers. Your mind becomes slow and starts to wander;
- Violent shivering ceases and muscles begin to stiffen and become uncoordinated. Exposed skin becomes blue and thoughts are foggy. Victim usually lacks the capability of realizing how serious the situation is;
- Pulse and respiration slow;
- Victim will not respond and becomes unconscious;

- The section of the brain controlling the heart and lungs ceases functioning;

Treatment for hypothermia must be quick and efficient. Once shivering has ceased, other symptoms will progress quickly and result in a life threatening situation.

- While attending to the victim, contact WorkCare to help you assess whether medical attention is required;
- Move the victim to a sheltered warm area, out of the elements;
- Remove wet clothing and replace with dry clothes and, if possible, a blanket;
- Prevent the victim from losing consciousness by talking to them and jostling them;
- Give the victim a warm, nonalcoholic drink;
- Allow another person in the blanket to share body heat; and,
- Exhale warm air near the vicinity of the patient's mouth and nose.

# 3.17 Biological Hazards

Working in the field has the potential to expose workers to a variety of biological hazards, such as, but not limited to, poisonous or physically damaging plants; biting/stinging/poisonous insects and arachnids; snakes (venomous and nonvenomous); feral animals; and other aggressive animals. This section discusses the elemental recognition of H&S hazards and provides basic precautions and first-aid techniques. Any concerns related to non-life-threatening illnesses or injuries sustained from these biological hazards should be discussed with WorkCare.

## 3.17.1 Dogs

Dogs may be a serious concern when working on residential or farm properties. Domesticated dogs include animals used as guard dogs as well as pets. The following recommendations may be used to avoid being bitten by dogs:



Arcadis employees occasionally work in areas where dogs are seen roaming or have escape confinement. Report dog sightings to the Project Manager and always Stop Work if a dog or any animal poses a threat.

- If the client or property owner has guard dogs at the site or residence, the PM or Site Supervisor will work with the client/owner to ensure that the dog(s) is secured indoors and unable to gain access to any area in which Arcadis workers will or could be working.
- Do not approach strange dogs, especially dogs that are tied up or confined behind fences.
- Do not pet a dog unfamiliar with you or attempt to pet a dog familiar with you without the dog seeing and sniffing you first.

- Never turn and run away from dogs.
- Do not disturb dogs that are sleeping, eating, chewing on toys, or caring for puppies.

If approached by an aggressive or unknown dog, implement the following actions to avoid or reduce severity of attack:

- Use motor vehicle as a shield or shelter between you and the animal.
- Never yell, scream, or run.
- If you do not have a shield or place of safety, remain motionless, hands at your sides and avoid eye contact with the dog.
- Once the dog loses interest in you, slowly back away until the dog is out of sight.
- If attacked, “feed” the dog outer clothing like jackets, field equipment, field books, or anything else that may be used to place between you and the dog.
- If you fall or are knocked down to the ground, curl into a ball with your hands over your ears and remain motionless to the extent possible. Do not scream.

If bitten by an animal, thoroughly clean the bite area with soap and water and control bleeding. Do not scrub the wound. Lightly cover the wound, but do not tighten with tape or butterfly bandages. Call WorkCare and seek medical attention if so advised. Avoidance and alertness to surroundings are the best defense to biting animal hazards.

## 3.17.2 Ticks

Information in this FHSHB is limited to the hard ticks found in the U.S. and Canada. Ticks favor tall grass and brushy environments. Ideal nesting locations are area moist leaf piles located out of direct sunlight and strong wind. Ticks are primarily active during summer months but may be active any time of the year. Eighty percent of a tick’s life is spent dormant or not actively seeking food. The following should help reduce exposure to tick bites:




**Figure 3-6 Common Ticks in the U.S. and Canada**

- Avoid unnecessary entry into tall grass and brushy areas;
- When possible, clear around monitoring wells or other work areas, creating a buffer of at least 20 feet of short vegetation;
- Wear clothing that has been pre-treated with permethrin;
- Wear bug repellant containing Deet. DEET cannot be used on flame-resistant clothing;
- Minimize exposed skin and tuck pants into socks or boots.
- Tape your pant and sleeve cuffs to prevent ticks crawling in under your clothing;
- Wrap duct tape around the bottom of your legs, sticky side facing out, to capture ticks as they attempt to climb up your leg;
- Wear light-colored clothing so crawling ticks can be easily identified;
- Inspect yourself frequently during the day and at the end of work; and,
- In known or likely tick infested areas, wear light-colored, protective coveralls (i.e. Tyvek) or protective pants to provide a barrier between ticks and the skin and allow for easy identification of ticks against the light colored material. Boot covers attached to the coveralls are preferred, however, taping the cuff to the boot can be effective as well.




**Figure 3-7 Relative Sizes of Common Ticks**

Adult American Dog Tick and Lonestar Ticks are often approximately the size of an apple seed. Adult deer ticks are approximately the size of a sesame seed. Tick nymphs, or juvenile ticks, are approximately the size of a poppy seed.

If ticks cannot be avoided, chemical pesticides may be used in limited quantities (similar volume and frequency as a household consumer). Commercial or broad insecticides may only be applied by a licensed exterminator.

### 3.17.2.1 Tick Checks on Clothing and Body

Regularly check your clothing for ticks. Ticks may be carried inside on clothing. Any ticks that are found should be removed. Prior to washing, place dry clothing in a dryer on high heat for 10 minutes to kill ticks. If the clothes are damp, additional time may be needed. If the clothes require washing first, hot water (130 degrees F) is recommended, as cold or medium water may not kill ticks. See Section 3.17.6 Chemical Protection for Flying Insects and Ticks.

Check your body for ticks after being outdoors. Conduct a full body check upon return from potentially tick-infested areas. Use a hand-held or full-length mirror to view all parts of your body. Common areas of tick attachment include:

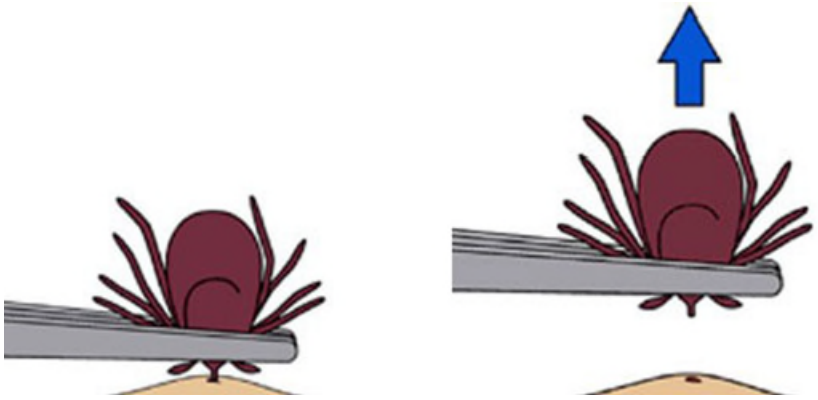
- Under the arms;
- In and around the ears;
- Inside the belly button;

- Back of the knees;
- In and around the hair;
- Between the legs; and,
- Around the waist

Shower soon after being outdoors. Showering within 2 hours of coming indoors has been shown to reduce your risk of getting Lyme disease. Showering may help wash off unattached ticks and it is a good opportunity to complete a tick check. While showering, use fingertips to feel the skin for small bumps that may reveal a crawling or imbedded tick.

If a tick is attached to the body, call WorkCare for proper removal, cleaning, and follow-up bite site monitoring. If tapered-tip tweezers are available, the following is the removal procedure:

1. If using narrow-tipped tweezers, grasp the tick as close to the skin as possible. Gently pull the tick strait up and out without twisting;
2. During removal, be careful not to squeeze the tick's body and grasp the tick where its mouth enters the skin.
3. After removal, inspect the tick to see if its head was removed;
4. Once the tick has been removed, wash the area with soap and water and apply antiseptic or antibiotic ointment to prevent infection;
5. Keep a close watch over the bite area and keep the tick in a small jar or bag for reference by a physician, if needed; and,
6. If parts of the tick stay in the skin, or if unexplained symptoms develop (severe headaches, fever, or rash within 10 days of the bite), call WorkCare.



To safely remove an imbedded tick, grasp the tick as close to the skin as possible with narrow tweezers and gently pull up with steady pressure. Avoid squeezing the body of the tick.

**Figure 3-8 Removing a tick safely**

Larval stage ticks (also known as “seed ticks”) are prevalent during August and September. During this period, the larvae accumulate in masses on vegetation and infest a host upon contact (brushing up against the infested vegetation), resulting in numerous tick bites. If infested with “seed ticks,” call WorkCare for removal procedures, cleaning, and monitoring of the bite area(s).

### 3.17.2.2 Washing and Drying Permethrin Treated Clothing

Permethrin applied to clothing is one of the most effective ways to reduce exposure to ticks. Human perspiration and exposure to water does not significantly deteriorate its effectiveness. However, agitation by a washing machine does deteriorate the permethrin application as it knocks the molecules loose from the fabric. For best results, hand washing and air drying is recommended for permethrin treated clothing. When using a conventional washer and dryer, use the gentle wash and dry cycles. Loss due to the dryer is limited compared to the detergent and washer agitation. Dry cleaning will also remove the permethrin from the fabric. Clothing that has been commercially treated with permethrin will stay effective for up to 70 launderings.

### 3.17.2.3 Lyme Disease and Ehrlichiosis

Lyme disease results from a tick-borne infection. Ticks that are removed within 24 hours of attachment typically do not result in lyme disease exposure. If lyme disease is transmitted, a red papule appears at the site of the tick bite. This infection tends to expand over a period of 3 to 4 days and may reach 6 inches (15 centimetres) in diameter. Other symptoms of the disease include influenza-like symptoms, such as chills, headache, and aching muscles. If you suspect that you have contracted Lyme disease, call WorkCare and seek medical attention.

Ehrlichiosis also commonly occurs in summer and is transmitted by the bite of infected ticks. Symptoms include muscle and joint aches and flu-like symptoms, but there is typically no skin rash. If you believe you have contracted Ehrlichiosis, call WorkCare and seek medical attention.

### 3.17.2.4 Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever is transmitted by infected ticks but can be very difficult to diagnose at its early stages, even by experienced physicians who are familiar with the disease. Patients infected with *R. rickettsii* (the bacteria that causes Rocky Mountain Spotted Fever) generally visit a physician in the first week of their illness, following an incubation period of 5 to 10 days after a tick bite. The early clinical presentation of Rocky Mountain Spotted Fever is nonspecific and may resemble a variety of other infectious and noninfectious diseases.

The classic symptoms for this disease are fever, rash, and history of tick bite. However, this combination is not always detected when the patient initially presents for care.

Initial Signs and Symptoms: Initial symptoms may include fever, nausea, vomiting, severe headache, muscle pain, and lack of appetite. The rash first appears 2 to 5 days after the onset of fever but is often not present or

may be very subtle when the patient is initially seen by a physician. Younger patients usually develop the rash earlier than older patients. Most often it begins as small, flat, pink, spots (macules) on the wrists, forearms, and ankles that typically do not itch. These spots turn pale when pressure is applied and eventually become raised on the skin.

Later Signs and Symptoms: Later signs and symptoms include rash, abdominal pain, joint pain, and diarrhea. The characteristic red, spotted (petechial) rash of Rocky Mountain Spotted Fever is usually not seen until the sixth day or later after onset of symptoms, and this type of rash occurs in only 35 to 60 percent of patients. The rash involves the palms or soles in as many as 50 to 80 percent of patients; however, this distribution may not occur until later in the course of the disease. As many as 10 to 15 percent of patients may never develop a rash.

## 3.17.3 Stinging Insects (Bees, Wasps, Hornets, and Yellow Jackets)

Care will be taken by all site workers to avoid stinging or biting insects. These insects include, but are not limited to, bees, wasps, hornets, and yellow jackets. The following will help reduce exposure to these types of insects:

- Yellow jackets nest in the ground or rotting logs. They are often aggressive;
- Avoid wearing brightly colored or patterned clothing;
- Avoid wearing perfume or cologne or using scented soaps;
- Inspect food and drinks prior to consumption;
- Wasps favor habitats provided by monitoring wells with stick-up completions. Exercise caution and take care to look for stinging insects before and during opening of protective monitoring well casings; and,
- Do not attempt to remove, destroy or apply insecticide to a nest unless necessary (i.e. wasp nest located in a building in close proximity to workers). Environmentally friendly wasp and hornet spray, made from plant and peppermint oils, may be used in environmentally sensitive locations. Consult the product manufacturer and your Arcadis Project Manager before proceeding with localized application.

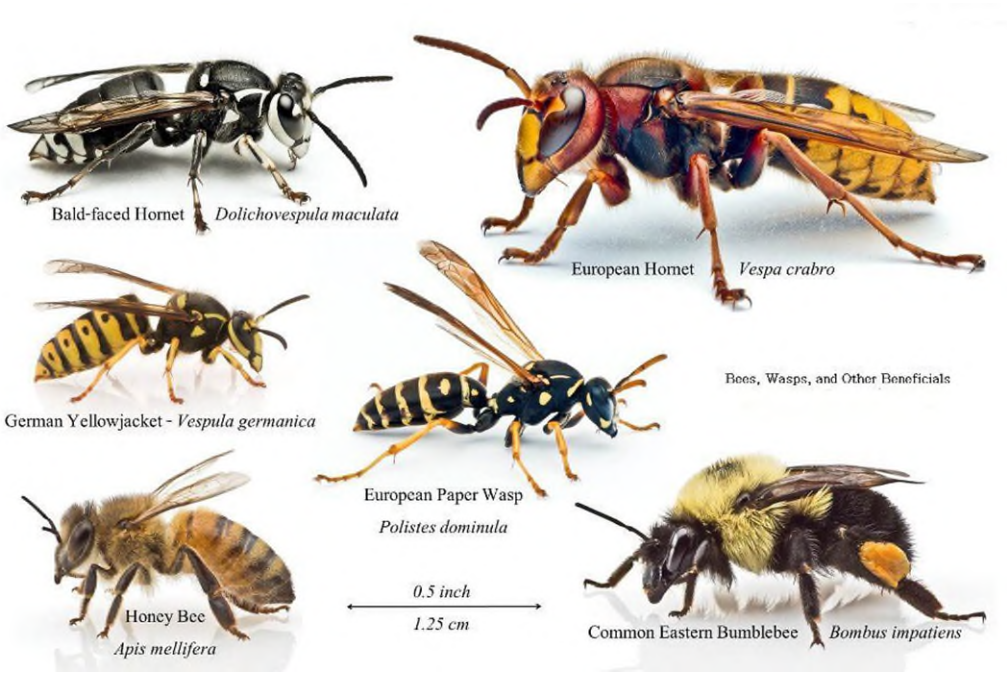



**Figure 3-9 Common stinging insects**

Of the common insects, hornets and yellow jackets are considered aggressive and may sting without provocation. Wasps and bees are less aggressive unless protecting a nest. Avoid swatting at bees as they release pheromones to signal other bees of a threat. All the insects pictured above are capable of stinging and injecting venom capable of producing an allergic reaction in some people.

### 3.17.3.1 First Aid for Stings

1. Call WorkCare for treatment, removal, and cleaning of the sting area.
2. Remain with the victim to be sure that they do not have an allergic reaction.
3. Remove the stinger using a 4- x 4-inch gauze pad wiped over the area or by scraping a fingernail over the area. Never squeeze the stinger or use tweezers.
4. Wash the site with soap and water.
5. Do not scratch the sting site. This will cause the site to swell and itch more and increase the chance of infection.

#### 3.17.3.2 Allergic Reactions to Stings

Allergic reactions to stings can be deadly. People with known allergies to insect stings should always carry an insect sting allergy kit and wear a medical ID bracelet or necklace stating their allergy and should alert coworkers onsite. There are several signs of an allergic reaction to stings. Look for swelling that moves to other parts of the body, especially the face or neck. Check for difficulty in breathing, wheezing, dizziness or a drop in blood pressure. Get the person immediate medical care if any of these signs are present. It is normal for the area that has been stung to hurt; have a hard, swollen lump; get red; and itch. Kits are available to reduce the pain of an insect sting. They are a valuable addition to a first-aid kit.

## 3.17.4 Rodents

Hantavirus is a rare but serious (can be fatal) illness. Deer mice are the main carriers of Hantavirus, although it is possible that other rodent species, such as field mice, voles, and rats, may carry the disease. Hantavirus can cause a serious lung infection called Hantavirus Pulmonary Syndrome.



Good housekeeping (eliminating food sources) and eliminating or reducing access points to structures are important in controlling rodent populations.

Exposure to the virus may occur through the inhalation of dust contaminated with dried mouse droppings, and urine and saliva from infected rodents. Other possible means of infection include contact with the eyes, contact with open wounds, rodent bites, and eating or drinking contaminated food. There is no evidence that household pets or infected humans can transmit the disease. First stage symptoms include fever, fatigue, weakness, chills, muscle aches (lower back and thighs), abdominal pain, headaches, nausea, mild diarrhea, and possible cough. The second stage starts with shortness of breath. This is due to the collection of fluid in the lungs. Do not delay medical treatment if you experience the above symptoms. If you have had recent contact with rodents or their droppings, make sure the doctor is aware of exposure history.

#### 3.17.4.1 Controls

The first and foremost precaution and preventive measure against Hantavirus is to avoid dermal contact with rodent droppings and inhalation of dust that is contaminated with the droppings. Special precautions are required

for working in and around areas of heavy rodent infestations. A rodent infestation is considered heavy if piles of feces or numerous nests or dead rodents are observed.

If rodents cannot be avoided, baits and chemical controls may be used in limited quantities (similar volume and frequency as a household consumer). Commercial or broad rodenticide applications may only be completed by a licensed and permitted professional. Be sure to understand federal, provincial, territorial and local laws regulating such applications before purchasing or using them. To treat a large area for rodents, subcontract a professional pest control service.

### 3.17.4.2 In Buildings

If the building has been closed and unoccupied for a long period (weeks or months), ventilate the building by opening doors and windows for at least 30 minutes before beginning any work. Use cross ventilation if possible. Leave the area during the airing-out period.

### 3.17.4.3 Clean Up of Rodent Urine and Droppings and Contaminated Surfaces

Areas with evidence of rodent activity (e.g., dead rodents and rodent excreta) should be thoroughly cleaned to reduce the likelihood of exposure to Hantavirus-infected materials. Cleanup procedures must be performed in a manner that limits the potential for dirt or dust from contaminated surfaces to become airborne. Persons involved in the cleanup should wear Tyvek® coveralls; rubber boots or disposable shoe covers; rubber, latex, vinyl, or nitrile gloves; protective goggles; and appropriate respiratory protection (e.g. full-face HEPA cartridge-equipped respirator). If respirators are required, workers must follow the Respiratory Protection Standard.

Spray rodent urine and droppings with a disinfectant or bleach solution until thoroughly soaked (see Disinfecting Solutions below). To avoid generating potentially infectious aerosols, do not vacuum or sweep rodent urine, droppings, nesting materials, or contaminated surfaces until they have been disinfected. Use a paper towel (while wearing gloves) to pick up the urine and droppings. Place the paper towel in the garbage.

After the rodent droppings and urine have been removed, disinfect items that might have been contaminated by rodents or their urine and droppings as follows:

- Mop floors with a disinfectant or bleach solution;
- Disinfect countertops, cabinets, drawers, and other durable surfaces with a disinfectant or bleach solution. Spray dirt floors with a disinfectant or bleach solution;
- Disinfect carpets with a disinfectant or commercial-grade steam cleaner or shampoo;
- Steam clean or shampoo rugs and upholstered furniture;

- Launder potentially contaminated clothing with hot water and detergent. Use rubber, latex, vinyl, or nitrile gloves when handling contaminated laundry. Machine-dry laundry on a high setting or hang it to air dry in the sun;
- Leave books, papers, and other items that cannot be cleaned with a liquid disinfectant or thrown away outdoors in the sunlight for several hours, or in an indoor area free of rodents for approximately 1 week before cleanup. After that time, the virus should no longer be infectious;
- Wear rubber, latex, vinyl, or nitrile gloves and wipe items with a cloth moistened with disinfectant; and,

Disinfect gloves with disinfectant or soap and water before removing them. After removing the gloves, thoroughly wash bare hands with soap and warm water

#### 3.17.4.4 Clean up of Dead Rodents and Rodent Nests

Use the following procedure to clean up dead rodents and/or rodent nests:

- Wear rubber, latex, vinyl, or nitrile gloves;
- Use insect repellent (containing DEET) on clothing, shoes, and hands to reduce the risk of flea bites;
- Spray dead rodents and rodent nests with a disinfectant or bleach solution, soaking them thoroughly (see Disinfecting Solutions below); and,
- Place the dead rodent or nest in a plastic bag or remove the dead rodent from the trap and place it in a plastic bag. When cleanup is complete (or when the bag is full), seal the bag, place it into a second plastic bag, and seal the second bag. Dispose of the material in the double bag by discarding them in a covered trash can that is regularly emptied.

#### 3.17.4.5 Disinfecting Solutions

Two types of disinfecting solutions are recommended to clean up rodent-contaminated materials:

- General-purpose household disinfectant. Prepare according to the label. Almost any agent commercially available is sufficient as long as the label states that it is a disinfectant. Effective agents include those based on phenols, quaternary ammonium compounds, and,
- Hypochlorite (bleach) solution. A chlorine solution, freshly prepared by mixing 100 mL of household bleach in 900 mL of water (or a 1:10 solution), can be used in place of a commercial disinfectant. Bleach solutions should be prepared fresh daily.

### 3.17.5 Mosquitos

Mosquitoes are blood-sucking insects that can spread several diseases, including malaria, West Nile Virus (WNV), Zika virus, and viral encephalitis. Some general precautions to take to avoid exposure to mosquito-borne diseases include:

- If possible, eliminate sources of standing water at the project site because mosquito breeding takes place in standing water;
- Use insect repellent containing DEET and apply to exposed, unbroken skin according to the manufacturer's instructions. Note, the use of DEET when sampling water or ground water may result in cross contamination of samples. When sampling water for low contaminant concentrations, DEET should not be used;
- Wear light-colored, long-sleeved shirts, long trousers, and socks; and,
- Conditions may warrant wearing bug hats/jackets or wearing two layers of clothing.

If mosquitoes cannot be avoided, baits and chemical controls may be used in limited quantities (similar volume and frequency as a household consumer). Commercial or broad insecticide applications may only be completed by a licensed and permitted professional. Be sure to understand federal, local, and state laws regulating such applications before purchasing or using. To treat a large area for mosquitoes, subcontract a professional pest control service.

## 3.17.6 Chemical Protection for Flying Insects and Ticks

Both DEET and picaridin are proven to be effective at fending off mosquitoes—and are superior to other repellents when it comes to protection time. However, DEET has shown to be protective against ticks as well, a common biological hazard encountered by Arcadis employees.

**DEET:** Developed by the U.S. Army in 1946, DEET (N,N-diethyl-m-toluamide) is a synthetic chemical that provides one to six-plus hours of complete protection against mosquitoes, depending on its concentration. DEET has been used billions of times by hundreds of millions of people (including an estimated 30 percent of the U.S. population each year). When properly applied, it has virtually no proven adverse health effects, though in rare cases a contact skin rash can result from exposure. The EPA has completed several comprehensive assessments of DEET over the years (most recently in 1998) and concludes that repellents containing DEET do not present a health concern as long as consumers follow label directions.

DEET has some notable drawbacks. It imparts a greasy feel to the skin upon application. It emits a distinctive—and to many, unpleasant—odor and it has the ability to dissolve certain plastics and some synthetic materials, including rayon, spandex, and vinyl. This is a particular hazard for sunglasses and plastic eyeglass lenses. (It has no effect on nylon, wool, or cotton.) DEET cannot be used on flame-resistant clothing.

**Picardin:** Created by Bayer in the 1980s, picaridin (pronounced pih-CARE-a-den) is a synthetic compound developed from a plant extract from the genus Piper, the same plant genus that produces table pepper. Picaridin has been available since 1998 in Europe and Australia—where it is the best-selling insect repellent—but was approved for sale in the United States only in 2005. (You may see it listed as KBR 3023, Bayrepel, or icaridin.) As with DEET, the EPA has concluded that the normal use of picaridin does not present a health concern.

Studies have shown picaridin to be as effective as DEET in repelling mosquitoes. Unlike DEET, however, picaridin is odorless, non-greasy, and does not dissolve plastics or other synthetics. The one possible concern with picaridin is its relative newness. Insufficient time has passed for long-term health risks (should they exist) to manifest themselves. A limited, but growing, number of repellents contain picaridin, including Cutter Advanced, Sawyer Premium, and Repel Smart Spray.

**Concentrations of DEET and/or Picardin:** The percentage of DEET or picaridin in a repellent determines its protection time, with higher concentrations offering longer protection. DEET is available in concentrations from 4 percent to 100 percent; picaridin levels range from 7 to 20 percent.

A landmark 2002 study in the New England Journal of Medicine compared the efficacy of DEET at different concentrations and found that the duration of complete mosquito protection ranged from one to two hours for concentrations between 5 and 10 percent, four to five hours at around 20 percent, and only marginally longer up to 50 percent, with no improvement at higher levels. “Slow-release” formulas can extend protection time to eight hours or more. When it comes to picaridin, recent studies have indicated that a concentration of 7 percent is equivalent to about 10 percent DEET (one to two hours of protection), and a 20 percent concentration offers the same protection (four to five hours) as an equivalent DEET concentration.

Few studies have evaluated the relative efficacy of DEET and picaridin in fending off ticks, black flies, sand flies, no-see-ums, midges, and other biting insects. Available evidence indicates that picaridin and DEET are both effective at repelling black flies, while DEET is more effective at preventing tick bites. Conversely, picaridin seems to be better at repelling other biting insects, notably no-see-ums.

**Permethrin:** Pyrethrin insecticides from pyrethrum daisies (Chrysanthemum cineraria folium) have been used in various forms for thousands of years. They were originally discovered in China and imported into Europe as “Persian powder”. Permethrin was first registered, and tolerances established in the United States in 1979 for use on cotton. Unlike topical insect repellents applied to the skin, Permethrin is applied to clothing and outdoor gear material, bonding to the fabric fibres for up to 6 weeks (42 days) or 6 washings. The decline in effectiveness over time since application and the fact that washing reduces effectiveness are very problematic for employees applying permethrin “at home”.

When a tick, mosquito, or other insect contacts Permethrin-treated material, it absorbs a dose that will either repel or kill the insect. The synthetic version of pyrethrum (a natural insecticide derived from the chrysanthemum flower), Permethrin is non-toxic and registered for use by the U.S. EPA. Permethrin is very toxic to fish and toxic to cats. Apply it in an open area outdoors, such as a driveway or back yard away from flowers (it is also toxic to bees).

To apply, follow the manufacturer instructions and spray Permethrin directly onto clothing and gear with a slow sweeping motion, keeping the bottle about 6 to 8 inches away and treating each side of the garment for about 30 seconds. The garment should be damp but not dripping. Only apply to the exterior of the clothing.

Insect Shield is a service that pressure infuses permethrin in your clothing, locking the permethrin in place at the molecular level. The repellence of Insect Shield-treated apparel is EPA-registered to last through 70 launderings – the expected lifetime of a garment. More information is available on www.insectshield.com or by calling Insect Shield directly at 866.712.7110.

#### 3.17.6.1 Washing and Drying Permethrin Treated Clothing

Permethrin applied to clothing is one of the most effective ways to reduce exposure to ticks. Sweating and exposure to water does not significantly deteriorate the application. It is primarily the agitation of a washing machine which deteriorates the permethrin application as it knocks the molecules loose from the fabric. For best results, hand washing, and air drying is recommended. When using a conventional washer and dryer, use the gentle wash and dry cycles. Loss due to the dryer is limited compared to the detergent and washer agitation. Dry cleaning will remove the permethrin from the fabric. Record the date permethrin was applied and record the number of times the garment has been washed. Depletion of permethrin is important in regard to washing but the chemical will only remain effective for up to 6 weeks regardless of the number of times it is washed.

## 3.17.7 Snakes

#### 3.17.7.1 Rattlesnakes

The possibility of encountering snakes exists, specifically for workers working in wooded or vegetated areas. There are two groups of venomous snakes in the U.S.: pit vipers and elapids. The Crotaline, commonly known as pit vipers, are a subfamily of venomous vipers found throughout Europe, Asia, and the Americas. They are distinguished by the presence of a heat-sensing pit organ located between the eye and the nostril on both sides of the head. This group of snakes include rattlesnakes, water moccasin (aka cottonmouth) and copperhead. Venom from pit vipers is broadly categorized as hemotoxins because they destroy red blood cells. Bites from pit vipers found in the U.S. are rarely fatal. Approximately 5,000 people are reported to be bitten in the U.S. each year with approximately 5 bites resulting in death.



Among the venomous snakes in the US, Copperhead snakes are responsible for the most snake bites, however, the bite is rarely fatal. Adult species can be identified by a “Hershey’s Kisses” pattern on the body.

Rattlesnakes account for the most deaths, whereas Copperhead snakes account for the most bites, often resulting from the snake being stepped on. Pit vipers are capable of controlling the amount of venom they inject. Approximately 20%-25% of pit viper bites are “dry”, meaning no venom is injected in the victim.

### 3.17.7.2 **Controls**

All workers walking through areas that are suspected or prone to have snake activity must be aware of the potential for encountering snakes and the need to avoid actions that will increase the risk of such an encounter (e.g., turning over logs). Avoid typical places where snakes like to hide, such as patches of tall grass and piled leaves, and rock and woodpiles. If you encounter a snake, give it space to retreat and let it take cover. Rattlesnakes will often coil when threatened and rattle, warning people of their location.

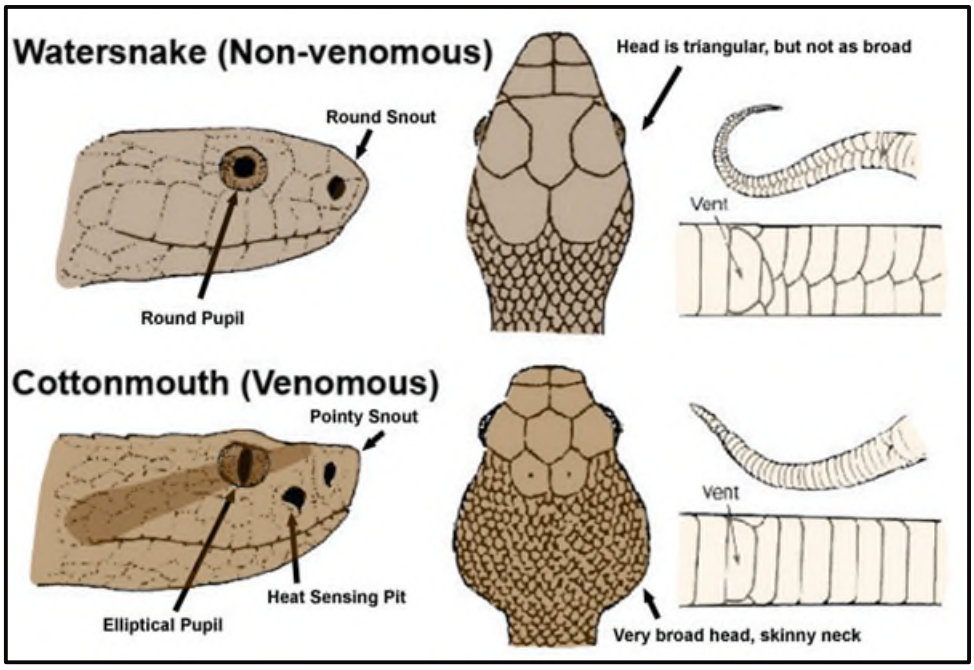



**Figure 3-10 Differences in Venomous vs Non-Venomous Snakes**

The snake species above illustrate the differences between a non-venomous snake and the Cottonmouth or Water Moccasin, a pit viper. All pit vipers have similar head structured and elliptical pupils. Some non-venomous snake species are capable of mimicking a venomous snake by creating a triangular shaped head appearance. In low light, the pupils of venomous snakes may be round.

When working outside where snakes may be present, wear tall boots, long pants, and leather gloves. If a venomous snake is identified in an area in which Arcadis will be continuing work, Stop Work and seek a professional pest removal service. Arcadis workers should not attempt snake removal.

### 3.17.7.3 First Aid

If a snake bite occurs, attempt to obtain markings, size, and color of the snake for identification. If bitten by a Rattlesnake, the victim must be transported to the nearest hospital as soon as possible.

**Snakebite 911** is an app that provides basic steps for rendering first aid to the victim of a venomous snake bite. Includes a venomous snake identification guide and hospital locations with antivenom supply.

To identify a snake bite, consider the following general signs and symptoms:

- numbness in the face or limbs
- lightheadedness
- weakness
- nausea or vomiting
- sweating
- salivating
- blurred vision
- difficulty breathing.

Take the following actions:

- Do a scene survey and primary survey. Most snakes will be in close proximity to the place where the bite took place–be careful;
- Reassure the victim. Remember, almost ¼ of bites result in little to no envenomation;
- Remove jewelry as swelling is likely near the bite location;
- Place the casualty at rest in a semi-sitting position and keep the affected limb below heart level. By placing the casualty at rest, the venom won't spread as quickly;
- Wash the bite location with soap and water, when possible;
- DO NOT use snake bite first aid kits that include cutting a "X" over the bite location and attempting to suction out venom. These kits often do more harm than good and are not recommended by medical professionals;
- DO NOT take antihistamines or anti-inflammatory medications. These medications have no benefit and may actually cause more harm. Antivenom, IV fluids, pain management and bloodwork to assess hematological changes are appropriate clinical measures.
- Seek emergency medical help as soon as possible. A doctor will evaluate the victim to decide on a specific course of treatment. The severity depends on the location of the bite and the age and health of the victim;

- Do not let a snakebite casualty walk if there is any other method of transportation to medical help. Limiting motion will slow down circulation of the venom;
- If the bite is not serious, the doctor may simply clean the wound and give the victim a tetanus vaccine. If antivenom is needed, the sooner the patient is provided with this treatment the more effective it will be; and,
- If the snake is confirmed to be non-venomous by a trained and experienced witness, contact WorkCare.

**Figure 3-11 Coral Snake**



Coral snake. The adage "Yellow on black is friend of Jack, red on yellow will kill a fellow" applies to the North American Coral Snake; however, there are species of coral snake that do not apply!

## 3.17.8 Fire Ants

Fire ants are prevalent throughout the southeast U.S. and live in nests in the ground. Fire ants typically climb unnoticed onto their prey and then simultaneously bite the victim. A bite is painful, usually resulting in a blister and later, itching that can lead to infection. Multiple bites can trigger an allergic reaction that can include swelling, heart palpitations, and responses similar to that of a bee sting.



Fire ant nests are not always visible and often located under the top layer of vegetation.

**FiFigure 3-12 Fire Ants**

### 3.17.8.1 Controls

When working in an area where ants may exist, a thorough inspection of the area should be made to mark and avoid the nests. Do not lay tools and equipment on the ground. Visibly check anything that may have come in contact with the ground before picking it up. Additional safety precautions include:

- Use caution when coming in contact with monitoring wells or any other item that is already in place.
- Individuals who know they are allergic to ant bites should wear Modified Level D PPE with pant legs taped to boots; gloves should be taped to sleeves to preclude ants crawling onto the skin.

- Allergic individuals should carry their auto-injectors when in the field and check that the auto-injector has not expired.

Fire ants have the appearance of ordinary ants, are reddish brown to black in color, and range from 2.5 to 6.3 mm (1/10- to ¼-inch) in size. Fire ants typically construct soil mounds up to 46 cm (18 inches) high in open sunny areas; however, fire ants may also colonize in mulched areas, cracked areas of pavement, electrical equipment, and utility housings, and may nest around bodies of water.

Fire ants are very aggressive when agitated and can cause painful bites and stings. Avoiding fire ant colonies is the preferred method to prevent bites and stings. However, if fire ants cannot be avoided, baits and chemical controls may be used in limited quantities (similar volume and frequency as a household consumer). Broad application of pesticides, without a license, is prohibited by law. Biological controls are generally considered beyond the scope of this handbook.

If bitten or stung by fire ants call WorkCare. An allergic reaction may occur that, in some instances, could be life threatening to sensitive individuals. If symptoms of flushing; general hives; swelling of the face, eyes, or throat; chest pains; nausea; severe sweating; loss of breath; serious swelling; or slurred speech occurs, the individual must promptly seek medical treatment.

General first aid for fire ant bites and stings includes:

- Elevate the extremity and apply ice or cold compress to reduce swelling and pain;
- Clean blisters with soap and water to prevent secondary infection; however, do not break blisters; and,
- Use topical steroid ointments or oral antihistamines to reduce itching associated with allergic reactions.

## 3.17.9 Spiders



Figure 3-13 Black Widow

Workers may encounter spiders during work activities. Two spiders of concern are the black widow and the brown recluse. Both prefer dark sheltered areas, such as basements, equipment sheds, and enclosures, around woodpiles or other scattered debris, and monitoring wells and vaults. The black widow is shiny black, approximately 1-inch long and found throughout the U.S. A distinctive red hourglass marking is located on the underside of the black widow's body. Generally, only females are cause for concern. The bite of a black widow is rarely fatal to healthy adults, but effects may include respiratory distress, nausea, vomiting, and muscle spasms. Even then the small amount of venom they produce gets quickly diluted by the human body. A black widow bite can, however,

cause severe pain at the bite site and lead to painful muscle contractions. Although these bites are generally not life-threatening for healthy adults, medical attention should always be sought following a black widow bite — particularly for children and the elderly. Other spider's native to the U.S. are not venomous, although bites from some spiders can be quite painful and dangerous, if they become infected.

The brown recluse (pictured) is smaller than the black widow and gets its name from its brown coloring and behaviour. The brown recluse is more prevalent in the southern U.S. The brown recluse has a distinctive violin shape on the top of its body. The bite is painful, and the bite site ulcerates and takes many weeks to heal completely. It is not uncommon for brown recluse bites to result in hospitalization.



**Figure 3-Figure 3-14 Brown Recluse**

The most telltale characteristic of brown recluse spiders is the presence of a dark, violin-shaped mark on the dorsum of the arachnid's light brown or yellowish-brown cephalothorax. The neck of this distinct violin pattern is directed toward the abdomen.

Both the black widow and the brown recluse spiders prefer dark sheltered areas, such as basements, equipment sheds, and enclosures, around woodpiles or other scattered debris, and monitoring wells and vaults.

### 3.17.9.1 Controls

To minimize the threat of spider bites, all workers walking through areas prone to have spider activity (e.g. wet, damp, dark crawl spaces, vegetated areas, basements) must be aware of the potential for an encounter. Workers should avoid actions that may result in encounters, such as turning over logs and placing hands in dark places, such as behind equipment or in corners of equipment sheds or enclosures. If spiders cannot be avoided, baits and chemical controls may be used in limited quantities (similar volume and frequency as a household consumer). The broad application of herbicides or pesticides may be considered a commercial application. Commercial applications may only be completed by a licensed and permitted professional. Be sure to understand federal, provincial, territorial and local laws regulating such applications before purchasing and using insecticides. To treat a large area for spiders, subcontract a professional pest control service.

If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible. First aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

## 3.17.10 Chiggers

Chiggers are small red mites (as adults) that are barely visible to the naked eye. Although not originally found in Canada, their habitat has expanded into southwestern Ontario. Typical chigger habitat includes tall grasses and overgrown brushy areas. When in the larval stages, chiggers are prone to feeding on animals and humans. Larval chiggers attach themselves to the skin, secret a digestive enzyme and feed off of liquified host tissue. The chigger's salivary secretions can cause an allergic reaction, resulting in a rash and intense itching. The following actions will reduce exposure to chigger hazards:

- Avoid unnecessary entry into tall grass and brushy areas; Wear insect repellents containing DEET; and,
- Minimize exposed skin and tuck pants into socks or boots.

**Figure 3-15 Chiggers**



Chiggers are so small, they're virtually impossible to see with the naked eye. Typically, orange-red to reddish-brown and covered with long surface hairs, their oval shape is very similar to the larger, adult form and to their close relatives, the ticks.

## 3.17.11 Caterpillars

While not aggressive towards humans, many caterpillars have bristles associated with venom glands, called urticating hairs, and can cause skin irritation on contact. In general, caterpillars should not be handled without protective gloves. In areas with high populations where caterpillars can fall from overhead trees, long sleeves and long pants should be worn.

## 3.17.12 Physically Damaging Plants

Plants like thistles, nettles, roses, raspberries, cactus, and hawthornes, which have thorns and irritating hairs, can create a hazard to skin and can damage protective or personal clothing. Plants of this nature are common on project sites and can often be found along fence lines, abandoned structures, or equipment. If work will be conducted near these plants, they should be removed prior to implementing the work activity. Long pants or chaps should be worn when working in dense thorny vegetation. Talk to local staff or plant experts to learn of hazardous plants unique to your location or geography. Often, new or visiting staff are not familiar with the appearance or hazards of plants in unfamiliar locales.

### 3.17.12.1 Common Nettle

Common Nettle or Stinging Nettle has many hollow stinging hairs called trichomes on the leaves and stems, which act like hypodermic needles, injecting histamine and other chemicals that produce a stinging sensation upon contact. Contact may result in small blisters. Anti-itch drugs, usually in the form of creams containing antihistamines or hydrocortisone, may provide relief from nettle dermatitis.



**Figure 3-16 Common (Stinging) Nettle**

Stinging nettle is widely distributed throughout the US. It is most often found in damp, rich soil.

### 3.17.12.2 Poisonous Plants

**Figure 3-17 Poisonous Plants**




The plants pictured above contain urushiol, an irritating, oily sap found in all parts of poison ivy, poison oak, and poison sumac plants, including the leaves, stems, and roots. It's even present after the plant is dormant or has died.

Poisonous plants are frequently present at Arcadis project sites. Workers should be alerted to their presence and instructed on methods to prevent exposure. Plants containing urushiol are notorious for causing contact dermatitis. Poison ivy, poison oak, and poison sumac, each contain urushiol, and are found throughout United States. The sap of giant hogweed is phototoxic and causes phytophotodermatitis in humans, resulting in blisters and scars. Contact with any poisonous plant should be avoided. If present on a project site, care should be taken to either avoid these plants or to have them removed by trained individuals equipped with appropriate tools and PPE. In general, poison ivy grows east of the Rocky Mountains, poison oak west of the Rocky Mountains, and poison sumac in the southeastern United States.

Poison sumac grows as a shrub or small tree with large alternate, compound leaves having seven to 13 leaflets without teeth. All plant parts are poisonous. The lack of leaflet glands, “wings” between the leaflets and teeth on the leaves, in addition to this species’ red stems supporting the leaflets and leaves, help to distinguish this plant

from similar-looking non-poisonous species, such as other sumacs and tree-of-heaven. Flowers are shades of green, white, and yellow and appear in late spring. Fruits are small white berries that mature in late summer and may last through winter. Poison Sumac grows almost exclusively in wet or clay soils, typically in swamps and peat bogs. Non-poisonous sumac is widely distributed in subtropical regions and is known for conical shaped clusters of bright red fruit in autumn.

Poison ivy grows in a number of different forms including as single plants, as a woody shrub or vine with hairy-looking aerial roots. It grows to 10 feet or more, climbing high on trees, walls and fences or trails along the ground. In winter, poison ivy vines traversing up tree trunks appear "hairy" with thousands of attachments to the tree bark. All parts of poison ivy, including the roots, are poisonous at all times of the year.

Poison oak is usually found in relatively dry sunny sites in woodlands, thickets, or fields. This species of poisonous plant generally prefers sandy soils. Poison oak grows as low shrubs that do not climb; leaves are dull green, densely hairy, are often lobed (3 to 7) and coarsely serrated. The fruit is white and hairy.

### 3.17.12.3 Controls

The main control for poison ivy, sumac, and oak is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. When working around poisonous plants cannot be avoided, workers should wear modified Level D PPE and decontaminate appropriately. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants including animals exposed to these plants and tools contacting the plants. Treat every surface that may have touched the plant as contaminated. Any object that contacts these plants can cause the rash if it subsequently contacts human skin. Removing PPE must therefore be executed in strict adherence with contaminated sites PPE doffing protocols. Other procedures may include privacy facilities for clothing removal and bagging (sealed containment).

If you come in contact with poison ivy, oak, or sumac wash the affected area(s) with soap and cool water as soon as possible. Washing within the first 6 hours, before the first symptoms appear, will help to minimize the effects of an outbreak or even completely prevent an outbreak. Commercially available products, such as Technu, break down the oils that cause rashes and should be used as soon as possible after exposure. Washing in tepid water and using friction is important in removing urushiol from the skin.

Rash symptoms can appear within a few hours but can take 2 to 5 days to appear. The rash starts as a red, annoyingly itchy area that starts to swell. The area then becomes inflamed and will get covered in clusters of tiny pimples; the pimples eventually merge and turn into blisters. The fluid in the blisters turns yellow, dries up, and becomes crusty. Left completely untreated, this cycle can last as short as 5 days and in severe cases, as long as 5 to 6 weeks.

Contact with giant hogweed should be avoided. Contact a professional landscape company to remove giant hogweed from a project site. Hogweed sap can severe phytophotodermatitis, which results in ultraviolet light from the sun causes sunburning where the sap is present. This can result in localized destruction of skin tissue. Hogweed sap can also cause blindness if the sap comes in to contact with the eyes.

## 3.17.13 Bears

Bears are curious, intelligent, and potentially dangerous animals, but undue fear of bears can endanger both bears and people. Most bears tend to avoid people. Bears feed on green grasses and on vegetation that grows in wet areas. They often rest in cool, dark, thick forests. Grizzly bears are typically, but not exclusively, active during dawn, dusk, and night-time.

### 3.17.13.1 Avoiding Bear Encounters

Be alert where recent bear activity has been documented. Some common areas where bears like to frequent are landfills, avalanche chutes, stream beds, dense edge cover, and, in late summer, berry patches.

- Use caution when travelling on trails in the early morning, at dusk, or at night;
- Watch for scat or bear tracks on the trail or near possible camp sites;
- If you come upon a dead animal carcass, immediately leave the area. Bears will often feed on a carcass for days and will stay in the area to protect their food; and,
- If you see a bear cub, the sow is likely nearby. Female bears will fiercely defend their young, so it is best to leave the area and find an alternative route.



Like all wildlife, bears can be unpredictable and may be aggressive when startled or approached. Of particular concern are adult bears that are accompanied by cubs, which they may defend aggressively.

Like all wildlife, bears can be unpredictable and may be aggressive when startled or approached. Of particular concern are adult bears that are accompanied by cubs, which they may defend aggressively.

Bears may make barking, woofing, and moaning sounds when agitated or threatened. Jaw popping is reportedly common before charging. A bear can reach speeds of 50 km per hour (30 to 35 mph) in a matter of seconds so attempting to outrun a charging bear is futile.

### 3.17.13.2 Controls

If bear encounters are a real threat, consider the use of a subcontracted professional wildlife monitor. Always stay near and within communication distance of an armed monitor. Additional personal controls to be considered in bear country are:

- Do not travel alone; use the buddy system or small groups;
- If possible, make plenty of noise on the trail, especially on blind curves, in dense vegetation, or areas with limited vision;
- Be conscious of the wind—bears have an excellent sense of smell. If the wind is at your back, chances are that a bear will smell you and leave the area well before you reach it. If the wind is blowing in your face, your chances of an encounter greatly increase. In high wind situations or along creeks and streams, a bear might not hear you coming, or you might not hear it;
- Consider bear encounter and/or attack survival training for staff in bear prone areas;
- Wherever possible stay near your vehicle or other mode of transportation or permanent shelter;
- Be careful with food smells—never cook close to camp. Store all foods in plastic away from camp at night. When camp is unattended, store food away from the camp site and at least 2 m up a tree hung 1.2 m away from the trunk; and,
- Project workers should always carry bear repellent pepper spray when working in bear country. Bear repellent spray is a proven defense against possible attack by grizzly and black bears.

### 3.17.13.3 Bear Encounters

Bear attacks are rare; most bears are only interested in protecting food, cubs, or their space. Being mentally prepared can help you have the most effective reaction when a bear encounter occurs. Every situation is different, but below are guidelines on how brown bear attacks can differ from black bear attacks. Help protect others by reporting all bear encounters immediately.

**Brown/Grizzly Bears:** If you are attacked by a brown/grizzly bear, leave your pack on and PLAY DEAD. Lay flat on your stomach with your hands clasped behind your neck. Spread your legs to make it harder for the bear to turn you over. Remain still until the bear leaves the area. Fighting back usually increases the intensity of such attacks. However, if the attack persists, fight back vigorously. Use whatever you have at hand to hit the bear in the face.

**Black Bears:** If you are attacked by a black bear, DO NOT PLAY DEAD. Try to escape to a secure place such as a car or building. If escape is not possible, try to fight back using any object available. Concentrate your kicks and blows on the bear's face and muzzle.

If any bear attacks you in your tent, or stalks you and then attacks, do NOT play dead—fight back! This kind of attack is very rare but can be serious because it often means the bear is looking for food and sees you as prey.

## 3.17.14 Moose

In the summer months, moose blend in well to their environment and can be surprisingly hard to see for such large animals. They are likely to stand their ground even when they hear people approaching, so pay close attention to your surroundings, especially in prime moose habitat such as willow thickets or around streams or ponds.



During the fall mating season (in late September and October) bull moose may be aggressive toward humans. Cow moose with young calves may also defend them aggressively.

If you do find yourself close to a moose:

- If it hasn't detected you yet, slowly retreat;
- If it knows you're there, talk to it softly and move away slowly;
- Don't be aggressive - you want to convince the moose that you aren't a threat; and,
- If you think the moose is going to charge you, take cover or run away.

If its ears are laid back and hackles are up it is likely to charge. Most of the time, when a moose charges it is a 'bluff', or warning for you to get go away. Once a moose bluff charges it is already agitated. If possible, get behind something solid (like a tree or a car). Unlike with bears, it is okay to run from a moose. It is rare for moose to chase people long distances.

## 3.17.15 Cougar (Mountain Lion)

When working in cougar (a.k.a. mountain lion, puma, catamount, panther) country, use the following precautions to avoid (or during) an encounter:

- Make noise. Cougars will often retreat if given the opportunity. Walking in large groups and making noise will give a cougar the chance to retreat and reduce the likelihood of a sudden encounter;
- Be cautious at dusk and dawn. Contrary to popular belief, most predators are most active at dusk and dawn. These are times to be especially cautious;



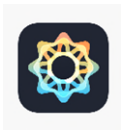
Cougars have short, muscular limbs and long, cylindrical tails that reach nearly one third of the animal's full length. They have four digits on their hind feet and five digits on their front feet, along with retractable claws.

- Remember, cougars are very different from bears. Cougars do not bluff charge and playing dead is never recommended in a cougar attack;
- Do not run. Cougars are a powerful predator. Running may trigger an attack;
- Face the cougar and retreat slowly. Keep direct eye contact with the cougar while you slowly retreat toward safety;
- Raise your arms above your head to make yourself look larger than normal. This may help to intimidate the cougar. You may also want to throw rocks and yell at it. Aggression will often scare it off. If a cougar attacks, fight back. Many people have survived cougar attacks by fighting back with anything, including rocks, sticks, and bare fists; and,
- Report the sighting.

## 3.18 Illumination

All portions of each work location will be sufficiently lit using natural or artificial illumination. All project sites should be lit so that all surfaces are illuminated at 54 Lux (5 foot candles; 5 lumens per square foot) or greater. The Site Supervisor will determine, based on feedback from site workers, whether an area is adequately lit. This may require the use of a light meter. **Table 3-6** provides minimum illumination requirements for various project sites and functions.





Lux Light Meter Pro is an easy-to-use, functional light intensity (lux) meter perfect for measuring, comparing, and adjusting lighting levels in your environment. While it doesn't replace a calibrated light meter, it can assist the user in determining if their work area is adequately illuminated.

**Table 3-6 Lighting Requirements**

| Lighting Requirements | | | |
|---|---|---|---|
| **Facility Name or Function** | **Intensity** | | |
| | **(foot-candles)** | **Lumens per square foot** | **Lux** |
| Access Ways | | | |
| General indoor | 5 | 5 | 54 |
| General outdoor | 3 | 3 | 32 |
| Exit ways, walkways, ladders, stairs | 10 | 10 | 108 |
| Administrative areas (offices, drafting, meeting rooms, etc.) | 50 | 50 | 538 |
| Chemical laboratories | 50 | 50 | 538 |
| Construction areas | 5 | 5 | 54 |
| General indoor | 5 | 5 | 54 |
| General outdoor | 3 | 3 | 32 |
| Tunnels and general underground work areas [minimum of 108 Lux (10 foot candles) required at tunnel and shaft heading during drilling, mucking and scaling] | 55 | 55 | 592 |
| Conveyor routes | 10 | 10 | 108 |
| Docks and loading platforms | 3 | 3 | 32 |
| Elevators, freight and passenger | 20 | 20 | 215 |
| First-aid stations and infirmaries | 30 | 30 | 323 |
| Maintenance, operating, and construction areas | | | |
| Vehicle maintenance shop | 30 | 30 | 323 |
| Carpentry shop | 10 | 10 | 108 |
| Outdoors field maintenance area | 5 | 5 | 54 |
| Refuelling area, outdoor | 5 | 5 | 54 |
| Shops, fine detail work | 50 | 50 | 538 |
| Shops, medium detail work | 30 | 30 | 323 |
| Welding shop | 30 | 30 | 323 |
| Mechanical/electrical equipment rooms | 10 | 10 | 108 |
| Parking areas | 3 | 3 | 32 |
| Toilets, wash and dressing rooms | 10 | 10 | 108 |

| Lighting Requirements | | | |
|---|---|---|---|
| Facility Name or Function | Intensity | | |
| | (foot-candles) | Lumens per square foot | Lux |
| Visitor areas | 20 | 20 | 215 |
| Warehouses and storage rooms and areas | | | |
| Stockrooms, active or bulk storage, indoor | 10 | 10 | 108 |
| Inactive storage, indoors | 5 | 5 | 54 |
| Rack storage, indoors | 25 | 25 | 269 |
| Outdoor storage | 3 | 3 | 32 |
| Work areas – general (not listed above) | 30 | 30 | 323 |

## 3.19 Medical Surveillance

Arcadis workers may be required to participate in medical monitoring, either over the long term or for specific periods of time as part of doing work. Workers are required to participate in the Arcadis medical monitoring program if they:

- Perform field work on US HAZWOPER sites;
- Have the potential to be exposed above the permissible exposure limit (PEL) to hazardous substances; defined in OSHA regulations;
- Wear a respirator while performing work;
- Are exposed to noise in excess of PELs; or,
- Are required by Corporate H&S; and,
- Are required by a client.



Did You Know? Arcadis Standard ARC HSGE010 “Medical Surveillance” includes requirements for Arcadis’ medical monitoring program.

### 3.19.1 Baseline and Annual Medical Examination

Where and when required, the baseline and annual medical examinations are administrated by Arcadis' third party medical surveillance service provider (currently WorkCare) and typically include the following elements:

- Medical and occupational history questionnaire;.
- Physical examination;
- Complete blood count, with differential;
- Liver enzyme profile;
- Chest x-ray, at a frequency determined by the physician;
- Pulmonary function test;
- Audiogram;
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination;
- Drug and alcohol screening, as required by job assignment;
- Visual acuity; and,
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

Additional elements may also be examined. Contact Corporate H&S for a complete list of elements examined during medical monitoring.

The examining physician will provide the worker with a letter summarizing his or her findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each worker during all project site work.

### 3.19.2 Respirator Questionnaires

If a worker is required to wear a respirator, or may be required to wear a respirator, they must be medically cleared to do so. This is accomplished by the Arcadis worker completing a respirator screening questionnaire and submitting it to Arcadis' third-party medical surveillance service provider (currently WorkCare) for review by a physician. Based on the answers provided, the physician may clear the worker to wear a respirator, clear the worker to wear a respirator with some restrictions, request that an in-person assessment be completed, or not clear the worker to wear a respirator.

### 3.19.3 Other Medical Examinations

In addition to baseline, annual and exit physicals, workers may be examined:

- At the worker's request, after known or suspected exposure to toxic or hazardous materials; and,

- At the discretion of Corporate H&S or occupational physician in anticipation of, or after a known or suspected exposure to, toxic or hazardous materials, noise, or other conditions that may affect the health of the worker.

### 3.19.4 Periodic Exam

Following the baseline examination, all workers that are enrolled in the medical surveillance program must undergo an annual or biannual examination. For workers potentially exposed more than 30 days per year to hazardous site conditions, periodic examinations will be conducted annually. For workers potentially exposed less than 30 days per year, periodic examinations may be conducted every 24 months if approved by WorkCare.

If WorkCare identifies a need to restrict work activity, the medical monitoring coordinator for Arcadis and the worker will be notified. The medical monitoring coordinator will notify the worker's supervisor of the restriction.

## 3.20 Field Office General Health and Safety Requirements

Injuries and accidents in field offices are just as serious and costly as those occurring at field locations. Many of these accidents involve tripping, slipping and falling; strains; and sprains. The field office must be kept neat and tidy, and workers must report and correct unsafe conditions. Complete workstation self-evaluations for long-term projects (>3 months). Contact Arcadis H&S representative for assistance in completing workstation assessments.

### 3.20.1 Access and Egress

- Ice and snow accumulation along entrances and exits must be addressed at Arcadis project sites and facilities to prevent worker injuries from slips, trips, and falls; or vehicle accidents;
- Outdoor steps leading to office trailers should have holes to allow dirt, sand, salt, etc. to fall below. If steps do not have holes, extra care must be taken to ensure they remain clean. Salt pellets used to melt snow and ice may cause a slick surface;
- Aisles, stairways, and walkways, and access to safety, firefighting equipment, and first-aid equipment must be kept clear of obstructions (e.g., equipment deliveries, office supplies), and/or tripping hazards;
- All fire lanes, access roads, and evacuation routes must be kept clear of equipment, materials, and parked vehicles at all times; and,
- The following list of unsafe situations should be avoided to make your field office workplace safer:
  - Blocked, malfunctioning, or non-functioning exit doors (e.g., locked, hard to open);
  - Blocked or cluttered exit passageways (e.g., halls, stairwells);
  - Extra or unnecessary boxes, paper, or other flammable/combustible products;

- Improper storage of office equipment and supplies;
- Overloaded outlets;
- File and desk drawers in poor condition and left opened; and,
- Sharp/bladed equipment (e.g., scissors, cutting knives) improperly stored and poorly maintained

### 3.20.2 Project Sites and Office Furniture

- Keep project sites clean and free of tripping hazards (e.g., cords, drawers, books, files);
- Never use chairs and other office furniture as stepping stools, ladders, or climbing aids;
- Leaning back in straight-backed chairs should be avoided.

### 3.20.3 Filing and Storage Cabinets

- Prevent cabinets from tipping over by bolting cabinets together side by side, where possible, or bolting to support walls;
- Do not overload top shelves or drawers. Materials on shelves or in file cabinets should be stored with no heavy items kept above shoulder height);
- Open drawers one at a time and close them after use to avoid overbalancing the cabinet. Use handles for closing the drawers to prevent fingers from being pinched and broken; and,
- Do not struggle with firmly stuck drawers to avoid hurting your back or having the drawer pull loose and drop on your foot.

### 3.20.4 Paper Cutter and Shredder

After using the paper cutter, close the blade. Be careful when using the paper shredder to avoid catching jewelry, ties, clothing, or long hair in the blades.

### 3.20.5 Wastepaper Baskets

If the basket is being used to dispose of glass, sharp-edged cans, or other similar objects, first place these objects in a paper bag or wrap them in newspaper and mark the contents clearly. Never place these items loose in the basket.

### 3.20.6 Electrical Cords

- To avoid a fire hazard, make sure that all electrical cords and receptacles, including power bars, are in good condition and that they do not become overloaded;
- Do not “daisy-chain” multiple power strips;
- Repair or replace any worn or frayed cords immediately;
- Do not affix temporary electric cords to parts of any structure or run temporary electric cords through walls or ceilings;
- Do not run electrical or telephone cords across aisles or walkways where they may become damaged or present a slipping or tripping hazard around desks or in walkways; and,
- Never pull an electrical cord from the wall socket by yanking on the cord; pull the plug instead.

### 3.20.7 Floor, Aisles, Hallways, and Stairways

- Keep floors, aisles, entryways, exits, halls, and stairs free of debris and storage boxes and other obstructions;
- While walking, do not obstruct your view by carrying oversized loads;
- Watch for blind spots when walking down halls or around corners; be careful when carrying hot drinks;
- Pick up debris, wipe up spills immediately and watch for slippery surfaces;
- Use aisles provided to move around the office; do not take shortcuts between desks; and,
- Use handrails when climbing or descending stairways.

## 3.21 Fatigue Assessment

Fatigue is a human condition primarily caused by prolonged wakefulness and/or insufficient or disturbed sleep. It includes physical, cognitive, psychological, and physiological dimensions that interact with each other to reduce human performance and lead to uncontrollable sleep onset. Fatigue can lead to poor judgment, poor performance on skilled tasks, and slower reaction times. Fatigue can affect your decision-making and analytical process.

There are many factors that impact fatigue on a project including:

- Location of work such as remote areas versus easily accessible controlled sites;
- Weather conditions (cold, heat, snow, rain);
- Shift-work;

- Work duration;
- Travel distance to/from project location;
- Physical requirements of the project task(s); and,
- Mental intensity of work such as high intensity incident response versus lower intensity routine field work.

Some signs and symptoms of fatigue might include:

- blurred vision;
- difficulty keeping your eyes open;
- head nodding;
- drowsy relaxed feeling;
- irritability;
- not feeling refreshed after sleep (waking tired);
- falling asleep at work; and,
- micro sleeping – falling asleep for less than a second to a few seconds and being unaware that you have done so (usually due to sleep loss).

The following are tips to reduce fatigue:

- schedule critical tasks at times of maximum alertness;
- increase awareness of the need to get good sleep;
- establish a sleep routine that works best for the individual, take naps when needed;
- implement good dietary and hydration practices;
- when off-duty, take the time to rest and relax; and,
- exercise Stop Work Authority if you feel you cannot safely work.

PMs and Site Supervisors should evaluate potential fatigue on their projects on a site-specific basis and discuss the signs of fatigue and use Stop Work Authority with staff if necessary. If the PM or Site Supervisor use TRACK and determine that staff fatigue could be a potential concern, appropriate fatigue management methods and procedures should be implemented such as:

- Establishing work schedules compliant with federal, state and local regulations and appropriate for the task(s) being performed;
- Limiting the duration that a person can operate equipment, including motor vehicles;
- Establishing and effectively communicating, including conspicuously posting, notices regarding mandatory breaks, meal periods, and scheduled rotations;
- Being mindful of workers traveling from other time zones and making allowances for adjustments in the sleep/work cycle;

- Job rotation; and,
- Requiring overnight stays if driving before or after field work is a safety concern.

All project staff are encouraged to be cautious, stop work, and notify their supervisor if they feel fatigue is affecting their ability to work safely. Workers working under regulatory requirements with fatigue management elements (e.g. commercial motor vehicle drivers) will follow all aspects of those requirements in conjunction with any fatigue management requirements implemented on the project.

# 3.22 Personal Protective Equipment

All workers at Arcadis project sites are required to wear and use PPE to provide protection from potential hazards, as indicated by the project HASP. Every worker who works in the field or visits a client facility must be equipped with appropriate H&S gear and PPE. Minimum PPE includes a hard hat, work boots, visi-vest, gloves suited to task and protective eyewear.



Did You Know? Arcadis Standard ARC HSGE015 “Personal Protective Equipment” includes requirements and recommendations for utilizing and storing personal protective equipment.

## 3.22.1 General

Engineering and work practice controls are used to eliminate the hazard or to stop, contain, or capture it at the source or intercept it along its path to the worker. When feasible, these controls are preferred to burdening the worker with PPE. Administrative controls are measures to limit the duration of exposure to the hazard. Generally, administrative controls are not acceptable to control inhalation or direct-contact skin hazards, except when no other control technology is feasible or effective.

Arcadis will provide suitable PPE as required for the nature of the job being performed, such as, but not limited to, safety toe, puncture resistant and shock resistant sole work boots, chemical protective and high visibility clothing, respirators, eye and face protection, hard hats, and gloves. Workers will use assigned PPE on any task where there is potential exposure to physical hazards, such as equipment operation or falling objects, or to materials that may cause respiratory injury or skin irritation. Specific requirements will be established through a hazard assessment and documented in the applicable project HASP or other applicable planning documents.

## 3.22.2 Selection

The selection of PPE is based on the hazards identified during the workplace hazard assessment and the activities that will be performed while using the PPE. To provide adequate protection, the selected PPE will meet ANSI requirements where standards have been published (e.g., foot, eye, and head protection) and NIOSH or Mining Safety and Health Administration (MSHA) requirements for respiratory protection. The minimum level of PPE (hard hat; safety glasses; class II high-visibility vest, shirt, or coat; gloves and protective footwear with protected-toe cap puncture resistant sole and shock resistant sole work boots) is expected to be worn on all project sites unless in a field trailer or vehicle, unless a specific exemption has been established within an approved HASP or modification to a task-specific JSA or Permit to Work upon completion/review of the hazard analysis.

PPE should be purchased through Arcadis's national safety supply vendors. All personal prescription safety eyewear should be acquired through Arcadis national safety eyewear provider. Workers who require prescription glasses are eligible to participate in the prescription safety glasses program. See the Health & Safety landing page of the Arcadis Intranet site for the most current PPE vendors and order forms.

Each worker should store and carry their PPE in a durable crate, box or bag suitable for travel. **Table 3-7** lists equipment that is required by practice.

**Table 3-7 PPE by Practice**

| Listed "General PPE" is required for field staff, the last column specifies PPE for Arcadis staff visiting project sites. | Staff in Resilience BA[1] | Staff in Mobility BA[1] | Staff in Places[1] | Staff Visiting Project Sites |
|---|---|---|---|---|
| Minimum PPE Required to be Worn[1] | | | | |
| Hard Hat | R | R | R | R |
| Reflective Traffic Vest (minimum Class 2) | R | R | R | R |
| Safety Glasses – Clear and Tinted | R | R | R | R |
| Safety Toe Boots | R | R | R | R |
| Minimum PPE Required to Have on Hand | | | | |
| Hearing Protection - Ear plugs (need for earmuffs TBD) | R | R | R | R |
| Safety Gloves and Glove Clip | R | R | R | R |
| First Aid Supplies[2] | | | | |
| Small First-aid Kit | R | R | R | O |

**Table 3-7 PPE by Practice**

| Listed "General PPE" is required for field staff, the last column specifies PPE for Arcadis staff visiting project sites. | Staff in Resilience BA[1] | Staff in Mobility BA[1] | Staff in Places[1] | Staff Visiting Project Sites |
|---|---|---|---|---|
| 16 oz. Bottle of Eye Wash | R | R | R | O |
| Tick Remover (fine-tip tweezers) | O | O | O | O |
| PPE Supplies | | | | |
| PPE duffel bag with logo, or equivalent | O | O | O | O |
| Half Face or Full-Face Respirator[3] | O | O | O | O |
| Insect Repellent (Recommended 20-30% DEET) | O | O | O | O |
| Sunscreen | O | O | O | O |
| Hand Sanitizer | O | O | O | O |
| Cut-Resistant (Level II) or Chemical-Resistant Gloves[4] | O | O | O | O |
| Poison Ivy Pre-exposure Wipes or Post-exposure Cleanser (i.e., Tecnu or Zanfel) | O | O | O | O |
| Other Specialized Protective Equipment (see THA) | O | O | O | O |
| Outdoor Wilderness Survival Kit[5] | O | O | O | O |

**R** – Required **O** - Optional. Based on HASP Task Hazard Analysis (**THA**) or geographic location of work.

THA - Task Hazard Analysis - Review the HASP Task Hazard Analysis (THA) in making this determination. Certain specific factors can influence the determination for requiring this PPE for the site or task. For example, certain geographic regions may have a higher incidence of the hazard or associated risk, the proximity of the site relative to emergency services may require such, previous observations of the hazard at the site, or where unknown hazard conditions apply. Modifications to the minimum required PPE are required to be communicated via the HASP and/or JSA.

[1] The Division Director, Operations Manager, Project Manager or Worker Supervisor is responsible for making the decision to provide Arcadis branded shirts to workers. Billing of such shirts is related to the authority level of the decision maker.

[2] For project sites with an office/trailer, First Aid/emergency response supplies can be kept in a central location and may not be required to be carried by each Arcadis worker.

[3] Staff must comply with the Arcadis Respiratory Protection H&S Standard before a respirator can be worn. The H&S Standard is available on the H&S landing page of the Arcadis Intranet Site.

[4] Determination for use of cut resistant (Level II), chemical resistant gloves or other specialized hand protection are to be based on the THA in the project HASP.

[5] Outdoor survival kits are generally required when working in remote wilderness locations. See the HASP THA and the Field H&S Handbook for requirements and supply list.

Workers are expected to maintain this PPE in a clean, ready-to-use condition, and to perform periodic inspections to confirm that PPE is undamaged and fully functional. Any problems should be identified to the Site Supervisor immediately so that replacements can be arranged.

Prior to use of any safety equipment (individually issued or centrally stored), workers should inspect each piece to confirm that it is in good working order. Equipment exhibiting any signs of wear or damage will be immediately placed out of service and repaired or replaced.

### 3.22.3 Flame-Resistant / Arc Flash Clothing

Since the 1970s, oil/gas and chemical processing industries have relied on flame-resistant (FR) clothing to help protect workers in the event of a flash fire. These industries recognized the damage that ordinary cotton clothing and synthetic clothing had on the wearer when these short duration, high temperature fires occurred. Today, FR clothing is used in many industries to protect workers performing tasks that range from working around live electric conductors, which may have the potential to release a sudden burst of energy known as an “arc flash” to working in refineries or product distribution pipelines where there is a higher potential of injury from flash fires. The National Fire Protection Association (NFPA) developed guidelines for wearing personal protective equipment (PPE) when the potential for an arc flash exists. NFPA 70E, Standard for Electrical Safety in the Workplace, identifies when specialized PPE is required based on the results of a hazard assessment related to the task. In the latest version of NFPA 70E, the term Hazard Risk Category (HRC) was changed to PPE Category (CAT), which consumers will see on up-to-date garments tags. The four levels, CAT 1 through CAT 4, are where most employees stop since the testing methods and various material requirements do get a little complicated. In a nutshell, CAT ratings are based on a garment’s Arc Thermal Performance Value (ATPV) and its Energy Breakopen Threshold (EBT). These values are determined by applying various level of heat energy, measured in calories, to material to determine specific failure points. The PPE needs for an electrician working near live electrical circuits will vary but approximately 2/3 of most live electrical work will be covered by CAT 2 level of protection.

Poeple working in the oil and gas industry have different PPE requirements than electricians. NFPA 2112, Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fires, specifies the test methods and minimum construction and performance requirements that FR fabrics, components, and garments must meet to provide protection from Flash Fires (the 2018 version no longer uses the term “flash fires” and instead labels them as “short duration thermal exposures”). This clothing is tested under ASTM F1930 – 18, which is the Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin. The test method focuses on a sudden thermal exposure of no more than 3 seconds.

Remember, NFPA 70E and CAT levels are for those concerned about arc flash and NFPA 2112-compliant garments are for oil and gas employees needing protection from flash fires. The flame-resistant layer should always be the outermost layer AND synthetic materials should never be worn under the FR. Because of these limitations, it is important to choose a variety of garments that will work well in various climates.

### 3.22.4 Hinderances or Reduced Effectiveness of PPE

Employees should use TRACK when deciding the appropriate PPE. Site conditions, such as temperature, humidity, physical hazards, should be considered. Additionally, items such as jewelry, piercings, long fingernails, hairpins, etc. should be avoided when working in the field.

### 3.22.5 Training

Workers must receive training on the proper use, inspection, and maintenance of the assigned PPE. Training will include:

- How to know when and what PPE is required;
- How to properly don, doff, adjust, and wear PPE;
- Limitations of the PPE;
- Decontamination procedures;
- Proper care, maintenance, useful life, and disposal of PPE.

## 3.23 Confined Spaces

***NOTE**: Persons using this section of the handbook must first have core competency and training as required by the Arcadis Confined Space Health and Safety Standard (ARC HSFS003)*

Confined spaces include, but are not limited to: storage tanks, bins, sewers, in-ground vaults, vessels, tunnels, manholes, attics, crawl spaces, and pits. These enclosures, because of inadequate ventilation and/or the presence of hazardous gases and vapors, may present conditions that could lead to asphyxiation. Further, the physical conditions of the confined space, or equipment contained therein, or any other recognized serious safety or health hazards could result in injury and must be considered prior to entering confined spaces.



Did You Know? Arcadis Standard ARC HSFS003 “Confined Space” includes requirements and recommendations for use when working in and around confined spaces.

Potential confined spaces in the work area that could be purposely or mistakenly entered by Arcadis or subcontractor worker must be identified as confined spaces. Entry is forbidden into these spaces until they are classified. If no entry is necessary, classification is not required. A competent person must evaluate each confined space in accordance with the criteria defined in the Confined Space Evaluation Form as either Permit require, Alternate Procedures or Non-Permit Required Confined Space.

If a permit-required confined space (PRCS) exists at a project site, the following requirements will apply:

- PRCS must be marked to identify them as such if not already;
- PRCS must be identified in the site-specific HASP and a task-specific JSA must be developed;
- A thorough hazard analysis of the space and the activities that could create hazards in the space must be completed – TRACK;
- A permit package must be completed prior to any entry, including the evaluation form, the permit form, and the confined space entry checklist;
- All hazards must be appropriately controlled (i.e. locked out and tagged out) and their conditions verified before entry;
- An Entry Permit must be reissued for each entry and cancelled at the completion of an entry. Cancelled permits should be maintained in the project files;
- Before entering, attending, or supervising a confined space, the Site Supervisor and project manager must be notified of the intent to enter, attend, or supervise;
- A monitoring plan and implementation of the plan is required for the entry.
- Entrants and attendants must be suitably trained in Confined Space Entry;
- The identified rescuer must be appropriately trained to conduct confined space rescue;
- Entrants must be outfitted with appropriate equipment including PPE and rescue equipment; and,
- A pre-planned rescue plan is required including identification of rescue services and trained workers.

If it is required for Arcadis or subcontractor workers to enter, attend, or supervise entry into confined spaces, the PM, with assistance from Arcadis H&S staff, will verify that a program has been developed and implemented, that

all applicable workers have received the appropriate training and that a PRCS Entry form has been completed and is in place at the site.

The Site Supervisor will review the following safe entry requirements with site workers:

- Before entering, confined spaces should be as clean and free of hazardous materials and chemicals as possible. Where appropriate, confined spaces may be purged with water, air or other suitable means. Purging with hazardous solvents should be avoided where possible;
    - All input lines that discharge into the confined space shall be disconnected and capped or isolated;
    - The use of a single in-line valve shut-off as the sole means of isolating the confined space from any input lines is prohibited. However, the use of a double in-line valving arrangement with a vent or drain in between the two valves is acceptable, provided that dangerous air contaminants are not introduced by such venting; and,
    - Isolation valves will be locked in the closed position, vent or drain valves will be locked in an open position, and the person performing the work will keep the key;
- Electrical lockout of energized equipment in a confined space:
    - If electrical devices located within the confined space (e.g., motors, switches) must be repaired or worked on, the line-disconnect switches supplying the power must be tagged and locked in the “OFF” position;
    - The lock key will be kept by the person performing the work, and only this person is authorized to unlock the switch and remove the tag upon completion of the work; and,
    - If more than one person is working on the line, each person must place a lock on the switch and retain possession of their key;
- If multiple sources supply power to an electrical device through an automatic or manual bus transfer switch, lockout devices must be placed on the breaker nearest to the electrical device that is to be isolated, and an electrician will test the power supply lines to verify that power has been secured;
- Line-disconnect switches supplying power to any mechanical apparatus in the confined space (e.g., mixers, conveyors) must also be tagged and locked in the “OFF” position. This must be done for any entry, even when work will not be performed on the apparatus itself;
- All manhole and cleanout covers will be removed, and the openings maintained clear of any obstructions. When hinged doors or lids are provided, they will be secured so they cannot close;

- The Site Supervisor, using only equipment approved and tagged for Class 1, Division 1 locations will conduct appropriate tests for oxygen-deficient and toxic atmosphere in the confined space and place a record of the test results at the entrance to the confined space. Testing shall confirm the following:
  - Combustible gas and vapor concentrations do not exceed 10 percent of the lower explosive limit;
  - Oxygen content is no less than 19.5 percent and no greater than 23.5 percent;
  - Appropriate respiratory protective equipment and other appropriate personal protective devices will be provided for all workers if concentrations of toxic materials* exceed applicable occupational exposure levels;

    ** Testing for these materials must be made using equipment appropriate for potential chemical compounds. If space contains and/or has potential to contain an unknown chemical, Level B equipment must be used to enter the confined space.*
- If the nature of the work to be performed introduces, or has the potential to introduce, harmful air contaminants, or the oxygen content drops below 19.5 percent, all personnel will evacuate the confined space immediately;
- All confined spaces found to be unsafe must be ventilated by mechanical exhaust systems arranged to avoid recirculating contaminated air. Personnel will be evacuated immediately in the event of failure of the mechanical ventilation system. The confined space will be retested prior to reentry following ventilation system repair;
- All entry of permit-required confined spaces will be performed in accordance with the Permit-Required Confined Space Entry Program. As a minimum, signs with the following wording must be posted around the entrance and exit of confined spaces:
  - HAZARD AREA KEEP OUT;
  - DANGER;
  - CONFINED SPACE;
  - AUTHORIZED WORKERS ONLY; and,
  - PPE IS REQUIRED IN THIS AREA

While excavations have the elements of a confined space when worker entry is required, they are regulated under the OSHA Excavation standard and should not be classified as confined spaces. Spaces WITHIN the excavation, such as manholes, vaults, sewers, caissons, etc. may be classified as confined spaces. It should be noted that

some Clients may classify excavations as confined spaces. In these circumstances, Arcadis will proceed in accordance with Client requirements.

### 3.23.1 Sewer Entry

Sewer entry differs in three vital respects from other permit entries; first, there rarely exists any way to completely isolate the space (a section of a continuous system) to be entered; second, because isolation is not complete, the atmosphere may suddenly and unpredictably become lethally hazardous (toxic, flammable or explosive) from causes beyond the control of the entrant or employer, and third, experienced sewer workers are especially knowledgeable in entry and work in their permit spaces because of their frequent entries. Unlike other employments where permit space entry is a rare and exceptional event, sewer workers' usual work environment is a permit space.

- Only designated entrants who are thoroughly trained in the sewer entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing sewer entries are permitted to complete sewer entry.
- Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions are encountered:
    - Oxygen concentration less than 19.5 percent;
    - flammable gas or vapor at 10 percent or more of the lower flammable limit (LFL);
    - or hydrogen sulfide or carbon monoxide at or above 10 ppm or 35 ppm, respectively, measured as an 8-hour time-weighted average. Atmospheric monitoring equipment needs to be calibrated according to the manufacturer's instructions. The oxygen sensor/broad range sensor is best suited for initial use in situations where the actual or potential contaminants have not been identified, because broad range sensors, unlike substance-specific sensors, enable employers to obtain an overall reading of the hydrocarbons (flammables) present in the space. However, such sensors only indicate that a hazardous threshold of a class of chemicals has been exceeded. They do not measure the levels of contamination of specific substances. Therefore, substance-specific devices, which measure the actual levels of specific substances, are best suited for use where actual and potential contaminants have been identified. The measurements obtained with substance-specific devices are of vital importance to the employer when decisions are made concerning the measures necessary to protect entrants (such as ventilation or personal protective equipment) and the setting and attainment of appropriate entry conditions. However, the sewer environment may suddenly and unpredictably change, and the substance-specific devices may not detect the potentially lethal atmospheric hazards which may enter the sewer environment.

- Although OSHA considers the information and guidance provided above to be appropriate and useful in most sewer entry situations, the Agency emphasizes that each employer must consider the unique circumstances, including the predictability of the atmosphere, of the sewer permit spaces in the employer's workplace in preparing for entry. Only the employer can decide, based upon his or her knowledge of, and experience with permit spaces in sewer systems, what the best type of testing instrument may be for any specific entry operation.
- The selected testing instrument should be carried and used by the entrant in sewer line work to monitor the atmosphere in the entrant's environment, and in advance of the entrant's direction of movement, to warn the entrant of any deterioration in atmospheric conditions. Where several entrants are working together in the same immediate location, one instrument, used by the lead entrant, is acceptable.
- Sewer crews should develop and maintain liaison, to the extent possible, with the local weather bureau and fire and emergency services in their area so that sewer work may be delayed or interrupted and entrants withdrawn whenever sewer lines might be suddenly flooded by rain or fire suppression activities, or whenever flammable or other hazardous materials are released into sewers during emergencies by industrial or transportation accidents.
- Entry into large bore sewers may require the use of special equipment. Such equipment might include such items as atmosphere monitoring devices with automatic audible alarms, escape self-contained breathing apparatus (ESCBA) with at least 10 minute air supply (or other NIOSH approved self-rescuer), and waterproof flashlights, and may also include boats and rafts, radios and rope stand-offs for pulling around bends and corners as needed.

## 3.24 Control of Hazardous Energy

***NOTE**: Persons using this section of the handbook must first have core competency and training as required by the Arcadis Lockout / Tagout (LO/TO) Health and Safety Standard*

LO/TO is the process used to prevent injuries by controlling energy sources, such as electrical power, hydraulic fluid under pressure, compressed air, steam, energy stored in springs, potential energy from suspended parts, or any other source that may cause unexpected energization when it is necessary to perform work on the system. LO/TO also applies to similar functions performed on systems containing hazardous materials. All potential sources of energy must be isolated prior to work on any equipment capable of transmitting that energy. This isolation can be anything from turning off a circuit breaker to blocking open a power press. Once the energy source is isolated, steps must be taken to make sure that the isolation technique is not discontinued until the worker is done with his/her work. This will be accomplished by using locks to secure access to the system, and/or

placing warning tags at the isolation point. The use of tags alone for energy control is only authorized where the use of lockout devices is impractical or otherwise cannot be performed.

A written LO/TO Procedure will specify the proper LO/TO Procedures, which includes obtaining a Permit to Work. LO/TO of energy sources must be performed only by the authorized employee doing the work. If more than one worker is involved, either each individual worker must use his/ her own lock (multiple LO), or a group LO can be performed by the workers' supervisor/ foreman. The locks, tags, and equipment will not be tampered with by any worker. Only the person originally locking and tagging the equipment is authorized to remove the locks and tags. If the worker who placed the LO/TO device/sign no longer works for the company, only the supervisor/foreman can remove the locks and tags.



Did You Know? Arcadis Standard ARC HSFS004 ""Lockout/Tagout" includes requirements and recommendations for use when completing lockout/tagout.

## 3.24.1 Steps to Locking Out

The authorized worker(s) shall notify all affected worker(s) prior to the shutdown and isolation of the equipment/machine. Affected workers should be informed of the reason for shutdown and the approximate length of time required for servicing or maintenance.

1. The authorized worker(s) shall review the type(s) and magnitude(s) of energy present and the hazards present as well as any other hazards present;
2. If the machine/equipment is operating, the authorized worker(s) shall have the machine/equipment operator explain the standard shutdown procedure and then shut it down according to the procedure;
3. The energy isolating devices shall be deactivated so the machine/equipment is isolated from the energy source(s);
4. Each isolating device shall be locked out and tagged out. If lockout is not feasible, only tagout of the isolating device will be conducted, and additional precautions will be required to provide worker protection equivalent to the protection provided when lockout procedures are utilized. Each authorized worker conducting activities on the equipment/machine shall attach a(n) individually assigned safety lock to each isolating device. A standard tag shall also be attached to each individual's lock that identifies, by name, the authorized worker responsible for each lock. Stored or residual energy must be released or dissipated from each system to reach a zero-energy state. Visual inspection shall be made to confirm that all moving parts have stopped. Any

stored or residual energy shall be drained, blocked, repositioned, restrained, or bled. Electrical circuits shall be grounded to discharge electricity stored in capacitors.

To confirm that the equipment is completely isolated from the energy source(s), it is necessary to test the equipment to make certain that it will not operate. The following methods shall be used to test the equipment:

- Check the area and equipment to assure that no workers are exposed to the start-up of the equipment;
- Activate all start-up devices and operating controls;
- Use tic-tracers or voltage indicators to test electrical circuit; and,
- Return all operating control(s) to the neutral or off position after verifying the isolation of the equipment.

## 3.24.2 Written Lockout/Tagout Procedure Exception

If the following elements exist, a written LO/TO Procedure is not required for a particular machine or equipment:

- The machine or equipment has no potential for stored or residual energy or accumulation of stored energy after shutdown that could endanger workers;
- The machine or equipment has a single energy source which can be readily identified and isolated;
- The isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment;
- The machine or equipment is isolated from that energy source and locked out during servicing or maintenance;
- A single lockout device will achieve a locked-out condition;
- The lockout device is under the exclusive control of the authorized worker performing the servicing or maintenance;
- The servicing or maintenance does not create hazards for other workers; and
- There have been no accidents involving the unexpected activation or reenergization of the machine or equipment during previous servicing or maintenance.

The authorized worker is responsible for confirming the elements listed above are met prior to proceeding with LO/TO operations without a specific written LO/TO procedure.
When performing LO/TO procedures, it is important to identify all systems that require locking out. For instance, when working on a pump, it is important not only to lock out the electrical system, but also the fluid system must

be locked out. Complex systems may have several individual components or systems that must be locked out before the entire system can be considered locked out.

# 3.25 Electrical Safety

***NOTE**: Persons using this section of the handbook must first have core competency and training as required by the Arcadis Electrical Safety Standard.*

## 3.25.1 Electricity and Electrical Equipment

When performing electrical work, always take appropriate precautions against the potential hazards including shock, arc flash and fire) likely to be encountered with this type of work, in particular:

- All electrical guards and protective devices (including LO and isolation) must be in place and functioning properly; and,
- Workers must follow safe work practices and procedures when working around electrical equipment and power lines.



Did You Know? Arcadis Standard ARC HSFS006 “Electrical Safety” includes requirements and recommendations for use when working around electricity.

## 3.25.2 Electrical Work Hazard Assessment

A Safe Work Permit must be completed and issued when working on energized or deenergized electrical circuits.

## 3.25.3 General Safety Precautions

When performing electrical work, always take appropriate precautions against the hazards likely to be encountered when performing the work. In particular:

- Consider every circuit to be energized until otherwise proven;
- Turn off electrical power before changing a light bulb;
- When operating and/or working on electrical equipment where there is a possibility of an arc flash, always stand to one side to avoid exposure to arc flash energy;

- Do not overload electrical systems;
- In an emergency when power lines are down, consider every wire, including fences and guy wires, to be energized. Only qualified workers should handle them;
- Electrical equipment must be kept clear of all obstructions; do not store materials inside, in front, behind, or on top of this equipment;
- Report broken wire poles, guy lines, and any other equipment requiring repair to your supervisor when discovered. Repair promptly;
- Use the proper stopping control for all motors. The motor should only be disconnected by the main breaker in an emergency;
- All electrical equipment will be provided with a local control station located within sight of the controlled equipment;
- All electrical maintenance tools must be in good condition and approved and certified for the work being performed;
- Electrical equipment must be cleaned by a qualified person. Only approved materials may be used;
- Work must not be performed on pole lines, outdoor electrical services, or associated equipment during electrical storms, except during an emergency;
- Never place wet rags on electrical equipment either to cool down the equipment or to dry the rags;
- The use of water for washing down equipment in the vicinity of electrical apparatus is not permitted;
- Poles supporting electrical wires, or any type of electrical equipment should not be used as a snub or dead man for winch lines on trucks or pickups; and,
- Any connected wire that is found on or near the ground shall be considered energized and not be touched by anyone except a qualified person.

## 3.25.4 Use of Extension Cords

Due to the hazards of arcing electrical equipment or connections, the following safety precautions must be adhered to when using extension cords at Arcadis project site:

- Listed, labelled, or certified (i.e., approved) equipment be used in accordance with the instructions included in the listing, labeling, or certification. Extension cord manufacturers often prohibit cords being plugged in to each other;

- Portable cord- and plug-connected equipment and flexible cord sets (extension cords) shall be visually inspected before use on any shift for external defects (such as loose parts, deformed and missing pins, or damage to outer insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket);
- Cord- and plug-connected equipment and flexible cord sets (extension cords) which remain connected once they are put in place and are not exposed to damage need not be visually inspected until they are relocated.
- Flexible cords and cables shall not be used:
  - As a substitute for the fixed wiring of a structure;
  - Where they run through holes in walls, ceilings, or floors;
  - Where they run through doorways, windows, or similar openings;
  - Where attached to building surfaces; or
  - Where concealed behind building walls, ceilings, or floors.
- All extension cords used in a confined space must have hazardous-location-rated connections;
- All connections at standard U-ground plugs must be made and adequately taped (to prevent them from pulling apart) before plugging into the hazardous location-rated receptacles;
- When the work is completed, connections must be broken at the hazardous-location-rated receptacle first;
- All portable electrical equipment that is approved for use in hazardous locations must have cords in good condition; and,
- Ground fault circuit interrupters (GFCIs) are required for all 120-volt, single-phase, 15- and 20-ampere receptacle outlets on construction sites that are not a part of the permanent wiring of the building or structure that are in use by workers.

## 3.25.5 Arc Flash Safety

Workers working around energized devices are subject to a dangerous condition associated with the release of energy caused by an electric arc called “arc flash.” An arc flash, defined as the energy released during an arcing fault, occurs when current flows through a medium that is not intended to conduct electrical current. An arc flash protection boundary (an approach limit at a distance from exposed live parts within which a person could receive a second-degree burn if an electrical arc flash were to occur) must be established for electrical devices where there is a potential for arc flash. This distance must be calculated by a qualified person. Refer to the Electrical Task Hazard Assessment Worksheet links in the Arcadis Electrical Safety Standard for additional details. The Arc

Flash Boundary must be physically demarcated prior to beginning work. Employers in all provinces are required by law to take the necessary measures to protect the health, safety and physical integrity of their workers, especially around electrical equipment.




According to the National Fire Protection Association (NFPA) 70E (2012), more than 2,000 people are admitted to intensive care burn units each year as a result of severe arc flash burns they received during an arc flash incident. Fatalities occur at a rate of approximately one per day in the United States, with nonfatal arc flash incidents occurring approximately 5 to 10 times per day.

NFPA 70 NEC 2017 Edition app includes the latest comprehensive regulations for wiring, overcurrent protection, grounding and installation. Includes important information relating to arc flash protection.

## 3.25.6 Electrical PPE Requirements

Workers and contractors must use electrical PPE that meets regulatory, Arcadis-specific, industry and manufacturer requirements. The PPE must be in serviceable condition (with current certifications) and appropriate to the nature of the work to be performed. The NFPA developed guidelines for wearing PPE when the potential for an arc flash exists. NFPA 70E, Standard for Electrical Safety in the Workplace, identifies when specialized PPE is required based on the results of a hazard assessment related to the task. In the latest version of NFPA 70E, the term Hazard Risk Category (HRC) was changed to PPE Category (CAT), which consumers will see on up-to-date garments tags. The four levels, CAT 1 through CAT 4, are where most employees stop since the testing methods and various material requirements do get a little complicated. In a nutshell, CAT ratings are based on a garment's Arc Thermal Performance Value (ATPV) and its Energy Breakopen Threshold (EBT). These values are determined by applying various level of heat energy, measured in calories, to material to determine specific

failure points. The PPE needs for an electrician working near live electrical circuits will vary but approximately 2/3 of most live electrical work will be covered by CAT 2 level of protection.

### 3.25.7 Portable Lighting

When portable lighting is being used in a damp environment, heavy-duty extension cords must be used and connected to power supply circuits equipped with a GFCI receptacle. Suitable guards must be provided for portable lamps.

### 3.25.8 Temporary Power Lines

If temporary power lines are installed, they must be clearly marked in a manner that prevents storage of material beneath the line(s) and vehicles or mobile equipment from travelling under or near the power lines. All lines must be properly supported.

### 3.25.9 Portable and Vehicle-Mounted Generators

The receptacles (plug sockets) mounted on the generator or vehicle are to be used only to provide power to cord connected tools or equipment. Grounding is not required if the generator supplies only equipment mounted on the generator and/or cord- and plug-connected equipment through receptacles mounted on the generator. Generators greater than 5kW single phase must have a connection to ground (earth). All 125V, 15A, and 20A receptacles on portable generators must be provided with GFCI protection. This is not the same as over-amp protection.

## 3.26 Fall Protection

***NOTE**: Persons using this section of the handbook must first have core competency and training as required by the Arcadis Work at Heights Health and Safety Standard*

All Arcadis workers and contractor workers working from walking/working surfaces that are 6 feet or more above a lower level will be protected from falling by a guardrail system, covers, or a personal fall-arrest system. The selected fall protection method must be developed or overseen by a competent person. All workers must use or wear fall protection equipment at temporary or permanent installations if a worker could fall:

- More than 6 feet.
- Less than 6 feet when there is a possibility that a worker could sustain injuries more serious than those likely to result from landing on a solid, flat surface (e.g., over moving or rotating equipment, open water or tanks, ice, heated surfaces).

- More than 4 feet but less than 10 feet in the case of a permanent installation where guardrails or other similar means of fall restraint have not been provided.
- Any time aerial bucket equipment, powered manlifts, or forklift-attached manbaskets are used. The personal fall arrest system will be used and secured to the attachment point on the boom, manlift, or manbasket.

  There are limited construction standard exemptions for inspection work conducted prior to or after all construction work is complete, but staff must comply with all provisions outlined by the exemption detailed in the Elevated Work and Fall Protection Standard. This exemption does not apply to activities that fall within the General Industry Standard of OSHA.



Personal fall arrest, fall restrain and fall limiting devices are critical when other fall protection systems do not exist. Training on proper use of this equipment is important.

A fall protection system may include:

1. Guardrails;
2. Safety Nets;
3. Personal Fall Arrest System (full body harness with lanyard and/or lifeline);
4. Positioning Device System (vertical/horizontal lifeline);
5. Warning Line System (only applies to roofing work on low-slope roofs);

6. Controlled Access Zones (only applies to overhead bricklaying and related leading-edge work);
7. Fall Protection System (this option is available only to workers engaged in leading edge work, precast concrete erection work, or residential construction work, who can demonstrate and document that it is infeasible, or it creates a greater safety hazard to use conventional fall protection equipment);
8. Non-conforming Guardrail (a warning line at least 15 feet from edge of roof or hole, combined with effective work rules, that can be expected to prevent workers from going past the line and approaching the edge)
9. Designated Area for General Industry Work Only – such as an worker inspecting a HVAC unit on the roof (the designated area is similar to the 6-foot warning line for roofers, but several additional conditions must be met for it to apply. Refer to the Arcadis Work at Heights Health and Safety Standard); and,
10. Any other system (e.g., guardrails, scaffolds, work platforms, aerial lifts, safety net) as determined by the JSA or site-specific procedures that provide the necessary safeguards or alternative worker access relating to General Industry compliance,



Did You Know? Arcadis Standard ARC HSFS007 Work at Heights" includes requirements and recommendations for use when working at heights

## 3.26.1 Personal Fall Arrest Systems

Personal Fall Arrest Systems must consist of three key components:

- A body harness worn by the worker;
- A connecting device used to connect the harness to an anchor point; and,
- An anchor point or secure point of attachment to which the connecting device is attached;.

Personal Fall Arrest Systems used to protect workers from falls must meet the following criteria:

- Limit maximum arresting force to 1,800 pounds;
- Be rigged so that a worker can neither free fall more than 6 feet, nor contact any lower level;





Miller Fall Clearance Calculator app calculates the fall clearance distance for shock absorbing lanyards and self-retracting lifelines.

- Bring an worker to a complete stop and limit maximum deceleration distance to 3.5 feet; and,
- Have sufficient strength to withstand twice the potential impact energy of a worker free falling a distance of 6 feet.

***NOTE:*** *All personal arrest systems must be visually inspected before each use and the entire device serviced per manufacturer's requirements. Staff must receive hands on training on PFAS.*

### 3.26.1.1 Body Wear

Where allowed, avoid the use of safety belts. Use a full body harness, which provides the best distribution of force in the event of a fall. For example, a free fall from 6 feet generates up to 1,800 pounds of force. This force is best distributed by a full body harness. In addition, the full body harness suspends the victim in an upright position while waiting for assistance in the event of a fall.

### 3.26.1.2 Connecting Device

The safety lanyard links the body wear to the anchor point. Lanyards are typically short lines made of rope, strap, webbing, cable, or similar materials with connectors on both ends. Many lanyards have shock-absorbing features to provide additional force reduction (up to 80 percent) in the event of a fall. Shock-absorbing lanyards may not be applicable in all situations, particularly where fall distances must be minimized. When a fall occurs, the lanyard acts as a fixed (or shock-absorbing) arresting system.

When a worker must detach and reattach the lanyard to a new anchorage point, such as when moving either horizontally or laterally, the "Y" lanyard technique must be used to avoid any period of time, however brief, that the worker is not protected. Two safety lanyards must be used, and the "old" lanyard must not be detached from the anchorage point until the "new" lanyard is attached to the "new" anchorage point. Simply detaching and reattaching a single lanyard is not permitted.

### 3.26.1.3 Anchor Point

The anchor point is a secure point of attachment for the connection device of the fall protection system. The anchor point is a sturdy support structure located above or at an even level with the user. Anchor points positioned above the user are preferable because they reduce the distance of free fall. A direct connection to the anchor point should be used, with a locking snap-hook and spring-loaded keeper, cross arm strap, eye bolt, or other method to properly secure the connection device. The anchor point must be capable of withstanding a static force of 22.5kN (5,000 pounds), increased by a factor of 0.2 (20 percent) for each additional lanyard.

#### 3.26.1.4 Inspection of PFAS Equipment

Personal fall arrest systems shall be inspected prior to each use for wear, damage, and other deterioration, and defective components shall be removed from service if any defect is identified. PFAS equipment shall also be inspected by a Competent Person annually. It is recommended that quarterly inspections of PFAS equipment be completed and documented. The following defects, as a minimum, are cause for destruction of the equipment:

- Cracked, dry, or rotten leather;
- Nylon or cord that has worn thin;
- Bent or deformed attaching hardware;
- Cuts of worn places deep enough to weaken the strap or belt; and,
- Broken stitches at buckles, D-rings, or snaps

## 3.26.2 Overhead Work

When working overhead, the area below must be roped off or barricaded to protect other workers from falling debris, tools, or equipment. Signs reading “Danger – Overhead Work” shall be conspicuously posted and a Safety Watch (if necessary) shall be stationed to warn other workers to stay clear.

## 3.26.3 Guardrail Systems

Guardrail systems used to protect workers from falls must meet the following criteria:

- Toprails must be capable of withstanding a force of at least 200 pounds applied within 2 inches of the top edge in any outward or downward direction.
- A midrail must be installed at a height midway between the top edge of the guardrail system and the walking/working surface.
- Midrails must be capable of withstanding a force of at least 150 pounds applied in any outward or downward direction.
- A toeboard must be installed and be a minimum of 4 inches tall from its top edge to the level of the walking/working surface and have no more than a ¼-inch clearance above the walking/ working surface.
- Toeboards must be capable of withstanding a force of at least 50 pounds applied in any outward or downward direction.
- Guardrail systems used around holes must be set up on all unprotected sides or edges.

# 3.27 Walking and Working Surfaces

At a minimum, walking and working surfaces at the project site must meet the following criteria:

- Aisles and passageways will be kept clear and in good repair, with no obstructions across or in aisles that could create a hazard;
- Floors will be kept dry with all liquid spills cleaned up as soon as possible or contained using drip trays or absorbent material;
- If water or other debris will be falling to the floor below, the area will be roped off with “DANGER – CAUTION” tape to warn any worker in that area;
- Potential hazards located in walking/working areas will be visibly marked with barriers or “DANGER – CAUTION” tape to minimize exposure and to promote worker safety. No job is complete until all material, scrap, and debris are removed, and the site is restored to a neat condition;
- Incomplete jobs will be left so that they are not a hazard to fellow workers or the public;
- All floor hole covers will be adequate to support at least twice the maximum potential loading, secured in place, and marked with the words “HOLE COVER.”;
- Every temporary or permanent floor opening will have standard railings or will be constantly attended by project worker; and,
- When working on or above open grating, a suitable covering will be used to cover the grating to prevent tools or parts from dropping to a lower level.
- Walkways and travel ways, including steps, are to be salted or cleared of snow and ice as soon as practical.
- Steps from field offices are to be swept or cleaned of sand and gravel to the extent practical. Steps with holes to allow material to fall below are preferred.
- The hazards associated with working around unstable snow and ice should be communicated to workers and incorporated in task hazard analysis.
- Cold weather supplies, such as sand, salt, or ice melt should be kept on hand to the extent reasonably possible.

## 3.27.1 Records

Quarterly equipment inspection records will be retained for 1 year in addition to the current year.

# 3.28 Hand and Power Tools

The use of hand and portable power tools during site activities is a potential source of accidents. A fundamental program for using the right tool in the correct manner, together with proper maintenance and storage, is necessary to prevent personal injury and property damage.

The following procedures will be used when performing operations involving portable hand and power tools:

- Protective eyewear and other PPE will be worn, as specified in the JSA;
- Guards will not be removed or rendered inoperative;
- Only workers who have reviewed the manufacturer's use and operations manual, review this section of this handbook and have been appropriately trained in the use, operation and proper handling of hand and portable power tools will be permitted to use hand and power tools.
- The Site Supervisor will confirm that only workers who have reviewed the manufacturer's use and operations manual, reviewed this section of this handbook and have been appropriately trained in the use, operation and proper handling of hand and portable power tools are permitted to perform work activities with portable hand and power tools;
- When working outside or in damp or wet environments, only GFCI or GFCI-protected receptacles shall be used;
- Each type of portable hand or power-operated tool will be operated using the manufacturer’s recommended operating procedures;
- If the manufacturer has not developed specific operating procedures, only workers familiar with the safe operating procedures of that equipment will be permitted to operate it. The Site Supervisor will conduct periodic inspections of hand and portable power tools that are used at the project site. Inspections will include both powered and nonpowered equipment. Any damaged, worn, or improper tool must be removed from service immediately and remain out of service until it is repaired or replaced.



Did You Know? Arcadis Standard ARC HSFS008 “Hand and Power Tools” includes requirements and recommendations for use when using hand and power tools.

## 3.28.1 Tools

Workers shall review the manufacturer's use and operations manual, review this section of this handbook or have adequate training, and be competent in the use of tools provided at the project site. When working with tools, workers shall meet the following requirements:

- Use of fixed open-blade knives (e.g., pocketknives) is prohibited;
- Maintain tools in accordance with the manufacturer’s instructions;
- Use tools that are in good condition and proper for the job (including cutting tools). Report defective tools and remove from service;
- Secure your footing before using any hand tool;
- Guards on all power tools must be in place;
- Shut down all machinery for oiling;
- When working at height, hand tools must be tethered to the user or work platform;
- Cutting tools must be equipped with self-retracting or guarded blades; and,
- When operating vibratory tools, follow administrative controls by limit the duration of operation. Wear PPE capable of absorbing the vibration.

## 3.28.2 Portable and Fixed Grinders

Grinders (portable and fixed) must be used, maintained, and inspected regularly according to the manufacturer’s recommendations and those provided below:

- Workers who are grinding or buffing must wear full face shields and safety eyewear with side shields;
- Prior to starting a grinder, the abrasive wheels and discs must be inspected for defects (e.g., cracks, chips etc.,).
- The position of the safety guards must be checked;
- Do not use grinders without guards;
- Abrasive wheels and discs must not be used for side grinding unless designed for that purpose;
- A work or tool rest for a grinding wheel must have a maximum clearance of 1/8-inch from the abrasive wheel, must be positioned at the center of the abrasive wheel, and must not be adjusted while the abrasive wheel is in motion; and,

- Equipment that is intended to be mounted, such as a bench grinder, must be mounted to prevent movement.

### 3.28.3 Portable Heaters

Workers must obtain permission from the Onsite Supervisor to heat buildings with portable heaters. Generally portable heaters will be of two (2) types – electrically powered or propane powered. It is important to keep heaters away from flammable or ignitable materials.

When using propane heaters, care must be taken to ensure there is adequate ventilation to avoid the development of toxic environments due to the buildup of carbon dioxide and carbon monoxide.

When using electric heaters, they should be plugged directly into a wall receptacle and heaters should be equipped with a tip-over safety switch which automatically shuts off the heater if the unit is tipped over.

### 3.28.4 Machine Guarding

Machine and equipment safeguards should not be removed except for maintenance, repair, testing, or adjustment. If removal is necessary, the following precautions must be followed:

- Remove machine guards only after the machine or equipment is shut down following Arcadis LO/TO practices;
- Do not restart a machine until it is verified that all guards have been properly replaced and adjusted according to the manufacturer's instructions;
- Never, under any circumstances, use grinding or buffing tools without a proper manufactured guard. Always use eye and face protection.

## 3.29 Vegetation Management

### 3.29.1 Mowing and Grass Trimming

Workers will review the manufacturer's use and operation manual and be trained prior to use of mowing or brush clearing equipment. Mowing equipment appropriate for site conditions will be selected to maintain grass vegetative covers. Conditions to consider include:

- Height of the vegetation
- Type of vegetation to be cut;
- On-site slopes; and,

- Type of site security measures (e.g., fences, gates) onsite that could affect use or accessibility of mowing equipment

Before mowing operations proceed, the area to be mowed must be surveyed for hidden obstacles and evidence of biological hazards including poisonous and/or harmful plants (i.e. poison ivy, poison oak, poison sumac, giant hogweed, etc.), bee, wasp or hornet nests, animal burrows, etc. In the case of harmful plants, it is preferred that these be removed by a third-party contractor that is trained and specializes in managing vegetation. Likewise, nests of stinging insects should also be removed by a third-party contractor. If you suspect the presence of an animal burrow, an animal management professional should be contacted to relocate the animal.

Mowing and grass-trimming equipment shall have all manufacturer-supplied safety devices in place and be in good working order. Mowing and grass-trimming equipment shall be inspected prior to use to confirm good working condition. Defective equipment shall not be used until repaired by a competent person in accordance with manufacturer requirements and specifications. Mowing or grass-trimming equipment used shall have sufficient power to effectively cut the materials to be mowed. Site workers, vehicles, and other items not directly involved with mowing activities should stay the following minimum distances from the mowing equipment:

- 50 feet away from grass-trimming operations;
- 50 feet away from push-mower operations; and,
- 100 feet away from riding- or tractor-mower operations.

If prolonged use of grass trimmers or push mowers is required, ergonomic improvements should be considered (e.g. vibration absorbers, torso and back support belts, cushioned insoles). Site workers responsible for mowing or grass trimming shall wear PPE specified in the JSA for the project, but at a minimum must include hearing protection, safety glasses, and safety boots. Consider the use of vibration absorbing gloves.

Fuels used to power mowers and grass trimmers should be kept in approved safety cans. Only minimal quantities of fuel, sufficient to carry out the scope of work, will be brought and stored onsite with appropriate SDS.

## 3.29.2 Cutting Tools

General safe work practices for machete use include:

- Sharpen machete blades only 6 inches from the butt of the handle to within 2 inches of the point;
- Always wear cut-resistant gloves while sharpening;
- If more than one project team member is cutting on the same line, always station yourself in at least 10-foot intervals;
- Lean forward while chopping, if possible;

- Always chop away from your body;
- Swing with a full swing, but do not over swing or swing too hard;
- Clear small vines and other small vegetation before cutting large vegetation.
- Do not use machetes for heavy cutting;
- Wear all PPE as required by the JSA and/or HASP. Consider the use of chaps to protect your legs from errant machete swings;
- Keep machete sheathed when not in use; and,
- Do not throw or “stick” the machete in the ground after use.

General safe work practices for axe and brush hook use include:

- Clear away any impeding light growth with a machete before chopping;
- Allow ample space between adjacent choppers and keep those not involved in the clearing activity outside the area;
- Carry axes and brush hooks with the handle gripped behind the head and the cutting-edge facing outward.
- Use a small chain saw for extended heavy brushing; and,
- Keep axes and brushhooks sheathed when not in use.

General safe work practices for using pruning tools include:

- Carry pole pruners with cutting blades pointed forward;
- Wear leather gloves when operating pruners and arm protection when cutting thorny or poisonous vegetation;
- Avoid awkward twisting of body positions during pruning activities;
- Work into the vegetation by trimming the outer layers first instead of attempting to reach toward the base for bushy vegetation and briars;
- Use pruners with spring-opening devices;
- Avoid pinch points on hand-held pruners;
- Avoid using excessive force to cut through vegetation;
- Use large pruners or a pruning saw for thick limbs;
- Keep exposed blades covered with guards when pruner is not in use; and,
- Keep pruners closed/latched when not in use.

General safe work practices for large-scale site clearing include:

- Site workers not directly involved with site clearing must stay back at least 100 feet from any clearing operation involving the use of mechanized equipment. Consider fire danger and have necessary fire protection equipment available when using powered equipment for brush and site clearing;
- Accumulated vegetation will not be burned unless properly permitted by the appropriate regulatory agency;
- Follow all requirements in the burn permit;
- Accumulated vegetation known to contain poisonous plants (e.g., poison ivy, poison oak, poison sumac giant hogweed, etc.) will not be burned if:
- A reasonable probability exists that smoke will migrate offsite into inhabited areas;
- A reasonable probability exists that site workers will be affected by smoke; and,
- Control nuisance dusts by wetting or through other appropriate engineering control.

### 3.29.3 Herbicides

Warning: The application of herbicides or pesticides may be considered a commercial application. Commercial applications can only be completed by a licensed and permitted professional. Be sure to understand federal, local, and state laws regulating such applications before purchasing or using herbicides. If herbicides or other substances are used to control vegetation at the project site, the following requirements apply:

- Evaluate safety concerns associated with the herbicide product in relation to the effectiveness and cost of the product. Specifically, consider:
    - The toxicity of the product to humans and the environment versus the effectiveness and cost of the product;
    - The methods of application and amount of physical stress involved with the application versus the effectiveness and cost of the product; and,
    - Volume of product required to effectively achieve the desired result versus use of an alternative product requiring less volume for application;
- Purchase only the required volume of material needed for the application event. Stockpiling materials onsite is discouraged;
- Obtain a Safety Data Sheet for any chemical product purchased to control vegetation. Beneficial insects purchased for control purposes are exempt from this requirement; and,
- Wear PPE specified in the JSA for the project when applying herbicides.

## 3.29.4 Tree and Limb Removal and Disposal

Tree and limb removal is considered specialized work, which is typically completed by contracting trained and experienced workers. If a tree is or tree limbs are required to be removed, the following requirements apply:

- Oversight of tree and limb removal will be completed by a competent person;
- In general, perform limb removal from the ground surface using equipment designed to access limbs at height (e.g. pole saws, telescoping tree pruners) or using elevated work platforms. If climbing is required due to tree height and site access restrictions, fall protection will be used, with any specialized requirements stipulated in the JSA for the project;
- An audible warning must be sounded when the tree or limb is ready to fall;
- All workers not directly involved with the removal process will maintain a safe distance from the cutting and fall area. The Site Supervisor will determine the safe distance based on the particular cutting situation; and,
- Inspect and maintain tools used as part of the removal process in accordance with manufacturer's recommendations.

## 3.29.5 Brush Chippers

The use of bush chippers is considered specialized work, which is typically completed by contracting trained and experienced workers. The following requirements apply to brush chippers used to dispose of limbs, trees, or other vegetative debris:

- Use brush chippers with a feed throat extending not less than 36 inches from the knives;
- Never place hands, arms, feet, legs, or other body parts on the feed table when the chipper is in operation or the rotor is turning;
- Do not feed material such as stones and nails into the brush chipper;
- Confirm that all brush chippers are equipped with a locking device on the ignition system to prevent unauthorized starting of the equipment;
- Keep brush chipper cutting bars and blades sharp, properly adjusted, and maintained in accordance with manufacturer's recommendations;
- Do not raise or lower the brush chipper chute while the rotor is turning;
- Use push sticks and pokers made of a material that can be consumed by the chipper to shove smaller items into the chipper;
- Feed brush chippers from the side of the centerline, and immediately turn away from the feed table when the brush is taken into the rotor;
- Avoid loose fitting clothing and clothing with tie strings that could get entangled in the brush being feed into the chipper;

- Feed brush taking care that you do not become entangled in the feedstock;
- Chock or otherwise secure trailer chippers that are detached from the vehicle;
- Mount a swinging baffle in front of the knives to prevent throwback of material;
- Gloves must be tight fitting around the wrist to avoid catching on brush being fed in to the equipment;
- Wear PPE specified in the JSA for the project when working with brush chippers; and,
- Remain at least 50 feet away from the brush chipper if not involved in the brush chipping activity.

# 3.30 Ergonomics

The purpose of ergonomics is to evaluate and control work conditions known to cause injuries and illnesses because of the excessive demands placed on an individual's body

## 3.30.1 Manual Lifting

Prior to lifting, carrying, or lowering any object, some general considerations should be followed to move the object properly:

- Think before moving any object. Objects should be realistically evaluated by the lifter to determine if the mass of the object exceeds the lifter's ability to lift the object;
- Use mechanical aids (e.g. hand trucks, carts) or the buddy system whenever possible to move heavy objects, objects with poor hand holds, or large bulky objects;
- Prior to moving the object, evaluate the object for the presence of any physical hazards such as pinch points, sharp or jagged edges, burrs, and rough or slippery surfaces.
- Evaluate the route in which the object will be moved. The route should be free and clear of obstructions that could cause difficulty in moving the object;
- Avoid lifting outside of the worker's safety zone (the area below the knees or above the shoulders). Generally, heavy materials should not be stored at levels higher than 5 feet off the floor or on the floor unless appropriate mechanical aids are available to move the object;
- Design out of the work process recognized lifting hazards whenever possible; and,
- Perform stretching and warm-up exercises prior to lifting.






The NIOSH Lift Calculator app is a tool used to calculate the overall risk index for single or multiple manual lifting tasks. While it is technical in nature, it utilizes decades of research in back injury and risk reduction.

### 3.30.1.1 Proper Lifting and Carrying Techniques

The following techniques should be used to lift heavy objects (**Figure 3-9**):

- Establish a firm footing with the feet approximately shoulder-width apart and one foot slightly ahead of the other. This will aid in keeping good balance and provide a stable lifting base;
- When bending down to pick up the object, keep your back straight and as upright as possible (preferably perpendicular to the ground);
- Always bend at the knees, not at the waist when lowering or raising the object;
- Obtain a good secure grip on the object;
- When beginning to lift, tighten your stomach muscles and use your legs to lift the object. Your leg muscles should do all the work because they are a lot stronger than the lower back muscles;
- Take small steps and move slowly;
- If possible, face the direction in which the object is to be carried prior to lifting the object. Avoid twisting the body when carrying an object; always pivot with the feet;
- Hold the object as close to the body as possible and maintain a secure grip;
- Avoid objects that are large and bulky to the point where the worker's vision is obstructed while carrying the object; and,
- If possible, break down heavy objects that must be carried over a long distance into smaller, lighter loads to reduce stress on the body.

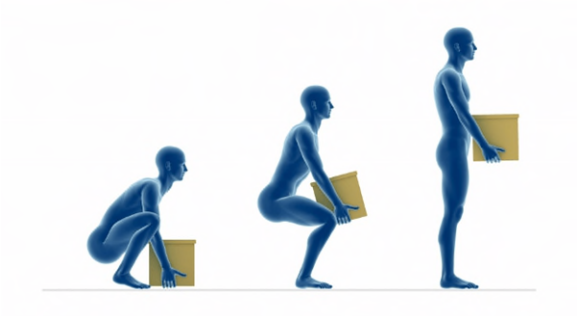


**Figure 3 18 The Basic Lift**

### 3.30.1.2 Lowering Objects

The following techniques should be used when lowering objects:

- Establish a firm footing with the feet approximately shoulder-width apart and one foot slightly ahead of the other;
- When beginning to lower the object, tighten your stomach muscles and use your legs to lower the object;
- Maintain a good secure grip on the object;

- Always bend at the knees, not at the waist when lowering the object; and,
- Keep your back straight and as upright as possible (preferably perpendicular to the ground) when lowering the object.

### 3.30.1.3 Lifting Utility Hole Covers

Always use a Utility Hole cover hook or lifter tool to lift and remove utility hole. The following instructions apply to removal and replacement of utility hole covers with the appropriate tool:

- Freeing the cover:
  - When a cover is stuck in its frame, remove any encrustation with a cold chisel; and,
  - Place a block of wood on the cover near the rim and hit the block with a heavy hammer. Do this at different points until the cover is loosened;
- Unseating the cover:
  - Lift the cover with the tool provided;
  - Engage the circumferential rib before lifting;
  - Unseat the cover about 4 inches by pulling and lifting with the leg and arm muscles; and,
  - Never place fingers or hands under the cover— injury can result;
- Removing the cover:
  - Use a helper when available;
  - Clear the area of any hazards to footing;
  - With your feet spread and footing secure, pull the cover clear of the frame and keep pulling until the cover is in a nonhazardous location; and,
  - Pull with the arm and leg muscles;
- Replacing the cover:
  - Stand parallel to the desired direction of travel with toes in the clear;
  - Place the point of the hook under the edge of the cover nearest you;
  - Lift slightly and swing the cover toward the structure;
  - Move to the opposite side and repeat the lifting and swinging;

  - Continue this alternate lifting and swinging until the cover is partially over the structure's opening; and,
  - With the hook, lift the edge that is farthest from the opening;
- Lift until the cover slides into the frame of the structure. If a helper is available with another hook, stand on opposite sides of the cover, parallel to the direction of travel; and,
- Securely hook under the cover and slide it to the frame.

Note: Once the utility cover has been removed, the opening may be required to be surrounded by a guardrail or the opening restricted in such a manner as to prevent a person from falling.

## 3.30.2 Repetitive and Range of Motion Activities

Certain field activities may require repetitive motion, such as climbing stairs repeatedly, crouching and standing repeatedly, carrying objects repeatedly, purging monitoring wells using inertial pumps, etc. It is important to recognize acute injury can occur from repetitive motion. As always, eliminating the need for repetitive motion is preferred. If equipment, tools or any load is to be moved repeatedly, seek assistance or attempt to move by mechanical means. Stretching and taking frequent breaks may also prevent acute injury due to repetition.

A hazard assessment must be completed to reduce or eliminate hazards associated with tasks such as standing for extended periods of time. Comfortable, supportive footwear is important. Also consider other PPE, such as knee pads, if kneeling is involved in the repetitive motion.

## 3.30.3 Field Workstation

Due to the nature of our field work it may be necessary to establish temporary workstations. Ergonomics should be considered for temporary workstation setup. It is important to maintain a neutral position when working for extended periods of time. It may be necessary to obtain folding tables and folding chairs or other proper work surfaces for the completion of administrative tasks and field sampling activities. Avoid using buckets, coolers, etc. as seats and tables.



Did You Know? Arcadis Standard ARC HSGE011 Office Ergonomics" includes guidance on establishing a safe workstation, some of which may be applied in field or remote work settings.

# 3.31 Site Storage of Hazardous Chemicals, Gases, and Solvents

In general, only approved chemicals should be used on Arcadis project sites. All chemicals must be properly labelled and the SDS reviewed by the Site Supervisor before being allowed on Arcadis project sites. Limit the storage of chemicals and other potentially hazardous materials to quantities that are reasonably needed at the project site.





The NIOSH Mobile Pocket Guide is a useful app that provides general industrial hygiene information for workers and includes details on 677 chemicals and substance groupings.

## 3.31.1 Container and Portable Tank Storage Requirements

This section describes the storage of liquids in drums or other containers with an individual capacity less than 119 gallons, portable tanks less than 660 gallons individual capacity, intermediate bulk containers less than 793 gallons individual capacity and overpack drums (used for temporary containment of containers) less than 60 gallons capacity. The container selected shall meet NFPA 30 standards.

Many projects use gasoline (Class I B Flammable Liquid) or diesel fuel (Class II Combustible Liquid) in limited quantities to operate machines such as generators, pumps, and pressure washers. Best management practice includes use of a DOT-approved metal closed container (not more than 5-gallon capacity, having a flash arresting screen, spring-closing lid, and spout cover, and so designed that it will safely relieve internal pressure when subjected to fire exposure) to store and transport gasoline and/or diesel. While most safety cans approved by listed agencies or organizations (e.g., Factory Mutual Engineering Corp.; Underwriters' Laboratories, Inc.; or Federal agencies such as Bureau of Mines or U.S. Coast Guard) have flame-arrestor screens in safety can spouts (Underwriters' Laboratories, Inc. does not require them for approval of safety cans). According to OSHA, the use of a UL listed <5 gallon-gasoline container could result in a *de minimis* violation for absence of a Flame Arrestor Screen in a Safety Can. A *de minimis* violation is one that has no direct or immediate relationship to safety or health. Consequently, there will be no citations, no penalties, and no abatement dates issued by OSHA, just documentation of the *de minimis* finding.

Therefore, UL approved gas safety cans, without a flame-arrestor screen, are technically permitted for the storage/transportation of gasoline; however, where feasible and practical, and if required by a client, Arcadis will use an approved container to store and transport gasoline.

Common decontamination materials like isopropyl alcohol (Class I B Flammable Liquid) will be stored in the container in which the material was purchased with a maximum capacity not exceeding the volumes shown in Table 3-8. If the purity of the material (such as American Chemical Society analytical grade or higher) requires storage in glass containers to preserve purity, the maximum size of the container shall not exceed 1.3 gallons. Care will be taken to protect glass containers from breakage during storage and handling.

**Table** 3 8 Flammable / Combustible Liquid Storage Requirements

| Flammable/ Combustible Liquid Storage Requirements | | | | | |
|---|---|---|---|---|---|
| Container Type | Flammable Liquids | | | Combustible Liquids | |
| | Class IA | Class IB | Class IC | Class II | Class III |
| Glass or approved plastic | 475 mL (1 pt) | 950 mL (1 qt) | 3.8 L (1 gal) | 3.8 L (1 gal) | 3.9 L (1 gal) |
| Metal (other than DOT drums) | 3.8 L (1 gal) | 18.9 L (5 gal) | 18.9 L (5 gal) | 18.9 L (5 gal) | 18.9 L (5 gal) |
| Safety drums | 7.6 L (2 gal) | 18.9 L (5 gal) | 18.9 L (5 gal) | 18.9 L (5 gal) | 18.9 L (5 gal) |
| Metal drums (DOT specifications) | 227 L (60 gal) | 227 L (60 gal) | 227 L (60 gal) | 227 L (60 gal) | 227 L (60 gal) |
| Approved portable tanks | 2,500 L (660 gal) | 2,500 L (660 gal) | 2,500 L (660 gal) | 2,500 L (660 gal) | 2,500 L (660 gal) |

All safety cans and other containers used to hold flammable or combustible liquids will be labelled in accordance with WHMIS requirements. If such items are stored in an Arcadis office all items will be recorded on the WHMIS Master Inventory List.

## 3.31.2 Storage Cabinet Requirements and Placement

Project sites with long-term use of flammable or combustible liquids shall be equipped with a storage cabinet meeting NFPA 30 standards Cabinets of this type are typically referred to as Flammable Cabinets. The capacity of each individual cabinet shall not exceed 120 gallons volume for Class I, Class II, and Class III A liquids.

Not more than three Flammable Cabinets may be stored in any one fire area. Metal cabinets shall be constructed in the following manner:

- The bottom, top, door, and sides of the cabinet shall be at least No. 18 gauge sheet steel and double walled with 1 ½-inch air space;
- Joints will be riveted, welded, or made tight by some equally effective means; and,
- The door will be provided with a 3-point latch arrangement and the door sill will be raised at least 2 inches above the bottom of the cabinet to retain spilled liquid within the cabinet.

Cabinets placed inside of buildings, office trailers, storage sheds, and other facilities shall be placed in locations where egress is not obstructed. Class I liquids will be placed so that a fire in the liquid storage area would not prevent egress from the area.

Under OSHA General Industry regulations (29 CFR 1910.106), the quantity of liquid that may be located outside of an inside storage room or storage cabinet in a building or in any one fire area of a building shall not exceed:

- 25 gallons of Category 1 flammable liquids (includes gasoline) in containers;
- 120 gallons of Category 2, 3, or 4 flammable liquids in containers; and,
- 660 gallons of Category 2, 3, or 4 flammable liquids in a single portable tank.

### 3.31.3 Transfer of Flammable and Combustible Liquids

When transferring flammable and combustible liquids from one storage container to another (conductive containers), the containers must be bonded and grounded. The transfer of flammable liquids from a storage container to an equipment gas tank or vehicle gas tank (refueling activities) does not require bonding or grounding unless required by the Site Supervisor. Portable equipment should be allowed to cool down prior to refueling. Carry fuels and other flammable liquids only in OSHA-approved, sealed containers.

## 3.32 Incident Response and Recovery Training (Hazwoper)

Arcadis provides emergency response services to several our North American clients in both Canada and the US. Those field staff who are part of the emergency response team in Canada have received HAZWOPER training, a weeklong, primarily health and safety focused training that trains workers in the care and use of Level A, B, C, and D personal protective equipment, including encapsulation suits and supplied air respirators.

### 3.32.1 Workers Covered by the HAZWOPER Standard

Employees and subcontractors who perform work or who are likely to perform work at incident response and recovery (IRR) sites should have HAZWOPER training.

If “skilled support contractors” are required as part of emergency response operations and these individuals lack the Hazwoper training, these individuals will be trained (minimum of 4 hours) commensurate with the duties they will perform.

## 3.33 Compressed Gas Cylinder Handling, Storage, and Use

Several hazards are associated with compressed gases, including oxygen displacement, fires, explosions, toxic effects from certain gases, as well as physical hazards associated with pressurized systems. Special storage, use, and handling precautions are necessary to control these hazards. A compressed gas is:

i. A gas or mixture of gases having, in a container, an absolute pressure exceeding 276 kPa at 21.1 °C (40 psi at 70 °F); or
ii. A gas or mixture of gases having, in a container, an absolute pressure exceeding 717 kPa at 54.4 °C (104 psi at 130 °F ) regardless of the pressure at 21.1 °C (70 °F); or
iii. A liquid having a vapor pressure exceeding 276 kPa at 37.8 °C (40 psi at 100 °F) as determined by ASTM D-323-72.

## 3.33.1 Transport of Compressed Gas Cylinders

The following requirements apply to the transportation of compressed gas cylinders:

- Ensure the valve is fully closed;
- Remove regulators and ensure protective caps are in place prior to moving cylinders;
- Move using a gas cylinder trolley or by tilting and rolling on bottom edge;
- Prevent dropping or striking the cylinder or letting cylinders strike each other;
- Transport cylinders in a vertical position and only when secured to prevent movement for each cylinder
- To secure compressed gas cylinders appropriate tie-down straps must be used. Seat belts or bungee cords may not be used to secure a compressed gas cylinder; and,
- When hoisting cylinders:
  - Secure in cradle, slingboard, or pallet;
  - Never hoist by slings, chains, or magnets; and,
  - Do not use valve caps for lifting.

## 3.33.2 Handling and Storage of Cylinders

The following requirements apply to handling and storing cylinders:

- Compressed gases will be handled and used by appropriately trained persons only;
- Exercise care in handling all gas cylinders;
- Inspections will comply with OSHA and DOT requirements;
- Conspicuously post a sign with “Danger – No Smoking or Open Flames” or approved equivalent wording in rooms and entrances to areas where flammable gases are stored;
- Properly identify all compressed gas cylinders by stenciling, stamping, or labeling the shoulder of the cylinder;
- Do not drop or jar the cylinders;
- Do not drag or slide the cylinders. Move the cylinders long distances using a cylinder trolley and move them short distances by tilting and rolling on their bottom edge;
- Keep cylinder valve protective caps in place at all times except during use;

- Secure cylinders from moving with a chain or similar device when transporting via equipment (e.g. a hand truck or forklift.);
- Use a suitable platform when handling cylinders with a crane or derrick. Handling with slings is prohibited;
- Do not use valve protection caps to lift cylinders from one vertical position to another; however, it is permissible to raise a cylinder from a horizontal to a vertical position by grasping the valve protection cap;
- Whenever possible transport cylinders in an upright position and secured to prevent movement for each cylinder. Compressed gas cylinders must be secured in an upright position when stored at project sites;
- Use approved lifting methods to raise or lower cylinders from vehicles;
- Secure gas cylinders, whether full or empty, in an upright position using a chain or other suitable noncombustible materials;
- Appropriately mark and store all empty cylinders separately from full cylinders;
- Separate oxygen cylinders in storage from fuel-gas cylinders and other combustibles by a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least a half hour;
- Do not store cylinders containing flammable gases (e.g. acetylene, hydrogen, liquefied petroleum gas) inside an occupied building or any building where an ignition source may be present. These cylinders will be stored in a separate, well-ventilated, fireproof area;
- Protect cylinders from weather extremes and from the direct rays of the sun;
- Connect a full cylinder to a header or manifold with other cylinders only when their temperatures are approximately the same; and,
- Some common materials used at project sites may include compressed gasses or products in the form of fire extinguishers, paint cans, some bug sprays, etc. While these may or may not fall under the definition of a compressed gas cylinder, they should be stored and secured in a manner that prevents physical damage and limits extreme temperature fluctuations due to direct sunlight or extreme cold. Extreme temperatures may cause pressurized containers to rupture.

### 3.33.3 Liquid Petroleum Gas and Compressed Natural Gas

The following requirements apply to the use of liquid petroleum gas (LPG) and compressed natural gas (CNG) at project sites:

- Store, handle, and use LPG and CNG in accordance with safe practices and standards;
- LPG must be stored outdoors, in a well-ventilated rack or cage, when not in use;
- Install appropriate guarding around LPG and CNG tanks to prevent damage from vehicles;
- Smoking and open flames are not permitted where LPG and CNG are used;
- Post “No Smoking” signs on LPG and CNG storage tanks and in associated storage areas;

- Electrical and grounding:
  - Properly ground all major stationary equipment. Provide ground connections between stationary and mobile equipment before any flammable gas is loaded or unloaded; and,
  - Electrical equipment and wiring shall be explosion proof.

## 3.33.4 Gas Cylinder Setup and Removal

The following requirements apply to gas cylinder setup and removal:

- Keep cylinders away from heat and from welding or cutting operations where sparks could reach them;
- Do not use the recessed top of cylinders to store tools;
- Do not use a leaking cylinder. Leaking cylinders should be tagged and taken outdoors away from sources of ignition. Management should be notified so the cylinder supplier can be notified. No attempt should be made to repair leaking cylinders;
- Never use a flame to detect cylinder leakage;
- Never tamper with the safety relief devices on cylinders;
- Never apply force to connections that do not fit;
- Never open the valve on a gas cylinder to “blow out” or clean the valve;
- Do not allow cylinders to come in contact with energized conductors, ground wires from electrical equipment, welding machines, or to be used as a grounding device;
- Make sure that ancillary equipment (regulators, connectors, hoses) is inspected and appropriately rated; and,
- Before removing a regulator from a cylinder, close the valve and release all pressure from the regulator.

## 3.33.5 Cryogenic Liquids

A broad range of compressed gases such as methane, oxygen, argon, carbon dioxide, nitrogen, hydrogen, and helium can create forming fluids. They can cause frostbite on skin and exposed eye tissue. When spilled, they can blanket surfaces completely, causing a potential oxygen-deficient atmosphere, in addition to their cooling properties.

The following requirements apply to worker exposure to cryogenic liquids at a project site:

- Properly ventilate areas exposed to high volumes of cryogenic liquids prior to entering the area (may require compliance with confined space entry policies); use instruments to monitor the area; and,
- Wear appropriate protective equipment such as gloves, eye protection, and protective clothing if exposed to cryogenic liquid or cold vapor:

- Wear protective gloves when cold liquids and their vapors are handled. Gloves will be loose fitting so they can be removed quickly if liquids spill into them; and,
- Keep bottoms of trousers outside of boots or work shoes.

## 3.33.6 Oxygen

The following requirements apply to the storage and handling of oxygen at a project site:

- Store oxygen cylinders with the valve end up;
- Keep sparks and flames away from oxygen cylinders;
- Liquid oxygen or oxygen-rich atmospheres should not come in contact with combustible materials;
- Smoking or open flames are not permitted where liquid oxygen is stored or handled;
- Post “No Smoking” signs in oxygen storage areas;
- Do not use oxygen to provide ventilation and,
- Properly label cylinders in accordance with WHMIS regulations.
- NFPA 704 labels are required when another Federal, state, or local regulation or code requires their use. NFPA 704 does not specify when a container, tank, or facility must label with the 704 diamond. It explains HOW to label when another code, standard, or an AHJ (Authority Having Jurisdiction, such as the local fire department) requires such labeling.

## 3.33.7 Acetylene

The following requirements apply to the storage and handling of acetylene at a project site:

- Store acetylene cylinders with the valve end up;
- Keep sparks and flames away from acetylene cylinders;
- Do not use acetylene at a pressure exceeding 103.4 kPa (15 pounds per square inch);
- Never use wrenches or other tools for opening or closing cylinder valves, except those provided by the valve or acetylene manufacturer. The wrench used for opening the cylinder valve should always be kept on the valve spindle when the cylinder is in use;
- Do not “crack” an acetylene cylinder valve without a suitable regulator and flow restrictor such as an attached torch. Opening the cylinder valve without proper attachments can cause a cylinder to spit acetylene and may cause an acetylene fire;
- Always open the acetylene cylinder valve slowly. Open the acetylene cylinder valves the minimum amount required to deliver acceptable flow so that it can be closed as quickly as possible in an emergency situation (¾ of 1 turn open is typically sufficient to provide adequate flow);

- Always close the cylinder valve when work is finished. Be sure the cylinder valve is closed and that all gas is released from the regulator before removing the regulator from a cylinder;
  Never use acetylene or any other compressed flammable gas to inflate bags or containers of any kind, due to the extreme risk of explosion and burns from fire; and,
- NFPA 704 labels are required when another Federal, state, or local regulation or code requires their use. NFPA 704 does not specify when a container, tank, or facility must label with the 704 diamond. It explains HOW to label when another code, standard, or an AHJ (Authority Having Jurisdiction, such as the local fire department) requires such labeling.

For those cylinders owned/maintained by Arcadis, the hydrostatic testing and date stamp requirements will be consistent with manufacturer and cylinder design requirements. To obtain these requirements, check with your H&S representative.

# 3.34 Drums and Other Material Handling

## 3.34.1 Use of Drums and Containers

OSHA defines “anything that holds hazardous chemicals except pipes and piping systems” as a container. OSHA does not concern itself with nonhazardous materials; however, that does not mean that drums or containers containing nonhazardous materials cannot cause injury to workers. Examples of nonhazardous materials stored in drums and containers causing injury would include a drum of molasses rolling or falling and striking a worker.

As applicable, additional activities requiring appropriate training of workers include:

- Sampling procedures;
- Communication methods;
- Methods for relieving pressure from drums and containers or for shielding when pressure cannot be relieved from a remote location;
- Emergency response to accidents on-site;
- Characterization of wastes to be bulked; and,
- Use of monitoring equipment.

## 3.34.2 Labelling Drums and Containers

Drums and containers shall be labelled in accordance with WHMIS Regulations. Labels on drums or containers of waste soil cuttings or purge water should identify its contents, the date the wastes were generated, the Project Manager responsible for the waste and their Arcadis office address and telephone number.

### 3.34.3 Procedures for Handling Drums and Containers

Where containers with capacities greater than 5 gallons are used for chemical products or waste materials, the containers will be handled according to the following procedures:

- When not in use, cover drums/containers with tightfitting lids or bung caps;
- Pressure relief bungs may be required when storing volatile liquids;
- At the conclusion of each work shift, place all drums/containers in a designated storage area. This area will be properly marked and secured;
- Use mechanical or powered drum handling equipment to move “filled” drums/ containers; and,
- Manual handling of the drums may lead to musculoskeletal injuries and should be avoided to the extent possible.

### 3.34.4 Drum Staging

The following practices should be followed when staging drums to eliminate or reduce unnecessary drum movement:

- Stage drums in rows, two drums wide, with adequate walking space between rows;
- Face drum labels out, toward the aisle so they can be easily read without moving a drum;
- Face the bolt on drums with lid rings out, toward the aisle;
- Do not stack drums on top of one another;
- Stage drums on pallets prior to filling, if possible; and,
- Leave enough room between drums to allow them to be tilted to facilitate a drum trolley (a.k.a. drum truck).

### 3.34.5 Opening Drums and Containers

Only slight built-up pressure can cause a loosened fitting to fly into the air like a rocket. This projectile can cause injury to site workers and can puncture adjacent containers or drums, causing rupture and leakage. If the drum or container is filled to or near the level of the opening, material can spew from the opening causing injury to site workers, formation of hazardous/flammable atmospheres at the project site, and/or environmental damage. As a general rule, Arcadis workers should never open a bulging container. They should retain the services of a specialty contractor that specializes in hazardous waste management. The procedure for opening drums and containers must incorporate the minimum safeguards listed below:

- Workers not directly involved in opening the drum or container must stay a safe distance from the drum or container during the process;

- PPE must be worn that is appropriate for exposure to the drum contents. If a drum of unknown contents is to be opened, workers may be required to wear Level A or Level B PPE. Contact Corporate H&S for additional guidance;
- If the potential for a flammable atmosphere exists or may develop onsite, all equipment and tools must be of a type to prevent sources of ignition (nonsparking, explosion proof, intrinsically safe), and grounding/ bonding of containers must be considered;
- Where possible, relieve pressure within a drum from a remote, safe location;
- If the pressure within a drum or container cannot be relieved from a remote location, the worker opening the drum or container must be protected by an appropriate shield to reduce the risk of injury;
- Drums and containers are not stepladders. Workers are not allowed to stand on or work off of drums or containers;
- Material handling equipment used to move drums and containers must be selected, positioned, and operated in a manner that minimizes the potential for the equipment to act as a source of ignition if a drum or container should rupture;
- When a drum or container exhibits signs of over-pressurization such as swelling or bulging, the drum or container will not be moved until the cause of the over-pressurization has been determined and proper containment procedures have been implemented;
- The number of areas where drums and containers are staged should be limited in order to identify and classify them; and,
- Areas where drums and containers are staged must be provided with adequate routes for access and egress from the staging area.

To safely open an open-top drum, remove the bolt from the lid ring, press your body against one of the ring ends, trapping it against the lid. With gloved hands, pry the other end of the ring from the lid, carefully removing it while keeping the other end trapped. Finally, remove the end of the ring that has been trapped by your body weight.

## 3.34.6 Use of Approved Drums or Containers

Drums and containers are required to meet the appropriate DOT, OSHA, and USEPA regulations and/or Canadian requirements for the materials they contain. Large containers or drums shall carry either a DOT approval, or a nationally recognized testing laboratory approval, or both. The use of approved drums and containers provides some assurance that the drum or container will not fail due to incompatibility with the stored material and that the drum or container is structurally suitable for designated duty.

## 3.34.7 Drum Condition

The following requirements apply to the assessment of the drum condition:

- When practical, inspect drums and containers and verify their integrity prior to being moved. Drums and containers that cannot be inspected prior to being moved due to storage conditions (e.g. buried, in a pile, stacked several tiers high) must be moved to an accessible location and inspected prior to further handling;
- Empty drums and containers that cannot be moved without risk of rupture, leakage, or spillage should be placed into a sound container using a device classified for use around the material being transferred (i.e. intrinsically safe or explosion proof for the class of flammable material);
- Open drums and containers in a manner that safely relieves excess internal pressure; and,
- If crystalline material is noted on any container, handle the contents of the container as a shock-sensitive waste until positive identification of the contents is determined.

## 3.34.8 Other Considerations

Unlabelled drums and containers must be considered to contain hazardous substances and will be handled accordingly until positive content identification has been made.

Polyethylene drums and containers are not equipped with a means for electrical grounding. When transferring flammable materials, the polyethylene container (or any other container for that matter) must be equipped with a mechanism that allows for grounding. A grounded suction pump (approved only) or a grounded metallic self-closing faucet can be used to accomplish safe transfer of flammable materials from these containers.

If leaking drums or containers may be present, or ruptures or spills may occur, salvage drums or containers must be available onsite along with suitable quantities of appropriate absorbent materials. Move drums and barrels with a drum trolley or forklift whenever possible. However, if they must be moved manually, follow these safety precautions:

- Before attempting to move a drum or barrel, identify its contents. Read the label on the drum and look for symbols, words, or other marks that indicate if contents are hazardous, corrosive, toxic, or flammable;
- Check for leaks in the drum or barrel. If leaks are detected, confirm that you have the correct materials to clean up the chemical. Make sure you have been trained in the hazards of the chemical and review the appropriate SDS if required;
- Roll the drums or barrels by pushing on the center rolling rings. Do not grasp the ends because this puts your hands in a position to be pinched between the barrel and another object. Never kick barrels with your feet; and,
- Never roll or push the barrel or drum off the back of a truck; use a low-angle ramp or a loading dock.

### 3.34.9 Pipe Handling

All workers involved in loading or unloading pipe from pipe racks or trucks must be competent and must follow these requirements:

- Never allow a worker to be on top of a load or in between the load and the racks during pipe handling operations;
- Do not remove load tie downs until lifting slings and the hoist line have been attached to the material and slack is taken up;
- Make sure that trailers used as pipe racks have guards that run the full length of both sides of the trailer;
- When unloading the pipe, position the truck so that the pipe can roll directly off the truck onto the pipe rack;
- If a picker truck is used to load or unload pipe, use tag lines so workers can work from the ends of the pipe well away from the swing radius of the boom; and,
- Refuse to unload unstable/unsafe loads.

### 3.34.10 Pipe Racking

Pipe racks shall be set on a level foundation designed to support the load placed on them and to prevent accidental rolling off of any tubular goods. Follow the procedures listed below when moving or otherwise handling pipe racks:

- Never rack piping more than 3.05 m (10 feet) high on ground-type racks;
- Keep the space around casing racks free of obstructions which might cause workers to stumble or fall during loading or unloading;
- Use spacers between the layers of pipe on a rack;
- Use 1-inch-thick blocks nailed to each strip to securely block all pipe measuring less than 7 inches in outside diameter. Other approved block systems are permissible; and,
- Use 2-inch-thick blocks nailed to each strip to securely block all pipe measuring 7 inches in outside diameter or more. Other approved block systems are permissible.

## 3.35 Ladders (Portable/Fixed)

When portable ladders are used to access an upper landing surface, the ladder side rails must extend at least 3 feet above the upper landing surface to which the ladder is used to gain access. Or, when such an extension is not possible because of the ladder's length, the ladder must be secured at its top to a rigid support that will not deflect, and a grasping device (such as a grab rail) must be provided to assist workers in mounting and

dismounting the ladder. In no case can the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

Did You Know? Arcadis Standard HSFS016 “Ladder Safety” requirements and recommendations for use when working with ladders.

Additional ladder precautions include:

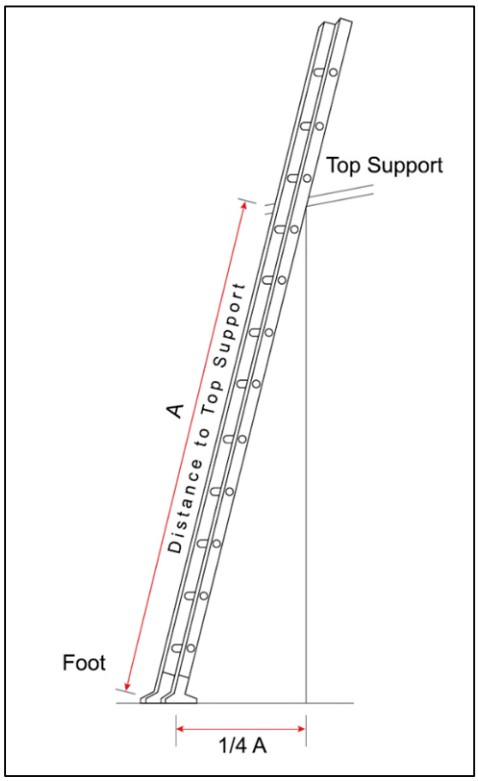



**Figure 3 19 Proper extension ladder placement**

- Maintain ladders free of oil, grease, ice, snow, and other slipping hazards;
- Do not load ladders beyond the maximum intended load for which they were built or beyond the manufacturer’s rated capacity;
- Use ladders only for the purpose for which they were designed;
- Use non-self-supporting ladders at an angle such that the ladder is about ¼ of the working length of the ladder (the distance along the ladder between the foot and the top support). The ladder will be leaning at a 75 degree angle to the ground;
- Use wood-job-made ladders with spliced side rails at an angle such that the horizontal distance is 1/8 the working length of the ladder;
- Use fixed ladders at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder;
- Use ladders only on stable and level surfaces unless secured to prevent accidental displacement;
- Do not use ladders on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet must not be used as a substitute for care in placing, lashing, or holding a ladder that is used on slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery;
- Secure ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways to prevent accidental displacement and use a barricade to keep the activities or traffic away from the ladder;

- Keep the area clear around the top and bottom of ladders;
- Place the top of a non-self-supporting ladder with the two rails supported equally, unless it is equipped with a single-support attachment;
- Do not move, shift, or extend ladders while occupied;
- Do not use the top of the ladder as a step (or the step labelled that it or any step above it should not be used as a step);
- Do not use cross-bracing on the rear section of stepladders for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections;
- Have ladders inspected by a competent person for visible defects daily and after any occurrence that could affect their safe use;
- Immediately mark portable ladders with structural defects (e.g. broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components) in a manner that readily identifies them as defective or tag the defective ladders with “Do Not Use” or similar language and remove them from service;
- Make repairs to restore a tagged out ladder to a condition meeting its original design criteria before the ladder is returned to use. Only the individual that took the ladder out of service can remove the tag to return the ladder to service;
- Do not use single-rail ladders;
- Face the ladder when ascending or descending;
- Use three points of contact when progressing up and/or down the ladder;
- Do not carry any object or load that could cause a loss of balance or a fall from the ladder;
- Wood ladders must be free of splinters, wood decay, or sharp edges;
- All movable parts should move freely and without play;
- Ropes should not be frayed;
- Any slip resistant surface material must be in good condition;
- Do not use metal ladders or ladders with conductive material around exposed or energized electrical equipment. Always know where you and the ladder are in relation to power lines and/or energized equipment and if you are in doubt, get off or do not get on the ladder;
- Ladders must have nonconductive side rails if they are used where the worker or the ladder could contact exposed energized electrical equipment;
- Load limits must be conspicuously marked and legible on the ladder and these load limits cannot be exceeded;
- Only one person is allowed on a ladder at a time;
- Ladders will not be tied/fastened together or used as guys, braces, or skids;

- Ladders must not be placed adjacent to a door unless the door is locked or guarded;
- Ladders must not be placed on top of boxes, barrels, or other unstable/movable objects to add height; Ladders will be placed in position or tied into position to prevent slipping. The footing must be secure and placed on a firm, flat surface; and the top of the ladder must be placed so that the two side rails are supported, and the steps/rungs are level;
- Working from ladders is generally discouraged;
- Where work from ladders is necessary (e.g. changing light bulbs), three (3) points of contact must be maintained;
- Work should not be done on ladders during storms, high winds, or with snow or ice on the rungs/steps; and,
- Check for appropriate fall protection and if required and not available, do not use the equipment.




The Ladder Safety app covers straight/extension and step ladders and is based on ANSI A14 Ladder Safety standards. The app covers inspections, provides checklists and even a tool using your phone's inclinometer to determine if your ladder is set up properly.

General requirements regarding length of various portable ladders include:

- Stepladders will not be more than 20 feet long and will have a spreader or locking device that is intact and working properly;
- Single ladders will be no more than 30 feet long;
- Extension ladders with sliding sections will be no longer than 60 feet with minimal overlaps of:
  - 3 feet for a ladder up to 36 feet;
  - 4 feet for a 36- to 48-foot ladder; and,
  - 5 feet for a 48- to 60-foot ladder;
- Trestle ladders, or extension/base sections of extension trestle ladders, will not exceed 20 feet in length;
- Mason's ladders will not exceed 40 feet in length; and,
- Trolley and side-rolling ladders will not exceed 20 feet in length.

## 3.36 Signs, Signals, and Barricades

This section describes the proper selection and use of safety signs to increase awareness and ensure proper actions are taken to prevent injury/ illness.

## 3.36.1 General Requirements

Properly located and clearly understood safety signs provide a reminder to facility/location workers to take proper action or precautions.

The placement of such signs is dependent upon the following:

- Required by law, resulting in mandatory posting; and,
- Where facility/location workers believe that the posting of such signs may assist in the prevention of accidents and injuries.

## 3.36.2 Sign Selection

In addition to specifically worded signs to serve a particular purpose, there are generally four types of signs:

- Danger Sign/Tags are to be used only where an immediate hazard exists or to tag out defective equipment or equipment in need of repair. Signs and tags should have white background with the word ‘’Danger’’ in white letters on a red oval inside a black rectangular panel at the top of the sign. The specific hazard should be identified in black letters centered below the word “Danger”;




- Caution Sign/Tags are to be used to warn against potential hazards or to caution against unsafe practices. Signs and tags should be a yellow background with the word “Caution” in yellow letters on a black rectangular panel at the top of the sign. The specific hazard should be identified in black letters centerd below the word “Caution”;




- Warning Sign/Tags are to be used to indicate a potentially hazardous situation, capable of resulting in severe, but not irreversible injury. Signs and tags should be a white background with the word “Warning” in black letters on an orange rectangular panel at the top of the sign. The specific hazards should be identified in black letters centerd below the word “Warning”; and,




- Notice or Instructional Signs/Tags are to be used to convey information not necessarily of a safety nature, but often aimed at avoiding confusion and misunderstanding. Signs and tags can be of various colors, but not red, yellow or orange, often blue or green.

## 3.36.3 Sign Wording

General requirements for sign wording are summarized below:

- Concise and easy to read;
- Contain sufficient information to be easily understood;

- Make a positive, rather than negative, message and be accurate in fact;
- Be presented in English or language understood by all workers. In some cases, signs in additional languages may be necessary.
- Follow certain regulations such as OSHA, which requires specific wording for some signs (e.g., asbestos)

### 3.36.4 Sign Placement

General requirements for sign placement are presented below:

- Place signs properly so that the intended message is received by workers and visitors;
- Securely affix signs to prevent accidental displacement by weather and normal wear and tear; and,
- Promptly replace illegible or damaged signs.

### 3.36.5 Training

Training will be provided to aid workers in understanding signs posted at project sites, as summarized below:

- Workers will be trained to understand signs posted in their workplace and job sites; and,
- Such training is not difficult or time consuming and shall be documented. Often such training is accomplished via a safety meeting or as a part of new worker orientation.

### 3.36.6 Barricades

Barricades will be used at all Arcadis project sites to protect workers, pedestrians or property from hazardous conditions, such as work areas, open pits, excavations, manholes, trenches, dangerous traffic situations, etc.

### 3.36.7 Traffic Control Signs

All work performed in a roadway or public right-of way (e.g. parking lot) requires the development and implementation of a traffic safety plan (TSP) addressing traffic control devices to be used and work zone traffic control layout. Traffic control signs should be rented from a traffic control service provider. See Section 3.3.4 for more information regarding traffic control and TSPs.

## 3.37 Utility Location

***NOTE**: This section of the handbook is not meant to replace the requirements of the Arcadis Utility Location and Clearance Health and Safety Standard. The standard must be reviewed, and required actions followed. This section of the handbook is meant as a quick reference only.*



Did You Know? Arcadis Standard ARC HSFS019 “Utility Location Procedures” includes requirements and recommendations for identifying and controlling risk around utilities.

Arcadis encourages and empowers all workers to take all required actions they deem appropriate to comply with the Utility Location and Clearance standard both in project planning and during field site operations. Authority is delegated to everyone on project sites to immediately stop any subsurface investigation work or work in the vicinity of above ground utilities where the worker believes that injury to persons or damage to property could occur. Where necessary, such action should be taken without regard to costs or schedule. Workers will immediately notify their supervisor of any concerns that they have regarding any subsurface work or work in the vicinity of above ground utilities.

Project teams are required to complete the Utilities Clearance Checklist, found on the Arcadis Intranet site under Health and Safety – Content - Forms and Templates prior to undertaking any underground work or any above grade work in the vicinity of overhead utilities.

For all subsurface work, three reliable lines of evidence are required for each utility, at a minimum, for utility clearance. A reliable line of evidence provides sound utility clearance information specific to each area of intrusive work. Also, calling the 811 "DigSafe" state One-Call is required by law. It is a reliable line of evidence when working in the public Right of Way (ROW) or directly adjacent to the ROW..

Additional lines of evidence beyond three (3) may be required based on field conditions and client requirements for subsurface utility locating. The PM or Site Supervisor in cooperation with the subsurface contractor(s) (e.g. driller, excavation contractor, etc.) will determine what additional lines of evidence are required. Additional lines of evidence include, but are not limited to, the following:

- Detailed site utility maps, preferably “As-Built” drawings (drawn to scale);
- Hand auguring or digging;
- Hydro-knife;
- Air-knife;
- Private locates using direct connect or induced current line locating technology;
- Private locates using a radio frequency detector;
- Private locates using a beacon/sonde or tracer wire extended down a pipe or conduit; and,
- Private locates using ground-penetrating radar.

Colors used to identify utilities are referenced in **Table 3-11**.

**Table 3 9 APWA Uniform Color Code for Marking Underground Utility Lines**

| APWA Uniform Color Code for Marking Underground Utility Lines | |
|---|---|
| **Color** | **Utility Type** |
| White | Proposed Excavation |
| Pink | Temporary Survey Markings |
| Red | Electric power lines, cables, conduits, and lighting cables |
| Yellow | Gas, oil, steam, petroleum or gaseous materials |
| Orange | Communications, alarms or signal lines, cables or conduits |
| Blue | Potable water |
| Purple | Reclaimed water, irrigation and slurry lines |
| Green | Sewers and drain lines |

## 3.37.1 Overhead Electric Utilities

If activities take place in the vicinity of an aboveground utility or guy lines/wires that help support aboveground infrastructure, the utility line should be controlled (e.g. through LO/TO procedures) or protected from being contacted (e.g. covering overhead power lines). **Table 3.12** is used to develop acceptable separation work distances between machinery with high extensions (e.g. backhoes, drilling rig masts, cranes) and overhead power lines.

The distance may be lengthened if directed by the client or the electric company and any specified distances must be strictly followed. Work involving machinery, vehicles, or equipment that may come in contact with aboveground utilities and for which recommended clearances cannot be maintained should not be completed until those utilities are locked out, protected or control processes are in place to avoid contact with those utilities. If an aboveground utility is discovered that has not been previously identified prior to mobilizing to the field, the field staff must notify the PM, who will request the client to assist in identifying the utility and implementing control procedures, as appropriate. In addition, if a utility or subsurface structure is compromised, the field staff must initiate Emergency Action Plan Guidelines. Detailed emergency action procedures should be reviewed with the client and documented in the site-specific HASP prior to initiating work.

Table 3.10 Overhead Utility Line Safe Distances

| Overhead Utility Line Safe Distances | |
|---|---|
| **Power Line Voltage Phase to Phase (kV)** | **Minimum Safe Clearance (feet)** |
| 50 or below | 10 |
| Above 50 to 200 | 15 |
| Above 200 to 350 | 20 |
| Above 350 to 500 | 25 |
| Above 500 to 750 | 35 |
| Above 750 to 1,000 | 45 |

## 3.37.2 Product Lines and Underground Storage Tanks (all types)

Compromise of a product line or underground storage tank (UST) requires immediate action to mitigate the impact to the environment. For gasoline stations and similar facilities, the following guidelines should be followed during a line or UST breach:

- Immediately shut down equipment and turn off the emergency shutoff switch for the facility dispensers;
- If there are no injuries, attempt to contain any flowing product using absorbent materials and/or by physically pumping or bailing product out of the breached area;
- If product is flowing on the surface away from the break area, attempt to protect downgradient storm drains, sewer drains, and surface-water features from impact by the petroleum product using readily available materials including sorbent pads, sorbent socks, kitty litter, earth, sand, etc.;
- If the bottom of a UST has been breached, immediately contact a vacuum truck to remove product from the affected UST; and,
- Clear the area and arrange for prompt repair.

For industrial sites with lines or USTs containing multiple products with varying hazards, similar guidelines may be followed as above if the material encountered is known and workers have a fundamental understanding of the hazards associated with the material. Upon discovery of a line or UST breach due to work activities at these sites:

- Immediately stop work and notify the client representative or call the client-designated emergency number. For abandoned sites call 911; and,
- If the material is not known, promptly evacuate the area and allow HAZMAT teams to take care of the release.

# 4 General Field Construction Health & Safety

***NOTE**: For Arcadis work, government requirements for the country where the work is performed are always the minimum standards to follow. Where this handbook specifies more stringent requirements, those requirements must be followed.*

## 4.1 Elevated Work Surfaces

***NOTE:** This section of the handbook is not meant to replace requirements provided by the Arcadis Aerial Work Platforms Health and Safety Standard (ARC HSFS022). This section of the handbook is meant as a quick reference only. Persons using this section of the handbook must first have core competency and training as required by Arcadis Standard ARC HSFS022.*

### 4.1.1 Fixed Elevated Work Platforms

Fixed, elevated, work platforms present a fall hazard if the platform contains unguarded edges, floor, or wall openings, or openings for ladders. The best control on elevated work platforms is to eliminate the fall hazard. In most cases, the installation of guardrails is the most feasible and practical control. When guardrails cannot be installed or while they are being installed on a work platform, fall protection, or other protective means must be used to control the fall hazard.



Did You Know? Arcadis Standard ARC HSFS022 “Aerial Work Platforms” includes requirements and recommendations for use when using aerial lifts and other work platforms.

### 4.1.2 Guardrail Systems

The platform must include a guardrail system around the entire periphery. If the guardrail system is removable or can be lowered, the means used to secure it in the normal operating position shall be readily accessible for inspection and maintenance. The guardrail system must include a top rail around the upper periphery. The height of the top rail above the platform must be 42 inches +/- 3 inches (1.07 meters +/- 0.08 meter). The guardrail must include a mid-rail approximately mid-way between the top rail and the platform surface. Guardrail systems must be capable of withstanding at least 200 pounds of force.

Flexible materials such as cables, chains, and ropes may not be used in the guardrail system; however, they may be used as a mid-rail at access openings of 30 inches (0.76 meter) wide or less. The platform must include toeboards on all sides. The minimum toeboard height is 4 inches. Toeboards may be omitted at the access opening(s).

## 4.1.3 Self-Propelled Aerial Lift Platforms

***NOTE**: This section of the handbook is not meant to replace requirements provided by the Arcadis standard. This section of the handbook is meant as a quick reference only. Persons using this section of the handbook must first have core competency and training as required by Arcadis standard.*

Self-propelled elevated work platforms pose similar hazards to fixed platforms with the additional characteristic of being power operated with primary functions (including drive controls) located on the platform. These platforms use guardrail systems, including top rail, mid-rail, and toeboards, as the primary engineering control to protect workers from falls.

The platform must include a guardrail system around its periphery. The requirements for these guardrails are the same as those presented for fixed elevated work platforms. All workers on an elevating work platform must be attached to an adequate anchorage point on the elevating work platform by a method of fall protection. Never tie a safety lanyard to an adjacent structure.

Workers operating self-propelled elevated work platforms must be properly trained.

## 4.1.4 Boom-Supported Elevating Work Platforms

***NOTE**: This section of the handbook is not meant to replace requirements provided by the Arcadis standard. This section of the handbook is meant as a quick reference only. Persons using this section of the handbook must first have core competency and training as required by Arcadis standard.*

Boom-supported elevating work platforms are self-propelled units having a platform that can be positioned completely beyond the base. These platforms are used to position workers, along with their necessary tools and materials at work locations. Primary functions (including drive controls) are located on the platform.

Guardrail systems, inclusive of top rail, mid-rail, and toeboards, are the primary engineering control for the protection of workers from falls while using boom-supported elevating work platforms. All workers on a boom-supported elevating work platform must be attached to an adequate anchorage point on the boom-supported elevating work platform by a method of fall protection. Never tie a safety lanyard to an adjacent structure.

All elevated work will be performed in a safe manner and in compliance with all regulations governing such work and the requirements of the project HASP. All workers exposed to fall hazards will be trained regarding the nature of the hazards of elevated work prior to assignment.

### 4.1.5 Aerial Lifts

When working on man lifts or elevating platforms, workers must meet the following operating requirements:

- Only trained workers shall operate aerial lifts or elevating platforms (e.g., scissor lifts).
- Manufacturer's operating instructions will be followed, and their rated load limits will not be exceeded.
- When aloft, fall protection systems shall be used. Never tie a safety lanyard to an adjacent structure.

## 4.2 Scaffolds

***NOTE:*** *This section of the handbook is not meant to replace requirements provided by the Arcadis Scaffolds Health and Safety Standard (ARC HSFS015). This section of the handbook is meant as a quick reference only. Persons using this section of the handbook must first have core competency and training as required by Arcadis standard ARC HSFS015.*

Scaffolding is defined as a temporary platform or structure used to support personnel and materials used in the construction or maintenance industry.

All scaffold systems will be erected under the direction of a competent person qualified in scaffold erection, and should be designed, constructed, and maintained in accordance with the manufacturer's instructions and OSHA sections 1926.451 and 1926.500.



Did You Know? Arcadis Standard ARC HSFS015 "Scaffolds" includes includes requirements and recommendations for use when working on scaffolds.

These systems will be inspected each day prior to work activities and these inspections will be recorded and kept in the project files. Scaffolding systems will:

- Be erected to provide safe access and egress to work areas; provide safe work platforms from which to work, and to protect workers below the platforms. Safe access will include provisions for stairways, ladders, or ramps;
- Include permanently installed access ladders;

- Be made of steel (except platform planks);
- Be constructed so the footing or anchorage for scaffolds are sound, rigid, and capable of carrying the maximum intended load without settling or displacement;
- Be placed on a firm surface that is level and not subject to subsidence:
  - Unstable objects such as blocks will not be used to support scaffolds;
  - Poles, legs, or uprights of scaffolds shall be plumb and securely braced to prevent swaying and displacement;
  - Scaffolds will have a firm, level platform capable of bearing the maximum design load and have both mid- and top rails in place;
- Be capable of supporting, without failure, a minimum of four times the anticipated loads for platforms supported from the ground and six times the expected load for suspended platforms;
- Be maintained so scaffolding is in a safe condition and not altered or moved horizontally while in use or occupied;
- Be immediately repaired or replaced when damaged or weakened and not used until repairs have been completed; and,
- Use a tag line when hoisting materials onto a scaffold;
- Not be used during storms, high winds, or on ice or snow;

Additionally,

- All planking will be supported at each end and secured from movement;
- Bolts, pins, and keepers will be inspected by a supervisor prior to use by any workers; and,
- Wood planking shall be scaffold-rated lumber;
- Tools used on a scaffold should be tethered to prevent them from falling;
- The area around the scaffold should be kept clear of vehicle or pedestrian traffic;
- Tools, materials, and debris from scaffolds/scaffold work will be placed/discarded where they won't become a hazard; and,
- Only treated or protected fiber rope shall be used for or near any wok the use of corrosive substances or chemicals. Wire or fiber rope used for scaffold suspension shall be capable of supporting at least six times the intended load

# 4.3 Lifts

## 4.3.1 Workers Basket or Cage (Suspended)

Prior to hoisting workers in a workers basket or cage:

- The workers basket or cage must be certified by a professional engineer. Document the certification and label as such on the guardrail;
- All clevises used to attach cables to the cage will be properly secured;
- The workers basket or cage on the hoist will be suspended using two lines for redundant safety reasons. The first line, which is the main lift line, is attached to the hook assembly. The second line or the safety line must be capable of supporting the full load should the hook assembly fail. This second line must pass over the hoisting block and through the frame to the workers basket or cage;
- Each worker in the workers basket or cage must have a safety harness that is properly fitted and secured to a lanyard with a shock cord. The lanyard must be securely fastened to the anchor point on the workers basket; and,
- At least one tag line (¼- or 3/8-inch nylon rope or equivalent) will be attached to the cage and suspended to a worker below for control of the cage movement. The tag line can be retrieved by workers in the basket if entanglement occurs and relowered to the person controlling the line at ground level.

# 4.4 Excavation/Trenching

***NOTE:*** *This section of the handbook is not meant to replace requirements provided by the Arcadis Excavation and Trenching Health and Safety Standard (ARC HSCS005). The Excavation and Trenching HSS must be reviewed and followed. This section of the handbook is meant as a quick reference only. Persons using this section of the handbook must first have core competency and training as required by Arcadis Standard ARC HSCS005.*

The following safe operating guidelines apply to open trenches or excavations exceeding 4 feet in depth or of any depth if in unstable soil conditions. An excavation is any cut, cavity, trench, or depression in an earth surface, formed by intentional earth removal; a trench is a narrow excavation (in relation to its length) made below the surface of the ground.



Did You Know? Arcadis Standard ARC HSCS005 “Excavation and Trenching” includes requirements and recommendations for use when completing excavation and trenching activities

## 4.4.1 Excavation Construction Guidelines

The following minimum requirements must be met before any workers are permitted to enter an excavation:

- Store excavated materials at least 2 feet from the edge of the excavation. (NOTE: This procedure must be observed even when excavation/trench entry will not occur.)
- Before excavation begins, remove, or make safe any trees, boulders, and other surface encumbrances that may create a hazard.
- Take special precautions in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation.
- Confirm that, except in hard rock, excavations below the level of the base of the footing of any foundation or retaining wall are not permitted unless the wall is underpinned, and all other precautions have been taken to confirm the stability of the adjacent walls.
- Only use ladders for excavation operations that meet the requirements of 29 CFR 1926 Subpart L.
- All excavations are inspected by a competent person at least daily, or more often as conditions warrant, to confirm that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibrations, or nearby equipment operation has not caused weakening of sides, faces, and flows. The SSO will accompany the competent person and document this inspection in the daily safety log. Use diversion ditches, dikes, or other suitable means to prevent water from entering an excavation and for drainage of the excavation.
- Install stop logs or barricades when mobile equipment is used or allowed adjacent to excavations. The grade will always be away from the excavation.
- Keep dust generation during excavation to a minimum. Use wetting agents at the direction of the SSO.
- Make sure that field personnel do not enter any excavation without specific direction.
- Mark and protect all excavations at all times so that site personnel, visitors, or unauthorized personnel do not enter without permission or fall into the trench.
- Personnel must work in pairs when working around an excavation of 2 feet or more.
- When excavations are subjected to vibrations, additional precautions shall be taken by way of shoring and bracing to prevent slides or cave-ins.

## 4.4.2 Excavation Entry Requirements

The following requirements must be met before personnel are permitted to enter any excavation:

- Expected hazardous ground movement areas and banks more than 4 feet high (or less if soil is deemed unstable by the competent person) shall be shored, laid back to a stable slope, and shielded (or equivalent).
- Sides of trenches or excavations in unstable or soft material 4 feet or more in depth (or less if soil is deemed unstable by the competent person) shall be shored, sheeted, braced, sloped, or equivalent.
- A trench 4 feet or more in depth (less, if soil is deemed unstable by the qualified person), shall be shored or otherwise supported in hard compact soil, including embankments.

- Materials used for sheeting, sheet piling, bracing, shoring, and underpinning shall be in good, serviceable condition.
- A means of egress (e.g., ladder, ramps, stairways) shall be accessible at any location inside the excavation without requiring more than 25 feet of lateral travel distance.
- When excavations are subjected to vibrations, additional precautions shall be taken by way of shoring and bracing to prevent slides or cave-ins.

### 4.4.3 Atmosphere and Testing

Before a worker enters an excavation greater than 4 feet deep (or less if soil is deemed unstable by the competent person), the atmosphere must be tested to confirm that an oxygen-deficient or hazardous atmosphere does not exist. If the concentration of any airborne contaminant exceeds one-half its PEL or other applicable occupational exposure limit, the airborne oxygen concentration is less than 19.5 percent or explosivity exceeds 10 percent of the lower explosive limit (LEL), then no workers shall be permitted to enter the excavation until such engineering controls or other hazard controls are instituted to eliminate or control the hazard.

### 4.4.4 Soil and Waste Management

Whether soils are “live-loaded” to a dump truck, off-road truck or placed in roll-off containers for future pickup, consideration much be given to the final weight of the container. Project teams are expected to work closely with waste hauling providers to determine safe load limits. The weight of a yard of soil depends on the type of soil, its moisture content, and whether it is compacted or loose. Here are some estimates for the weight of a yard of soil:

**Dry soil:** A cubic yard (0.76 cubic meters) of dry topsoil weighs around 2,100 lb (950 kg) depending on its composition. If it’s dry and sandy, it can weigh around 2,600 lb (1,200 kg) per cubic yard. Clay soil is lighter at around 1,700 lb (770 kg) per cubic yard.

**Damp soil:** The weight of damp soil varies depending on how much moisture it contains. A yard of topsoil can weigh between 1,400 and 2,000 pounds depending on the type of soil.

**Wet soil:** Wet dirt weighs more than dry dirt. One yard of wet dirt can weigh about 3,000 pounds or 1.5 tons.

Please note that these are just estimates and the exact weight varies based on the type of soil, how wet it is, and what kinds of debris, rocks, or mulch are present.

## 4.5 Heavy Equipment

*NOTE: This section of the handbook is not meant to replace requirements provided by the Arcadis Heavy and Mechanized Equipment Health and Safety Standard (ARC HSCS006). This section of the handbook is meant as a quick reference only. Persons using this section of the handbook must first have core competency and training as required by Arcadis Standard ARC HSCS006.*

## 4.5.1 General

Field operations that involve heavy equipment represent a significant hazard to ground workers as well as heavy equipment operators. Heavy equipment may cause serious injury or death as a result of rollover, contact with ground workers, contact with utilities and pinch/crush points. All workers working at or visiting a site where heavy equipment operations occur must read and abide by the requirements of Arcadis Standard ARC HSCS006 Heavy and Mechanized Equipment and this section.

Mechanized equipment such as skid steers, trackhoes, bulldozers, and backhoes represent serious hazards to site workers. Personnel must exercise caution when working with mechanized equipment to prevent clothing from being caught in moving parts, placing body parts near pinch points on equipment or using the equipment on slopes or unstable surfaces in excess of the manufacturer's recommendations. Site personnel, visitors, or other persons who are not performing necessary work shall remain at a distance of at least 15 feet from any moving part of the mechanized equipment and all workers within 15 feet of the equipment are required to wear, at a minimum, hard hats, minimum Class II safety vests, safety glasses, safety toe boots, and hearing protection. All heavy equipment shall be equipped with functional back-up alarms.

## 4.5.2 Inspections

All mechanized equipment will be inspected by the subcontractor (for non-company-owned equipment) and the operator (for Arcadis-operated equipment) prior to use for proper working condition and to confirm that all manufacturer-supplied safety cutoff switches and protective guards are in place. Equipment with deficiencies in these areas will not be used on the project until appropriate repairs are made by a properly trained individual.

All equipment will be inspected daily to confirm the absence of any fluid leaks, absence of damaged hoses or cables, and in general, the absence of any damage that could affect the proper operation of the equipment.

Additional requirements for heavy equipment operation and inspections are presented below:

- Heavy equipment operators must be trained to operate the specific pieces of equipment they will be operating;
- The owner/operator will inspect equipment daily and will maintain daily logs. All discrepancies will be corrected prior to placing the equipment in service;
- Inspections will include but are not limited to: all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, drill controls; and emergency shut off switches;
- Preventive maintenance will be conducted on all equipment according to the manufacturer's recommendations and/or the subcontractor's internal policies, schedules, and equipment maintenance procedures;

- Only designated, qualified persons will operate machinery and mechanized equipment;
- The contractor will maintain records of tests and inspections onsite, will make these records available upon request by the designated authority, and upon request, the records may become part of the official project file;
- Equipment found to be unsafe for operation will immediately be taken out of service and its use prohibited until unsafe conditions have been corrected;
- All equipment that could become contaminated will be kept in the contaminant exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas; and,
- Equipment with an obstructed rear view must have an audible alarm that sounds when equipment is moving in reverse. Spotters should be used when reversing heavy equipment.

## 4.5.3 Operation of Heavy Mechanized Equipment

All Arcadis workers must be trained and Authorized by an approved Arcadis Sponsor prior to operating heavy equipment. Additionally, equipment-specific approval is required by the Field Supervisor at the project level. Evidence of competency of subcontractor equipment operators should be obtained from the operator's employer and be maintained on-site.



Did You Know? Arcadis Standard ARC HSCS006 "Heavy and Mechanized Equipment" includes requirements and recommendations for use when operating and working around heavy equipment.

## 4.5.4 Hoisting and Rigging, Cranes, and Derricks

***NOTE:*** *This section of the handbook is not meant to replace the requirements of Arcadis Hoisting and Rigging Health and Safety Standard (ARC HSCS003). The Arcadis Standard ARC HSCS003 and the core competency and training requirements stated in the procedure must be met before work is permitted in and around cranes and derricks.*

A crane is a movable machine used for lifting or moving heavy weights by means of a movable projecting arm or boom. A derrick is a fixed machine used for lifting or moving heavy weights by means of a movable projecting arm or boom. Requirements for crane and derrick operation are provided below:

- Cranes and derricks having ratings that vary with boom length; radius (outreach) and other variables and will have a durable rating chart visible to the operator covering the complete range of the manufacturer's capacity ratings;
- The rating chart will include all operating radii for all permissible boom lengths and jib lengths and optional ratings for optional equipment affecting such ratings. Precautions or warnings specified by the owner or manufacturer will be included along with the chart;
- The crane or derrick will be equipped with a boom angle or radius indicator, visible to the operator, when the rated load varies with the boom radius;
- Lifting devices will be used to hoist material and equipment only. Workers are prohibited from riding hoists except for authorized purposes of inspection and maintenance.
- All equipment will be maintained and operated in accordance with the manufacturer's-specified procedures and limits (e.g. maximum load, height restrictions) without exception;
- Designated persons shall visually inspect each crane or derrick and lifting devices on each day of use for defects or damage. Any defects found must be reported to the Site Supervisor and the device or equipment taken out of service until replaced or repaired by a competent repair person.
- A qualified person shall thoroughly inspect all functional components and accessible structural features of each crane or device at monthly intervals;
- A record of monthly inspections will be maintained for 6 months in or on the crane or derrick;
- A crane or derrick with a known or visible defect that affects its safe operation will not be used;
- A crane or derrick will not be used in a manner that exerts side loading stresses upon the boom;
- Designated workloads will not be increased beyond the manufacturer's ratings or original design limitations;
- Workers will not work or otherwise be located beneath suspended loads to prevent injury resulting from equipment failure. Additionally, workers will use hard hats, safety glasses, a safety vest, safety gloves and safety boots when working in lifting operations;
- The area where the lift or lifts are to be made will be marked with proper warning devices;
- When two or more cranes are used together to hoist a load in unison, a designated person will direct the operation and instruct all workers in positioning, rigging, and movement of the load being lifted;
- During operation, accessible areas within the swing radius of the body of a revolving crane will be physically guarded to prevent a worker from being caught between the body of the crane and any fixed structure or between parts of the crane;
- When possible, electrical distribution and transmission lines at the point of work will be de-energized and provided with visible grounding unless insulating barriers not part of or attached to the crane have been erected to prevent physical contact with the lines;
- When working around live power distribution lines, use the clearance guidelines provided in **Table 3.12**;

- While in transit, with no load on the equipment and the boom lowered, the clearance between the crane and power line at or below 50 kV will be a minimum of 4 feet;
- All material hoists will conform to the most current requirements of ANSI, Safety Requirements for Material Hoists.
- Workers are prohibited from riding material hoists except for authorized purposes of inspection and maintenance.
- Hoistway doors or gates of workers hoists will be at least 6 feet, 6 inches high, and will be protected with mechanical locks that cannot be operated from the landing side and are accessible only to persons on the car;
- Overhead protective coverings on the top of the hoist cage or platform will be provided;
- Prior to placing a hoist into service, functions and safety devices will be tested thoroughly under the supervision of the manufacturer's representative or other similarly qualified person. At frequencies specified by regulation or OSHA regulations, a full inspection and test must be made by the manufacturer's representative or other qualified individual. Keep records of such inspections and tests onsite;
- Rigging (ropes, chains, and cables) equipment must be handled and stored properly so that it is maintained in good condition and to maximize its service life. A competent person is responsible for:
  - Inspecting rigging equipment prior to use;
  - Tagging and reporting defective equipment to the Site Supervisor; and
  - Using and maintaining equipment as outlined in the applicable regulations, manufacturers' instructions, and industry-recognized practices.



Did You Know? Arcadis Standard ARC HSCS003 "Hoisting and Rigging" includes requirements and recommendations for use when hoisting and rigging is required.

## 4.5.5 Common Safety Measures for Crane Operation

The following common safety measures are required at project sites:

- Crane operators must be licensed and trained in the operation of the specific crane that is to be operated;

- A crane operator must move loads according to the established code of signals and use a signaler. Hand signals are preferred and commonly used;
- Only a qualified person will give signals to the crane operator. **Figure 4-1** references standard hand signals for crane operation;
- Only one person at a time will be designated to give crane signals;
- A crane operator will move loads only on crane signals from one person;
- A crane operator must obey STOP signals no matter who gives it;
- The person giving crane signals must be in clear view of the crane operator;
- The person giving crane signals must have a clear view of the load and the equipment;
- The person giving crane signals must keep persons outside the crane's operating area. Any requests or questions will be addressed to the signaler. The person giving crane signals will never direct a load over a person;
- As a general rule, no part of a crane or load should come within 15 feet of any power line. High voltage power transmission lines may require additional clearances;
- Each crane operator will be held directly responsible for the safe operation of the crane. Whenever there is any doubt as to safety, the crane operator must stop the crane and refuse to handle loads until safety has been assured; and,
- These safety rules will by no means be considered complete for all situations of crane operation

## 4.6 Powered Industrial Trucks (Forklifts)

***NOTE:*** *This section of the handbook is not meant to replace requirements provided by the Arcadis Powered Industrial Trucks (Forklifts) Health and Safety Standard (ARC HSSP006). This section of the handbook is meant as a quick reference only. Persons using this section of the handbook must first have core competency and training as required by Arcadis Standard ARC HSSP006.*

Only trained and certified drivers are allowed to operate a powered industrial truck. The most common type of powered industrial truck is a forklift. Training must occur before the worker operates the truck as part of his or her workday. The training program must be based on:

- Operator's prior knowledge and skill in operating powered industrial trucks;
- Operator's demonstrated ability to operate a powered industrial truck safely; and,
- Hazards present at the project site.

Training must consist of both classroom-type and practical instruction in proper operation of the specific forklift that will be used, possible hazards encountered during forklift operation and other specific requirements such as operating instructions, engine and motor operation, and vehicle stability.



Did You Know? Arcadis Standard ARC HSSP006 “Powered Industrial Trucks (Forklifts)” includes requirements and recommendations for use when operating a forklift.

## 4.6.1 Certification

Anyone operating a forklift at an Arcadis office or project site must be adequately trained and be able to produce a Certificate that demonstrates their training. The certification will include the name of the operator, date of training and identity of the trainer (if an outside contractor who conducted the training, the name and address of the trainer will be included). Trained workers should submit their Certificate to HR Operations. The trained operator is responsible for maintaining a copy of their Certificate.

## 4.6.2 Forklift Operation Requirements for Safety Inspection

Requirements for safety inspections of forklifts include:

- Perform once per day or shift; and,
- Log all defects daily.

Things to check prior to and during use of a forklift:

- Weight of the load and forklift capacity;
- Stability of load;
- Height to which a load must be lifted;
- Obstacles both in the path and overhead where the forklift operator is operating;
- Blind spots;
- Individuals who might share workspace with the forklift operator; and,
- Vertical incline.

## 4.6.3 Operator Responsibility

Forklift operators have the following responsibilities:

- Safety inspection;
- Driving to pick up a load;
- Load pick-up;
- Driving the load; and,
- Setting down a load

Safety inspections are fundamental to safe operations of a forklift. In addition to knowing the load capacity, operators must be knowledgeable regarding the use of all forklift levers. Operators must be cautious of driving forklifts up or down inclines, whether or not they are carrying a load. Drivers will engage forks completely when picking up a load. Loads will only be lifted to a height that is sufficient to clear stacks and then lowered to a position that gives both maximal stability and clearance of obstacles. Operators must always be aware that they may have to share their space with pedestrians. Therefore, they will always use spotters when driving around blind corners or other areas where visibility is impaired.

## 4.6.4 Precautions

When operating a forklift, always take the following precautions:

- Be aware of obstacles, both ahead and overhead;
- Move materials only in the designated areas with adequate space; and,
- Do not block individuals into a stack

Forklift operators must always be aware of overhead obstacles. Electrical power lines are the leading cause of death in forklift operations. Confirm that the designated area for load placement is of adequate square footage and that no individuals will be trapped between the load and other obstacles if the load is placed in the designated area. Never place a load where an individual will be trapped.

## 4.6.5 Loading Docks

The following guidelines for working safely in a loading dock area are not meant to be all-inclusive. Arcadis workers working in a loading dock area will be briefed on safe work practices by the client or other responsible party.

Only properly trained, qualified persons will operate forklifts or any other motorized equipment. Authorization to operate forklifts or other motorized equipment at an Arcadis office or job site must be received from the Site Supervisor prior to initiating operation.

Motorized equipment such as forklifts, pallet movers, and pickers on loading docks must be equipped with reverse-gear audible warning alarms, lights, and horns. Clearly identified aisleways will be present for motorized equipment to move in and for pedestrians to walk in, and mirrors will be located at blind corners. Be aware of the movement of motorized vehicles, never assume that the operator can see you and move out of the way if a horn or back-up alarm sounds. Never stand under or ride on the “forks” of a piece of mechanized equipment such as a forklift or pallet mover, and do not distract the operator.

Verify that wheel chocks are in place to prevent movement of trucks, trailers, flatbeds, and other vehicles. A vehicle or trailer restraint must be used to prevent the trailer from separating from the dock during loading/unloading.

Delivery or receiving truck engines will be shut off during loading/unloading operations.

Dock edges and loading areas must be clearly marked and guarded as appropriate. Stay away from dock edges and loading areas. Do not enter a trailer, flatbed, or other equipment that is being loaded or unloaded. Do not place any part of your body outside the dock door while a vehicle is moving in the vicinity of the dock to avoid a crushing or pinning injury.

Emergency exits must be clearly marked and not blocked. Lighting will be adequate for the environment, time of day, and work being performed. General housekeeping will be conducted, such as having the area free of equipment, tools, and other trip hazards; and floors will be in good repair and dry or marked as a “wet” area. Hearing protection and eye protection will be worn as required by the client or as necessary based on the H&S assessment conducted by the Site Supervisor. Wear appropriate gloves when loading or unloading goods or material. A hard hat and safety vest should also be worn during activities taking place in a loading dock environment.

## 4.7 Vacuum Truck Operation

Arcadis often provides oversight of vacuum truck operations that include vacuum excavation, chemical or petroleum recovery, transfer of waste material and emergency response. Vacuum truck operations that involve extraction or transfer of flammable liquids must include system grounding to dissipate static electricity generated during the movement of fluid within the hoses. During turbulent movement of fluids within sections of hose and pipe, friction between the liquid surface and the surface of the hose or pipe will create an electrical charge. If the static charge on the surface of the fluid becomes significantly higher than the potential electrical energy on the hose, tank or truck frame, a static spark may result. If the vapor concentration at the point of static discharge is within the flammable range, an explosion will result. Hoses used to transfer flammable liquids must be rated for this task. There are multiple hose types designed for this application. Additionally, the hoses must be checked before use to ensure wiring designed within the hose structure is intact, thus capable of dissipating electricity.

The frame of the vacuum truck must be adequately grounded by connecting it to an installed ground rod or to a secondary ground, such as a water spigot. Vacuum trucks may not utilize the ground rod connected to an electric panel or other source of errant electricity. The preferred safety device available for vacuum trucks is a Mobile Ground Verification System. This device takes the guess work out of determining if the vacuum truck and overall system is adequately grounded. This device is not required if the vacuum truck operation does not involve the transfer of flammable liquids.

**Figure 4-2 Vacuum Truck**



Vacuum trucks that do not have automatic vacuum relief may implode if the vacuum is exceeds the operating limits of the vessel.

Vacuum tank implosion is also a concern. Each vacuum truck must have the ability to release vacuum either manually or with an automatic vacuum release. Excessive vacuum within the tank may result in a catastrophic failure of the tank itself. To prevent his from occurring, Arcadis personnel must ensure the following conditions are met:

- Verify the equipment operating limits are known prior to using the equipment.
- Confirm equipment inspections are completed.
- Confirm operator's proficiency with the equipment prior to use.
- Confirm emergency controls are present and working prior to operating.

Determine if truck exhaust and/or blower will be a discharge concern for surrounding personnel and/or structures. When possible, position truck exhaust downwind of workers. An exhaust filter may be required depending upon the nature and concentration of the exhaust as well as state or local ordinances.

Keep non-essential personnel away from the vacuum truck operation. The pumps utilized on vacuum trucks are typically very loud. If noise levels exceed 105 decibels for any amount of time, Arcadis employees are directed to wear "dual" hearing protection, consisting of earplugs along with earmuffs. Based on current OSHA policy, the wearing of earmuffs over ear plugs will boost the overall attenuation of the earplugs by 5 decibels.

There is a potential for extracted material to be accidentally released to the environment. Hoses should not be disconnected until they are air flushed to remove residual solids or liquids remaining within the hose. Additionally, all valves must be inspected to ensure they will not leak during operation or when the vacuum has been turned

off. Spill kits appropriate for the work activity and potential impact to the environment must be readily available during vacuum truck operation.

# 4.8 Concrete and Masonry – General Requirements

## 4.8.1 Construction Loads

No construction loads will be placed on a concrete structure or portion of a concrete structure unless a qualified person determines, based on information received from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the loads.

## 4.8.2 Reinforcing Steel

All protruding reinforcing steel, onto and into which workers could fall, will be guarded to eliminate the hazard of impalement.

## 4.8.3 Post-Tensioning Operations

No worker (except those essential to the post-tensioning operations) will be permitted to be behind the jack during tensioning operations. Signs and barriers will be erected to limit worker access to the post-tensioning area during tensioning operations.

## 4.8.4 Riding in Concrete Buckets

No worker will be permitted to ride in, or on, concrete buckets.

## 4.8.5 Working Under Loads

No worker will be permitted to work under concrete buckets while buckets are being elevated or lowered into position. To the extent practical, elevated concrete buckets will be routed so that no worker, or the fewest number of workers, is exposed to the hazards associated with falling concrete buckets.

## 4.8.6 Personal Protective Equipment

No worker will be permitted to apply a cement, sand, and water mixture through a pneumatic hose unless the worker is wearing protective head and face equipment, and masonry work gloves.

### 4.8.7 Health Effects

Cement can cause ill health by skin contact, eye contact, or inhalation. Risk of injury depends on duration and level of exposure and individual sensitivity.

Hazardous materials in wet concrete and mortar include:

- Alkaline compounds such as lime (calcium oxide) that are corrosive to human tissue;
- Trace amounts of crystalline silica, which is abrasive to the skin and can damage lungs; and,
- Trace amounts of chromium that can cause allergic reactions.



Did You Know? Arcadis Standard ARC HSIH012 “Respirable Crystalline Silica” includes requirements and recommendations for use when completing activities that generate breathable silica-containing dusts.

### 4.8.8 Skin Contact

The hazards of wet concrete are due to its caustic, abrasive, and drying properties. Wet concrete contacting the skin for a short period and then thoroughly washed off causes little irritation. But continuous contact between skin and wet concrete allows alkaline compounds to penetrate and burn the skin. When wet concrete or mortar is trapped against the skin, for instance, by falling inside a worker’s boots or gloves or by soaking through protective clothing, the result may be first-, second-, or third-degree burns or skin ulcers. These injuries can take several months to heal and may involve hospitalization and skin grafts.

### 4.8.9 Waste Management

Drums may not be utilized to mix concrete or store wet grout as liquid-separated material may become corrosive over time. This may lead to drum degradation and leaking, while also rendering the drum a classified hazardous waste material due to elevated pH levels.

## 4.9 Demolition

Equipment dismantlement and building demolition activities involve a potential for exposure to many physical and health hazards. In addition to equipment dismantlement and removal activities, construction and installation of temporary facilities, and selective demolition of building components may be conducted.

## 4.9.1 Hazards

Hazards may be associated with materials or equipment used in demolition, or the dismantlement and removal activities themselves. Arcadis requires subcontractors to address all physical and health hazards presented by the dismantlement, removal, demolition, and construction activities (hereafter collectively known as construction activities) in accordance with 29 CFR 1926. Subcontractors may use their company's standard safe operating procedures for construction activities as long as they meet the minimum requirements of this handbook and 29 CFR 1926.

Physical hazards involved with demolition activities relate to the work conducted with heavy equipment, hand and power tools, and the demolition environment itself. During demolition-related activities, the potential exists for incidents involving workers being struck by or against equipment or materials, which may result in fractures, lacerations, punctures, and abrasions. Walking and working surfaces during demolition activities may present slip, trip, or fall hazards. Slippery surfaces can increase the likelihood of slips and falls in addition to back and overexertion injuries. "Hot work" activities, such as cutting and welding, may present the risk of fire or an explosion hazard. Overhead hazards such as electrical conduit or process piping also present hazards.

Demolition activities pose the potential for workers being struck by debris and objects associated with the demolition activities and the equipment being used. Improper planning and procedures may place workers in unsafe situations that may result in body strains, serious injury or death.

Operations on elevated surfaces (e.g., roofs, catwalks, mezzanines) may expose workers to falls if they are not using the proper fall protection system. Work from ladders, scaffolding, and aerial lifts also exposes workers to fall hazards and injuries if the equipment is used improperly or workers are not trained in the equipment's safe use.

Electricity may pose a hazard to workers during the use of portable electrical equipment and lead cords, or when demolishing walls containing live electrical circuits. Sources of energy that are not locked out and/or tagged out expose workers to various forms of energy (e.g., electrical, mechanical, high pressure) that could be hazardous while performing demolition tasks. Additionally, workers installing temporary and permanent wiring are exposed to electrical hazards if proper precautions and procedures are not followed or inexperienced or unqualified workers conduct the work.

Improper operation of heavy equipment (e.g. forklifts, front end loaders, aerial lifts, cranes) may result in workers being struck by the equipment or by the loads being handled, resulting in contusions, fractures, lacerations, and even death. Workers may be injured, and equipment damaged, if it is not used for the purpose intended, is overloaded or is used improperly by inexperienced or unauthorized individuals. Loads being lifted by cranes may shift, causing them to fall and strike workers, causing serious injury or death.

Due to the type of work involved in many demolition activities, the primary health hazards involve repetitive motion injuries, and lifting strains and other ergonomic disorders. Noise may also present a hazard to workers exposed to high noise levels. Operation of heavy equipment, power tools, pneumatic tools, and powder-actuated tools often result in high noise levels. Exposure to construction materials that may release harmful dusts during demolition are also possible (e.g. lead, asbestos, mercury, silica containing concrete and brick). Workers may be exposed to hazardous or toxic vapors created during hot work activities.

## 4.9.2 Hazard Control – General

Prior to initiating any field activity, site conditions will be discussed with all workers (including subcontractors). Hazards will be identified, and protective measures will be explained. Equipment will be inspected prior to use and will be in proper working condition. Workers will receive training in the use and care of the equipment they will be expected to operate. Tasks will be scheduled in a manner that reduces the likelihood of performing a repetitive task for prolonged periods. Proper lifting techniques will be employed, and mechanical means will be used for lifting heavy objects.

## 4.9.3 Demolition Safety

Prior to permitting workers to start demolition activities, an “engineering survey” of the structure will be made by a competent person to determine the condition of the framing, floors, walls, and the possibility of an unplanned collapse of any portion of the structure. Any adjacent structure that could be affected by an unplanned collapse and where workers or the public may be exposed will also be similarly checked.

When workers are required to work within a structure that has been damaged by fire, flood, explosion, or other cause, the walls and floor shall be braced or shored as necessary. All electric, gas, water, steam, sewer, and other service lines shall be shut off, capped, or otherwise controlled outside the building before demolition work is started. In each case, any utility company that is involved shall be notified in advance.

If it is necessary to maintain any power, water, or other utilities during demolition, such lines shall be temporarily relocated as necessary and protected. It shall also be determined if any type of hazardous chemicals, gases, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment onsite. When the presence of any such substance is apparent or suspected, testing and purging shall be performed, and the hazard eliminated before demolition is initiated. Where a hazard exists from broken glass, such hazards shall be removed.

Where a hazard exists to workers from falling through floor openings, the openings shall be protected to a height of 42 inches. When debris is dropped through holes in the floor without the use of chutes, the area onto which the material is dropped shall be completely enclosed with barricades that are not less than 42 inches high and not be less than 6 feet back from the edge of the opening above. Signs, warning of the hazard of falling materials, will

be posted at the lower (and ground) level. Removal shall not be allowed in this lower level until debris handling ceases above. Whenever materials are dropped more than 20 feet to any point lying outside the exterior walls of the building, an enclosed chute of wood, or equivalent material, shall be used.

## 4.9.4 Mechanical Demolition

Workers are not permitted in any area that can be adversely affected by mechanical demolition operations. Only those workers necessary for the performance of operations will be permitted in the area. The area should be barricaded as necessary to prevent unauthorized workers or anyone not associated with the demolition operation from entering the area.

When removing walls or portions thereof, all steel items affected shall be cut prior to wall removal. All roof cornices or other ornamental stonework shall be removed prior to removing the walls.

During demolition, a competent person shall continue to inspect the work progress to detect hazards resulting from the weakened or deteriorated floors, walls, or loosened material. No worker shall be permitted to work where such hazards exist until they are corrected by shoring, bracing, or other effective means.

Before the start of every demolition job, Arcadis will take several steps to safeguard the H&S of workers onsite. These preparatory operations involve overall planning of the demolition job, including methods to be used to bring the structure down, equipment necessary to do the job, and measures to be taken to perform the work safely. Planning for a demolition job is as important as actually doing the work. Therefore, a competent person experienced in all phases of the demolition work to be performed should lead all demolition planning work.

## 4.9.5 Engineering Survey

Prior to starting all demolition operations, an engineering survey of the structure should be undertaken. This survey will be conducted to determine the condition of the framing, floors, and walls so that measures can be taken, if necessary, to prevent the premature collapse of any portion of the structure. When the engineering survey identifies the need, any adjacent structure(s) or improvements that could be adversely affected during the demolition will also be similarly surveyed. Arcadis will maintain a written copy of this survey. Existing damage in neighboring structures which is present prior to the start of demolition will be photographed by the engineer conducting the survey.

The engineering survey provides Arcadis with the opportunity to evaluate the job in its entirety. Arcadis will plan for the demolition of the structure, the equipment to do the work, manpower requirements, and protection of the public. The safety of all workers onsite will be a prime consideration. While preparing the engineering survey, Arcadis will plan for potential hazards such as fires, cave-ins, and injuries. If the structure to be demolished has been damaged by fire, flood, explosion, or other cause, appropriate measures, including bracing and shoring of

walls and floors, will be taken to protect workers and any adjacent structures. A designated substance survey must be completed prior to the start of demolition to determine if any type of hazardous building materials, chemicals, gases, explosives, flammable materials, or similar dangerous substances are present on-site. If the nature of a substance cannot be easily determined, samples shall be taken and analyzed by a qualified person prior to demolition.

## 4.9.6 Utility Location

One of the most important elements of the pre-job planning is determining the locations of all above ground and underground utility services. All electric, gas, water, steam, sewer, and other service lines must be shut off, capped, or otherwise controlled, at or outside the building before demolition work is started. In each case, any utility company that is involved must be notified in advance, and its approval or services required to disconnect the utility must be obtained.

If it is necessary to maintain any power, water, or other utilities during demolition, such lines should be temporarily relocated as necessary and/or protected. The location of all overhead power sources should also be determined, because they can prove especially hazardous during any machine demolition. All workers must be informed of the location of any existing or relocated utility service. The telephone numbers of local police, ambulance, and fire departments must be available onsite. This information can prove useful to the Site Supervisor in the event of any emergency.

## 4.9.7 Medical Services and First Aid

Prior to starting work, provisions will be made for prompt medical attention in case of serious injury. The nearest hospital, infirmary, clinic, or physician must be located as part of project planning and HASP development. The Site Supervisor will provide with instructions for the most direct route to these facilities. Proper equipment for prompt transportation of an injured worker, as well as a communication system to contact any necessary ambulance service must be available onsite. The telephone numbers of hospitals, physicians, and ambulances will be conspicuously posted.

A properly stocked first-aid kit that meets regulatory requirements will be available on-site. The first-aid kit will contain approved supplies in a weatherproof container with individual sealed packages for each item. It will also include rubber gloves to prevent the transfer of infectious diseases. Provisions will also be made to provide for quick drenching or flushing of the eyes. Eye flushing will be done with clean water or saline eyewash solution. The contents of the kit should be checked before being sent out on each job and at least weekly to replace expended items.

# 4.10 Blasting and Explosives

***NOTE**: Blasting operations should be conducted under the direct control of authorized persons only,* subcontracted by Arcadis. Arcadis workers are not permitted to use explosives, regardless of their training and experience.

All subcontractors must adhere to this section. The transportation, handling, storage and use of explosives are subject to provisions of ANSI A10.7 - Safety Requirements for Transportation, Storage, Handling, and Use of Commercial Explosives and Blasting Agents; 29 CFR 1910.109 - Explosives and Blasting Agents; 29 CFR 1926, Subpart U - Blasting and the Use of Explosives (1926.900 to 1926.914); and 27 CFR Part 55 - Commerce in Explosives.

A blasting supervisor must be designated to direct and supervise all blasting operations. This includes the transportation, handling, storage, and use of explosives and blasting agents. The supervisor must provide written records of past experience to the appropriate person as evidence of competency.
It should be noted, that many provinces, territories, and municipalities have a range of legislation, regulations and by-laws that relate to the use of explosives within their respective jurisdictions. If blasting is to be a component of Arcadis field activities, involve Arcadis H&S early in the planning stages of the work.

# 4.11 Welding and Cutting

Welding and cutting is an activity that requires extreme caution and proper procedures, as described below:

- Welding, cutting, burning, and heating operations have a high potential for personal injuries and fires. Take precautions to ensure a safe work environment;
- The Site Supervisor will issue a Hot Work Permit prior to the start of welding/cutting activities;
- Workers will be instructed in the safe use of welding equipment. Workers who have not received instructions will not be allowed to use the equipment;
- Proper precautions (e.g. isolating welding and cutting, removing fire hazards from the work area, providing a fire watch, etc.) for fire prevention will be taken in areas where welding or other hot work is being conducted. If the necessary safeguards cannot be implemented (e.g. flammable painted surfaces are present, the presence of other flammable compounds or heavy dust concentrations creates a fire hazard), no welding, cutting, or heating will be undertaken. Suitable fire extinguishing equipment must be available at all locations where hot work is to be undertaken;

- Arc welding and cutting operations must be shielded by noncombustible or flameproof shields, barriers, or screens (i.e. welders mask or goggles) to protect workers from direct arc rays;
- When burning or welding, employees will wear approved eye protection with suitable filter lenses. Appropriate eye protection may also be required for other personnel in the area. See Table 4-1. If employees' eyes are exposed to flying objects from chipping slag or other weld-cleaning activity, employees must wear approved eye protection that includes side shields.
- When electrode holders must be left unattended, the electrodes will be removed, and the holder placed or protected so they cannot make electrical contact with workers or conducting objects;
- All arc welding and cutting cables must be completely insulated and be capable of handling the maximum current requirements for the job. There will be no repairs or splices within 10 feet of the electrode holder, except where splices are insulated equal to the insulation of the cable. Defective cables will be repaired or replaced;
- Fuel gas and oxygen hoses will be easily distinguishable and will not be interchangeable. Hoses will be inspected at the beginning of each shift and will be repaired or replaced if necessary;
- No welding or burning is allowed in a hazardous area (e.g. locations where combustible/flammable materials exist);
- Burning or welding equipment will be maintained in a safe operating condition;
- All welding leads and burning hoses will be kept off floors, walkways, and stairways and appropriately protected;
- Barrels, tanks, piping, or other systems that may have contained either combustible or unknown products will not be welded or burned without first properly purging and venting the container and obtaining approval from the appropriate supervisor;

**Table 4-1 Welding Lens Shade List**

| Welding Operation | Arc Current (Amperes) | OSHA Minimum Protective Shade Number | ANSI & AWS Shade Number Recommendations* |
|---|---|---|---|
| Shielded metal-arc welding – 1/16-, 3/32-, 1/8-, 5/32" electrodes | | | |
| Electrode Size (inch): <3/32 | <60 | 7 | - |
| Electrode Size (inch): 3/32-5/32 | 60-160 | 8 | 10 |
| Electrode Size (inch): <3/32 | >160-250 | 10 | 12 |
| | | | |
| Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW) | <60<br>60-160<br>>160-250<br>>250-500 | 7<br>10<br>10<br>10 | -<br>11<br>12<br>14 |
| Gas Tungsten Arc Welding (GTAW) | <50<br>50-150<br>>150-500 | 8<br>8<br>10 | 10<br>12<br>14 |
| Air Carbon Arc Cutting (CAC-A) (Light) | <500 | 10 | 12 |
| Air Carbon Arc Cutting (CAC-A) (Heavy) | 500-1,000 | 11 | 14 |
| Plasma Arc Welding (PAW) | <20<br>20-100<br>>100-400<br>>400-800 | 6<br>8<br>10<br>11 | 6-8<br>10<br>12<br>14 |
| Plasma Arc Cutting (PAC) (Light)** | <300 | 8 | 9 |
| Plasma Arc Cutting (PAC) (Medium)** | 300-400 | 9 | 12 |
| Plasma Arc Cutting (PAC) (Heavy)** | >400-800 | 10 | 14 |
| Torch Brazing (TB) | | 3 | 3 or 4 |
| Torch Soldering (TS) | | 2 | 2 |
| Carbon Arc Welding (CAW) | | 14 | 14 |

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then, go to a lighter shade which gives a sufficient view of the weld zone without going below the minimum. During oxygen gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light (spectrum) of the operation.

** Values apply where the actual arc is clearly seen. Lighter filters may be used when the arc is hidden by the workpiece.

| Welding Operation | Plat Thickness (Inches) | OSHA Minimum Protective Shade Number | ANSI & AWS Shade Number Recommendations* |
|---|---|---|---|
| Gas Welding | <1/8 | 4 | 5 |
| | ¼ to ½ | 5 | 6 |
| | <1/2 | 6 | 8 |
| Oxygen Cutting | <1 | 3 | 4 |
| | 1 to 6 | 4 | 5 |
| | >6 | 5 | 6 |

NOTE: When welding or oxygen cutting produces a bright yellow light, it is desirable to use a filter or lens that absorbs the yellow or sodium line in the visible light of the operation.

# 4.12 Temporary Working Surfaces and Railings

Hazards from floor and wall openings, careless movements, protruding objects, debris, spills, and placement of materials on paths or foot traffic areas present the potential for slips, trips, and falls. If any such hazards are identified, correct them immediately. If that is not possible, report the hazard to your Site Supervisor or project manager as soon as possible.

## 4.12.1 Floor and Wall Openings

The Site Supervisor will identify all ground, floor and/or wall opening hazards and ensure that guarding is in place. The Site Supervisor will convey to workers the location of the openings and what guarding must be in place at the opening(s). If guarding is not in place, the Site Supervisor will:

- Not allow work to continue in the vicinity of the opening until the appropriate guarding is in place; and,
- Notify the PM and the client when guarding has been installed.

If Arcadis is responsible for floor and/or wall openings, the openings will be guarded in accordance with CFR 1926.1910.23 and 1926.502.

## 4.12.2 Other Slip, Trip, and Fall Hazards

Workers must stay alert at all times and, if tired or distracted, take this into account when working at the site. Take the following precautions to minimize the possibility of injury:

- Wear safety toe boots with oil-resistant soles as required according to ANSI Z-41.1-1999.
- Do not walk up or down steep embankments or hills if possible. If not possible, walk at an angle when going up and/or down embankments and hills;

- Do not carry items that block your vision;
- Use handrails or grips when available and maintain three-point contact whenever possible;
- Do not jump down from equipment; look down before you step down;
- Use appropriate fall protection when working at elevation;
- Report any floor openings that are not clearly marked and/or guarded to the Site Supervisor or PM;
- Do not use ladders or scaffolds during high winds or when ice or snow is on the rungs or the work surface;
- Do not use ladder substitutes (e.g. box or truck tailgate) and do not use ladders or scaffolding that are not in good condition;
- Keep paths and work areas clear (e.g. tools, equipment, boxes, cords).
- Secure items that must cross floors or aisles (e.g. cords, wires) to minimize trip and fall hazards;
- If a protruding object cannot be moved, make sure the object can be easily seen. Guard/pad the object if possible; and,
- Use ancillary lighting such as flashlights and headband lights when necessary.

### 4.12.3 Walkways and Steps

Stairways and walkways must be kept free of debris and tripping hazards, as well as snow and ice. Use anti-slip material if required. Keep handrails clean and free of splinters or burrs. Avoid carrying tools or materials in a way that prevents the free use of hands while going up or down stairways or ladders; use handrails.

OSHA defines ladders, steps, stairs, and ramps based on riser angle:

- 90 degrees to 60 degrees: ladders
- 70 degrees to 50 degrees: alternating tread type stairs
- 70 degrees to 50 degrees: ship stairs
- 50 degrees to 30 degrees: standard stairs
- 30 degrees to 0 degrees: ramps

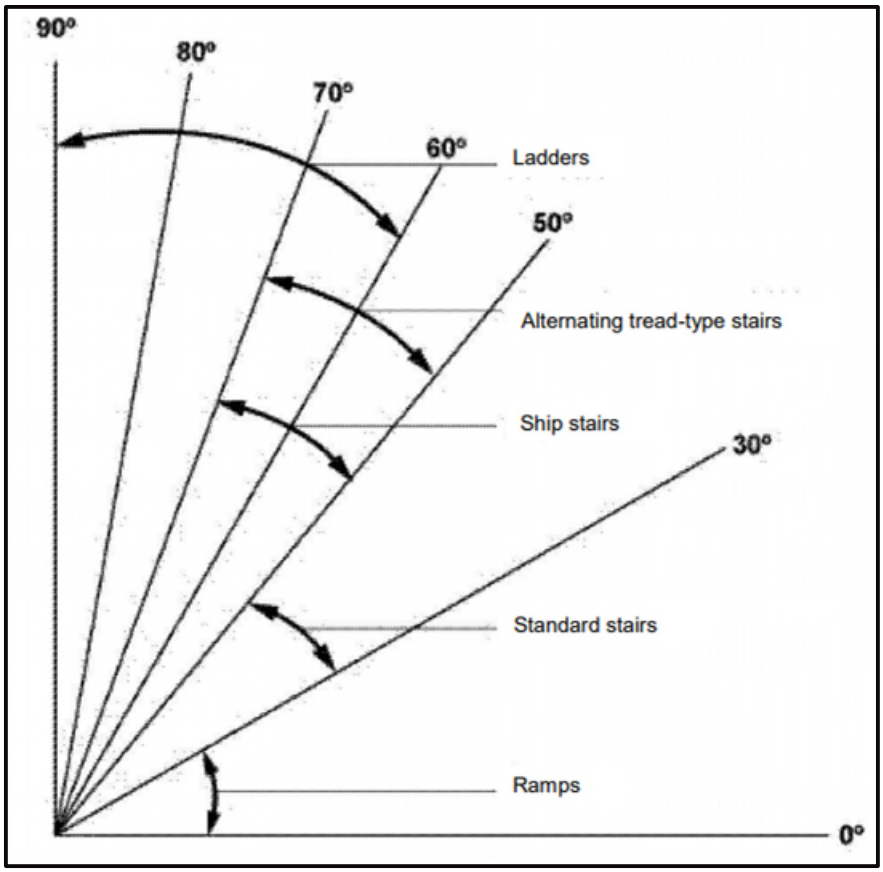



**Figure 4-3 Riser Angles per OSHA**

At construction sites, temporary stairs are often constructed for access to office trailers, sheds, remediation systems, etc. The stairs must be constructed with an angle of 30-50 degrees from horizonal. Variations in riser height or tread depth may not be over 1/4-inch (0.6 cm) in any stairway system. Stairways having four or more risers or rising more than 30 inches (76 cm), whichever is less, shall be equipped with at least one handrail; and one stair rail system along each unprotected side or edge.

# 4.13 Underground Construction (Work Conducted in Tunnels or Shafts)

## 4.13.1 Check In/Check Out

The Site Supervisor or other designated person specified by the Site Supervisor shall maintain a check-in/check-out procedure that determines an accurate count of workers working in a tunnel or shaft. The Site Supervisor or the designated person shall remain above ground and onsite anytime anyone is working in a tunnel or shaft.

## 4.13.2 Air Monitoring

A competent person will perform air monitoring activities related to tunnel and shaft work. Air monitoring will be performed prior to entry into the tunnel and shafts, and as often as necessary as determined by the competent person.

Oxygen testing of the underground atmosphere will be conducted prior to any other air measurements. The atmosphere in all underground areas will also be tested quantitatively for carbon monoxide, nitrogen dioxide, hydrogen sulfide and/or other toxic gases, dusts, vapors, mists, and fumes, which may be present based on the specific hazard(s) associated with the tunnel or shaft and the results compared to the prescribed limits of each contaminant to ensure these are not exceeded. Quantitative tests for methane and other flammable gases should be performed to verify the absence of these gases, and if present, to determine if underground activities should be classified as “potentially gassy” or “gassy” depending upon the following criteria:

- A potentially gassy operation exists when air monitoring shows, for more than 24 hours, 10 percent or more of the lower explosive limit (LEL) for methane or other flammable gases measured at 12 inches from the roof, floor, or walls in any part of the tunnel or shaft; and,
- A gassy operation exists when air monitoring shows, for 3 consecutive days, 10 percent or more of the LEL for methane or other flammable gases measured at 12 inches from the roof, floor, or walls in any part of the tunnel or shaft.

If potentially gassy or gassy conditions exist, the competent person shall implement more restrictive operating requirements including, but not limited to, more stringent ventilation requirements, use of specialized equipment designed for these types of conditions, smoking restrictions, collection of personal ignition sources, use of fire watches, and posting of warning signs at entrances. The competent person shall keep records of all air monitoring measurements.

If 10 percent or more of the lower explosive limit for methane or other flammable gases is detected in any underground work area or in the air return, all workers must be evacuated to a safe location above ground (except those workers required to eliminate the hazard). Electrical power (except for acceptable pumping and ventilation equipment) must be cut off to the area until concentrations reach less than 10 percent of the lower explosive limit.

## 4.13.3 Ventilation

Tunnel and shaft work areas shall be ventilated either by natural means, use of ventilation equipment or through a combined use of natural and forced ventilation. Fresh air shall be supplied in sufficient amounts to prevent the accumulation of toxic or flammable gases, mists, fumes, vapors, or dusts. A minimum of 200 cubic feet of fresh air shall be supplied to each worker in the tunnel or shaft continuously. If work activities generate dusts, fumes, or vapors in harmful amounts, the velocity of the airflow shall be at least 30 feet per minute.

## 4.14 Steel Erection

Each worker engaged in steel erection activities that involve walking and/or working on a surface with an unprotected side or edge more than 6 feet above a lower level must be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems. Connectors (e.g. workers assembling steel girders) more than 6 feet above a lower level shall be protected with a personal fall arrest system, positioning device system or fall restraint, or be provided with other means of protection from fall hazards. (Arcadis staff must be approved by Arcadis H&S to do this type of work);

- Training will be provided for all workers exposed to fall hazards. Special training will be provided to connectors, workers in controlled decking zones, and those rigging for multiple lifts;
- Steel erection may begin only when written notification that the concrete in the footings, piers, and walls or the mortar in the masonry piers and walls has attained the strength to support the loads that will be imposed during steel erection;
- Columns will be anchored using a minimum of four anchor bolts;
- Solid web structural members will be secured with at least two bolts per connection before being released from the hoisting line;
- Open web joists must be field bolted at each end of the bottom chord before being released from the hoisting line;
- Decking shall be laid tightly and secured; and,
- Controlled decking zones will be clearly marked; only those workers engaged in leading edge work (the unprotected side of a floor, decking, or the walking/working surface) are permitted to work in the area.

A competent person will inspect cranes used in steel erection prior to each shift. Plan routes for suspended loads so no worker is required to work directly under the load, except for connecting, hooking, or unhooking. Use hooks with self-closing latches. All loads shall be rigged by a qualified rigger. Lifts shall hoist a maximum of five members.

## 4.15 Rollover and Overhead Protection

Rollover protective structures (ROPSs) are required for the following equipment: rubber-tired vibratory compactors, self-propelled scrapers, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler tractors, crawler-type loaders, and motor graders (with or without attachments), which are used by Arcadis or Arcadis subcontractors. The ROPSs will be designed and built for the equipment by the equipment manufacturer or designed specifically for the equipment by a qualified engineer.

# 4.16 Hot Work

Hot work is any type of work that may produce uncontrollable sources of ignition. Hot work may include drilling, grinding, cutting, welding, or brazing operations that are conducted outside a controlled environment. Hot work permits are required to be issued anytime hot work is performed in areas where combustible hazards may exist. The Arcadis Hot Work Health and Safety Standard (ARC HSCS013) establishes the criteria for and proper method of obtaining and working under hot work permits.

In general, the permit to work procedure defines acceptable conditions under which hot work may be performed and the processes to be followed while conducting hot work operations. Under no circumstances will hot work proceed if the conditions set forth in the Hot Work Standard cannot be met.

Hot work will never take place in the presence of explosive atmospheres, or in atmospheres inside or around unclean or improperly prepared tanks that are or may become explosive, or in areas near the storage of large quantities of exposed, readily ignitable materials.

General precautions to take when conducting hot work are provided below:

- Verify that fire protection systems and equipment in the hot work area are in working condition;
- Be trained in the use of fire protection equipment;
- Clean area of all debris;
- Know all potential hazards of the system or equipment you are working on before you start;
- Eliminate or control all potential hazards of the system or equipment you are working on before you start;
- Prepare the hot work area through maximum use of engineering controls before you start;
- Use proper clothing, tools, and PPE for the job; and,
- Confine hot work to the permitted area.



Did You Know? Arcadis Standard ARC HSCS013 “Hot Work” includes requirements and recommendations for use when completing hot work activities.

# 5 Specific Project Sites, Hazards, and Activities

## 5.1 Chartering and Use of Aircraft (Fixed-Wing and Rotary)

The following information is designed to help charter an airplane or helicopter and provide guidance on selecting a safe, suitable, country-specific Civil Aviation Authority (CAA) certified air taxi operator. Selecting an air taxi operator is not difficult and does not require a vast knowledge of the air taxi industry or the CAA.

This section presents some general questions you should ask an air taxi operator prior to arranging for a flight. Table 5-1 describes different types of aircraft, passenger seating capacity, and some of the comfort items you may expect on the aircraft. Some of the applicable regulations that operators must meet are also discussed.

### 5.1.1 Selecting an Air Carrier

Any air taxi operator that offers services to the public must by law be certified by the CAA and meet stringent operational, maintenance, and safety rules. In addition, pilots must be specifically qualified.

The regulations for air taxis provide for a high level of safety and control. They address flight operations, maintenance requirements, and crew member training and testing. The CAA also addresses crew rest, physical examinations, and mandates a stringent anti-drug program for operators. The CAA closely monitors air taxi operators to make e sure they conform to established standards of performance. The safety of Arcadis employees depends on flying with a legally certified air taxi operator.

Asking a few basic questions of the air taxi operator will help be certain you are dealing with a CAA-Certificated Air Carrier (official name for an air taxi operator), and that the operator is authorized to provide the type and kind of service you require. The following questions may be helpful before arranging a flight:

1. Do you hold a current CAA Air Carrier Operating certificate?

_____ Yes _____ No

2. What is the name of the company as it appears on the certificate?

_____

_____

3. What is the certificate number?

_____

_____

4. What is the name and telephone number of the CAA Flight Standards District Office and who is the CAA Principal Operations Inspector overseeing your operation?

_____

_____

5. (For international trips) Is your company authorized by the CAA to conduct international operations to_____?

_____

_____

If the air taxi operator is unwilling or reluctant to provide answers to the above questions or does not want you to contact the CAA for verification of his or her Air Carrier Operating Certificate, you would be wise to consider another operator to fill your travel requirements.

**Table 5-1 Aircraft Guidance Comparison**

| Aircraft | Single-Engine Airplane | Multi-Engine Airplane | Multi-Engine Turbo Prop Airplane | Multi-Engine Jet Airplane | Single- and Multi-Engine Helicopter |
|---|---|---|---|---|---|
| Passengers | 1 to 9 | 1 to 9 | 1 to 30 | 1 to 30 | 1 to 12 |
| Crew Requirements | 1 pilot | 1 pilot, 2 if requested | 1 or 2, depending on aircraft requirements | 2 pilots, flight attendant over 19 seats | 1 pilot |
| Speed | 115-200 mph | 170-230 mph | 200-300 mph | 350-580 mph | 120-160 mph |
| Food/Beverage | Catering, if requested | Catering, if requested | Catering, if requested | Catering, if requested, many have ovens on board | Catering, if requested |
| Comfort Items | May have A/C, reading lights, and tray tables | Most have A/C, reading lights, and tray tables, reclining seats, and club seating | In addition, may have stereo and inflight telephone | Features are similar to an airliner | Many have A/C, stereo, in-flight telephone, reading lights, and tray tables |
| Lavatories | No | Mostly no | Mostly yes | Yes | No |
| Pressurization | Mostly no | Mostly no | Almost all | All | None |

## 5.1.2 Selecting the Right Aircraft

When making inquiries with Air Carriers, the operator will likely ask for the following information:

- Number of passengers;

- Amount of baggage;
- Time constraints; and,
- Your itinerary.

Also, tell the Air Carrier your passengers' preferred departure and ultimate destination locations so the most convenient airports and/or plane type can be selected.

Like everything, there are trade-offs between cost, aircraft speed, seating capacity, amenities, and weather capabilities. The Air Carrier is your best source of information for choosing an aircraft. Unless you have a specific preference, let the Air Carrier recommend the aircraft that is best suited to your needs.

## 5.1.3 Pressurized vs. Unpressurized Aircraft

Many Air Carriers use aircraft that are unpressurized. Cabin pressurization refers to an aircraft's ability to maintain a comfortable environment in the cabin as altitude increases and outside air becomes colder and thinner. There are differences in flying in a pressurized versus unpressurized aircraft. Pressurized aircraft can fly at higher altitudes than unpressurized aircraft. Unpressurized aircraft usually climb and descend slower than pressurized aircraft and fly around, rather than over, the weather. If weather is going to be a factor, the choice of aircraft can affect your flight plans. The Air Carrier you select can explain the options.

## 5.1.4 Helicopter Safety

Helicopters are not inherently dangerous machines. However, danger arises when people not familiar with helicopter hazards are suddenly required to use a helicopter. This section identifies where the potential dangers exist, and how to work around helicopters safely and effectively.

### 5.1.4.1 Approach Distance

No Arcadis worker should be permitted to approach within 50 feet of the helicopter when the rotor blades are turning, unless work duties require their presence in that area.

### 5.1.4.2 Approaching the Helicopter

Approach and depart the helicopter in a crouched position from the front or side of the helicopter, within view of the pilot. Never walk to the rear of the helicopter unless loading the rear cabin or baggage compartment, and only if the pilot is aware of your actions. Under no circumstances should you move rear of the baggage compartment. No worker should be permitted to work in the area from the cockpit or cabin rearward while blades are rotating, unless authorized by the helicopter pilot to work there.

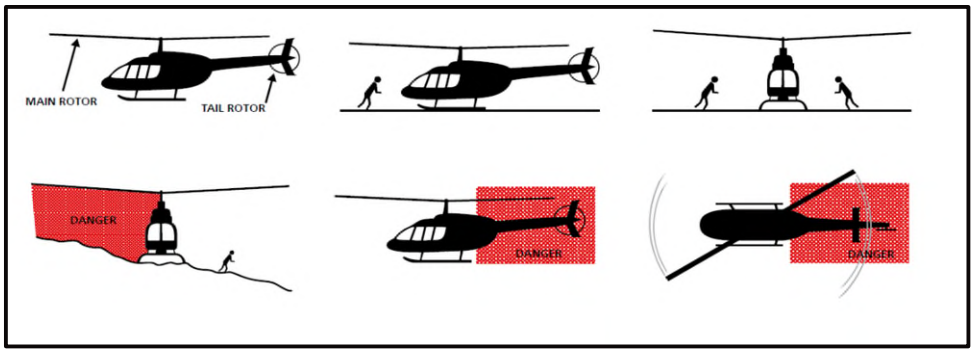



**Figure 5-1 Danger Zones Around Helicopters**

### 5.1.4.3 Rotor Blades

Helicopters generally have two sets of rotor blades: the main rotor (the large one on top) and the tail rotor (the smaller one at the tail of the helicopter).

The greatest threat when operating around a helicopter is the turning rotor blade. When the blades are turning, the high-speed tail rotor is virtually invisible. Physical contact with either of the blades when they are turning could result in serious or fatal injury. On uneven ground, always approach and depart the helicopter from the DOWNHILL side. As you approach the helicopter, carry long tools, rods, and other similar items horizontally to avoid possible contact with the main rotor blade. When rotating, the helicopter blades will produce a strong downward force that will blow dust and debris with considerable force. Employees must have eye protection working in areas with the potential for “rotar wash”.

### 5.1.4.4 Good Safety Practices

When in the helicopter, always keep your safety belt fastened until the pilot signals that it is safe to unfasten it. Wear eye and hearing protection when able. Never smoke in or near a helicopter on the ground. Your pilot will advise you if it is okay to smoke in flight. Smoking on EMS helicopters with an oxygen supply on board is never permitted.

### 5.1.4.5 Helicopter Landing Area

First, determine the dimensions of the area required for landing. At a minimum, the touchdown zone should be as follows:

- During daylight hours: 100 x 100 feet square; and,
- At night: 125 x 125 feet square.

The surface should be flat and firm, and free from debris that might blow up into the rotor system.

The landing area must be clear of people and obstructions such as trees, poles, and wires. Keep in mind that wires are very difficult to see from the air, especially at night. The landing area must also be free of stumps, brush, posts, and large rocks.

### 5.1.4.6 Visibility

Ground workers must be instructed that when visibility is reduced by dust or other conditions, they must exercise special caution to keep clear of main and tail rotors. Precautions should also be taken to eliminate, as far as practical, dust or other conditions that reduce visibility.

### 5.1.4.7 Requirements for Using Helicopters for Hoisting and Lifting

Prior to each day's operation, a briefing will be conducted. This briefing will identify the plan of operation for the pilot and ground workers. A helicopter safety plan must be completed in advance of an aerial lifting operation.

#### *5.1.4.7.1 PPE*

PPE will be provided to the worker receiving the load and the pilot will confirm its use. PPE will consist of complete eye protection and hard hats secured by chinstraps and may include hearing protection. Loose-fitting clothing likely to flap in rotor downwash and, thus, be snagged on the hoist line, will not be worn.

#### *5.1.4.7.2 Workers*

Sufficient ground personnel shall be provided to safely perform helicopter loading and unloading operations.

#### *5.1.4.7.3 Loose Gear and Objects*

Take all necessary precautions to protect workers from flying objects in the rotor downwash. All loose gear within 30 m (100 ft) of the location of lifting or depositing the load, or within all other areas susceptible to rotor downwash, must be secured or removed. Good housekeeping must be maintained in all helicopter loading and unloading areas.

#### *5.1.4.7.4 Communications*

There must be constant reliable communication between the pilot and a designated ground crew member who acts as a signalperson during loading and unloading. The signalperson must be clearly distinguishable from other ground workers.

#### *5.1.4.7.5 Signal Systems*

The Air Carrier will instruct the aircrew and ground workers on signal systems to be used and will review the system with workers prior to the start of hoisting operations. This applies to both radio and hand signal systems. Common hand signals, where used, are typically as shown in **Figure 5.2**.

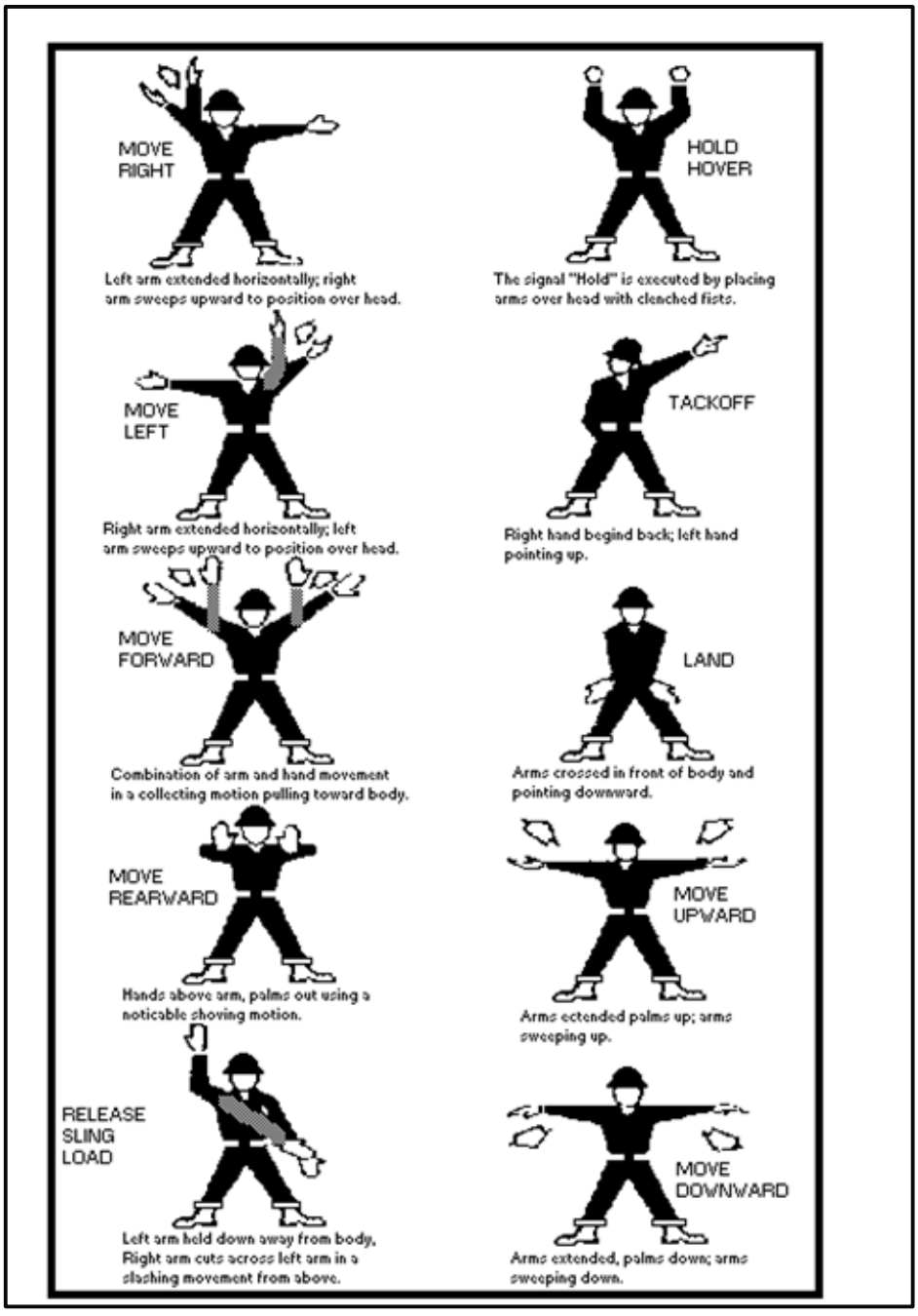



**Figure 5-2 Helicopter Landing Hand Signals**

#### *5.1.4.7.6 Slings and Tag Lines*

Loads should be properly slung. Tag lines must be of a length that will prevent them being drawn up into the rotors. Pressed sleeve, swedged eyes, or equivalent means shall be used for all freely suspended loads to prevent hand splices from spinning open or cable clamps from loosening.

#### *5.1.4.7.7 Cargo Hooks*

All electrically operated cargo hooks must have the electrical activating device designed and installed to prevent inadvertent operation. In addition, these cargo hooks must be equipped with an emergency mechanical control for releasing the load. The operator will confirm that the hooks are tested prior to each day's operation by a competent person to determine that the release functions properly, both electrically and mechanically.

#### *5.1.4.7.8 Load Safety*

The size and weight of loads, and the manner in which loads are connected to the helicopter will be checked. A lift may not be made if the helicopter operator believes the lift cannot be made safely.

#### *5.1.4.7.9 Hooking and Unhooking Loads*

When workers perform work under a hovering helicopter, a safe means of access will be provided for workers to reach the hoist line hook and engage or disengage the cargo slings. Workers will not be permitted to perform work under hovering helicopters except when necessary to hook or unhook loads.

### 5.1.4.8 Static Charge

Static charge on the suspended load must be dissipated with a grounding device before ground workers touch the suspended load, unless protective rubber gloves are worn by ground workers who may be required to touch the suspended load.

### 5.1.4.9 Weight Limitation

The weight of an external load must not exceed the helicopter manufacturer's rating.

### 5.1.4.10 Ground Lines

Hoist wires or other gear, except for pulling lines or conductors that are allowed to "pay out" from a container or roll off a reel, must not be attached to any fixed ground structure, or allowed to foul on any fixed structure.

# 5.2 Opening and Closing Gates

Slide gates: Gates that slide on tracks or that have wheels often require significant effort to move. Older slide gates that have not been well maintained are even more difficult, often requiring several people to move the gate.

The apparent hazard with this gate type is the amount of exertion required to get them to move. This can result in pulled muscles and tendon/ligament issues. Any time we are exerting tremendous energy and putting most of our body weight in to moving an object, we are vulnerable to slip/fall injuries and cuts and bruises in the unfortunate event we fall into parts of the metal gate. Hand injuries are also common. Chain linked sections often have metal burs. Keeps hands away from bracing and coupling sections as they may be prone to move or slide along metal pole sections. These pieces can tear through glove material. Wearing good abrasion-resistant gloves is a must when opening and closing these gates. Ones with rubber palms are helpful in reducing slipping if they are clean and in good condition. The not-so-apparent injuries may be caused by our hands or arms being struck by, caught in, or crushed by the moving gate. The energy required to stop the gate is very similar to the energy required to move it in the first place so, once in motion, sliding gates are capable of causing serious lacerations and broken bones.

Automatic slide gates: Motor-assisted slide gates eliminate the energy required to open and close the gates when they are functioning properly. The primary hazard associated with these gates is being caught in the chain that opens/closes the gate or being caught in or crushed by the moving gate. Automatic opening and closing mechanism may not detect if a person is caught in the equipment so stay away from the gates when they are in motion. Avoid standing or parking a vehicle in the path of the slide gate. Avoid standing to the side of the gate in the event the chain breaks. The safest location is at least 10 feet perpendicular to the gate.

Swing gates: Swing gates in industrial or agricultural settings may be heavy, off center and require lifting the far end of the gate (opposite to the hinged end) to move it. Lifting when also walking the fence to an open or closed position may cause a back strain injury. These gates types are more unpredictable than slide gates, which are limited to parallel movement next to the fence. Swing gates with posts that are not plumb may be difficult to move at first and then reach a point where they are difficult to stop. Double hinged gates may open when a central chain or lock is removed. Gate sections moving freely may cause struck by injuries to people that in the way of the moving gate. Avoid placing hands near hinges. If the gate is unsteady in the closed position, get assistance steadying it to remove chains or locks. These gates may come with cane bolts or drop rods. These are moving parts that are capable of significant pinch injuries to the hands. Single-hinged gates, such as in residential areas, are usually easy to open and close but may also be equipped with a drop rod or metal clasp. As these are moving parts, keep hangs away from pinch points. Chain-linked gates may have sharp points protruding on the edges. Always wear abrasion and cut resistant gloves when opening and closing swing gates.

# 5.3 Wilderness Survival

This section of the handbook is a basic introduction on how to prepare for and react in a wilderness survival situation. Wilderness environments may include, arctic and northern areas, remote deserts, mountainous terrain, deep woods, etc., with limited infrastructure and resources, such as roads, communication, etc. These wilderness skills and techniques are provided for information purposes only and are not intended to take the place of a professional wilderness survival or first-aid training course. Rather, they are intended to increase your awareness of being adequately prepared and having an understanding of basic wilderness survival skills.

Before venturing into the wilderness, check weather forecasts and hazards. When venturing into a remote area, you must have a written communication plan that identifies emergency contacts, check-in frequency, location, and scope of work, expected return time, etc. Always have printed topographical or similar map when working in remote areas and make certain you are familiar with how to read a topographical or contour map. To deal with an emergency situation, one must be able to make decisions, improvise and remain calm.

## 5.3.1 Issues of Concern When Faced with a Survival Situation

For anyone faced with a wilderness emergency survival situation, fear is a normal reaction. Unless an emergency situation has been anticipated, fear is generally followed by panic then pain, cold, thirst, hunger, fatigue, etc. It is extremely important to calmly assess the situation.

Pain may often be ignored in a panic situation. Remember to deal with injuries immediately before they become more serious. Wash and treat all wounds to reduce the potential for infections. Cold lowers the ability to think, numbing the body and reducing the will to survive. Never allow yourself to stop moving or to fall asleep unless adequately sheltered. Dehydration is a common enemy in an emergency situation and may cause you to overlook important survival information. Always keep water with you when travelling through or working in a remote area.

## 5.3.2 How to Build a Fire

Building a fire is the most important task when dealing with survival in the wilderness. Be sure to build yours in a sandy or rocky area or near a supply of sand and water to avoid wildfires.

The most common mistakes made by those attempting to build a fire are choosing poor tinder, failing to shield precious matches from the wind and smothering the flames with pieces of fuel that are too large. The four most important factors when starting a fire are: spark, tinder, fuel, and oxygen.

The most common ways to create spark are:

- Waterproof, strike-anywhere matches are the best choice. Matches may be waterproofed by dipping them in nail polish. Store your matches in a waterproof container;
- A cigarette lighter is also a good way to produce a spark, with or without fuel;
- The flint and steel method is one of the oldest and most reliable methods in fire starting. Aim the sparks at a pile of dry tinder to produce a fire;
- The electric spark produced from a battery can ignite tinder; and,
- Allow the sun's rays to pass through a magnifying glass or clear, full water bottle onto the tinder.

Dry grass, paper, or cloth lint, gasoline-soaked rags, and dry bark are all forms of tinder. Place your tinder in a small pile resembling a tepee, with the driest pieces at the bottom. Use a fire starter or strip of pitch if it is available. Remember that smaller pieces of kindling such as twigs, bark, or shavings are necessary when trying to ignite larger pieces of fuel. Gather fuel before attempting to start your fire. Dry wood burns better, wet or pitchy wood will create more smoke. Dense, dry wood will burn slow and hot. A well-ventilated fire will burn best.

## 5.3.3 How to Build a Shelter

A small shelter that is insulated from the bottom, protected from wind and snow, and contains a fire is extremely important in wilderness survival. Before building your shelter, be sure that the surrounding area provides the materials needed to build a good fire, a good water source and gain shelter from the wind.

Wilderness shelters may include:

- Natural shelters such as caves and overhanging cliffs. When exploring a possible cave shelter, tie a piece of string to the outer mouth of the cave so that you will be able to find your way out. Keep in mind that these caves may already be occupied. If you do use a cave for shelter, build your fire near its mouth to prevent animals from entering;
- A natural pit under a fallen tree that may be enlarged and lined with bark or tree boughs;
- Near a rocky coastal area, a rock shelter can be built in the shape of a U, covering the roof with driftwood and a tarp or seaweed for protection;
- A lean-to made with poles or fallen trees and a covering of plastic, boughs, thick grasses, or bark is effective to shelter you from wind, rain, and snow;
- A wigwam that may be constructed using three long poles. Tie the tops of the poles together and upright them in an appropriate spot. Cover the sides with a tarp, boughs, raingear, or other suitable materials. Build a fire in the center of the wigwam, making a draft channel in the wall and a small hole in the top to allow smoke to escape; and,

- A snow cave will provide good shelter if you find yourself in open terrain. Find a drift and burrow a tunnel into the side for about 24 inches; then build your chamber. The entrance of the tunnel should lead to the lowest level of your chamber where cooking will be performed, and equipment will be stored. A minimum of two ventilating holes are necessary, preferably one in the roof and one in the door.

## 5.3.4 Clothing and Equipment

Clothing must provide warmth and offer protection from the elements. Layering of clothing to trap heat is preferred when preparing for adverse climate conditions. This allows for adjustment based on temperature, level of work effort, and perspiration. It is important to avoid sweating in cold weather as this can lead to hypothermia. Waterproof outer layers are strongly recommended.

Equipment must be easily manageable and promote survival in any situation. Items to carry in your pockets may include a fire starter, waterproof matches and/or lighter, safety cutting tools, compass, small first-aid kit, and portable, nonperishable food like trail mix.

## 5.3.5 Survival Kit

To assemble your kit, store items in airtight plastic bags and put your entire disaster supplies kit in one or two easy-to-carry containers such as plastic bins or a duffel bag. A basic emergency supply kit could include the following recommended items:

- Water - one gallon of water per person per day for at least three days, for drinking and sanitation;
- Food - at least a three-day supply of nonperishable food;
- Battery-powered or hand crank radio and a NOAA Weather Radio with tone alert;
- Flashlight;
- First aid kit;
- Extra batteries;
- Whistle to signal for help;
- Mirror or other signaling device;
- Moist towelettes, garbage bags and plastic ties for personal sanitation;
- Toilet paper;
- A LifeStraw™ or water filter;
- Local maps and compass;and,

- Cell phone with chargers and a backup battery.

Portability is important when travelling in the wilderness. Items from the survival kit may be placed in a small hip pack or carried as a backpack.

## 5.3.6 Travel in the Remote Areas

It would be very unusual for an Arcadis worker to become stranded in a wilderness setting, away from others and confronted with a lone survival situation. It is very important that others are aware of your location and anticipated return if you must work in a remote area for even a brief period or are travelling through a remote location alone. If you do become lost or stranded, it is best to stay where you are and attempt to contact others using a cell phone or satellite phone. If needed, you may need to find a clearing or move to higher ground to obtain a cell phone signal or to connect to a satellite. Even without service, attempt to send text messages to contacts and include the time you are attempting to send the message (this may be different than the time the message is received), your condition and the condition of others with you and, of course, your location. Your exact location may be found using map apps, compass features, etc. on your cell phone. Learning how to find your location or send your location to others is important before finding yourself in an emergency. If necessary, build a fire, find or build a shelter, and carefully assess the situation. Resist using energy by wandering aimlessly if you are confident others are expecting your return.

During winter months use game trails, which will help you avoid walking in deep snow. Frozen streams and rivers are also easy to follow but be aware of weak ice. Avoid getting wet in low temperature environments.

## 5.3.7 Methods of Navigation

There are three common methods of navigation:

1. Electronic devices including Global Positioning Systems (GPS);
2. Map reading is a common method used, particularly in developed areas. Maps and aerial photos may be used when landmarks are clear;
3. Using a compass in conjunction with maps and aerial photos is wise in areas without good landmarks; and,
4. Navigation by dead reckoning is common in areas where landmarks are nonexistent or inadequate. This method combines plotting and recording a series of courses, measured by distance and direction from a starting point.

***NOTE**: It is important to stay alert and observe all unusual landmarks.*

Difficulties in navigation may occur for several reasons. The most important thing to remember if you find yourself in this situation is not to panic. Provide for your basic needs: heat, shelter, water, and food. Then consult your map and compass and try to recognize or remember landmarks you may have passed.

To determine how many hours of daylight are left, face the sun and extend your arm toward it. Bend your wrist inward and place your fingers just below the sun. Disregarding your thumb, count how many fingers separate the sun from the horizon. Each finger will represent approximately 15 minutes. If it is nearing dark, build a shelter and fire on high ground and out of the wind. Avoid travelling at night.




What3Words is an app that uses a unique way of referencing locations. The world is divided in to 3-meter squares and each square is assigned a unique combination of three words. It is the easiest way to find and share exact locations.

### 5.3.7.1 Global Positioning Systems (GPS)

All handheld GPS models will provide basic navigation tools. Some basic models include a barometer/altimeter, which will let you gauge weather trends, while also showing your current elevation. An electronic compass is also a basic feature on GPS units. Most importantly, your GPS should include a base map. Cell phone apps are also now available for outdoor navigation. If a standard cell phone will serve as the primary GPS navigation device, the relevant map must be preloaded if the outdoor area does not have cell phone service or internet. This is the primary strike against using a cell phone for wilderness navigation. Battery life is a big concern for both stand-alone GPS units and cell phones. Having a backup power supply or additional batteries is critical.

### 5.3.7.2 Finding Direction Using a Compass

A magnetic compass is important in a wilderness survival kit. First, decide which direction you want to follow then aim over the center of your compass to the bearing you want to follow and find a landmark on this sighting. After arriving at this landmark, repeat the process. Using this pattern, you will follow a relatively straight line.

### 5.3.7.3 Using the Stars

If you do not have a compass, the star Polaris (aka the North Star) will identify a northern direction. To find this star, use the Big Dipper constellation. The pole star will be located off the two ends of the “dipper,” opposite the side of the “handle”.

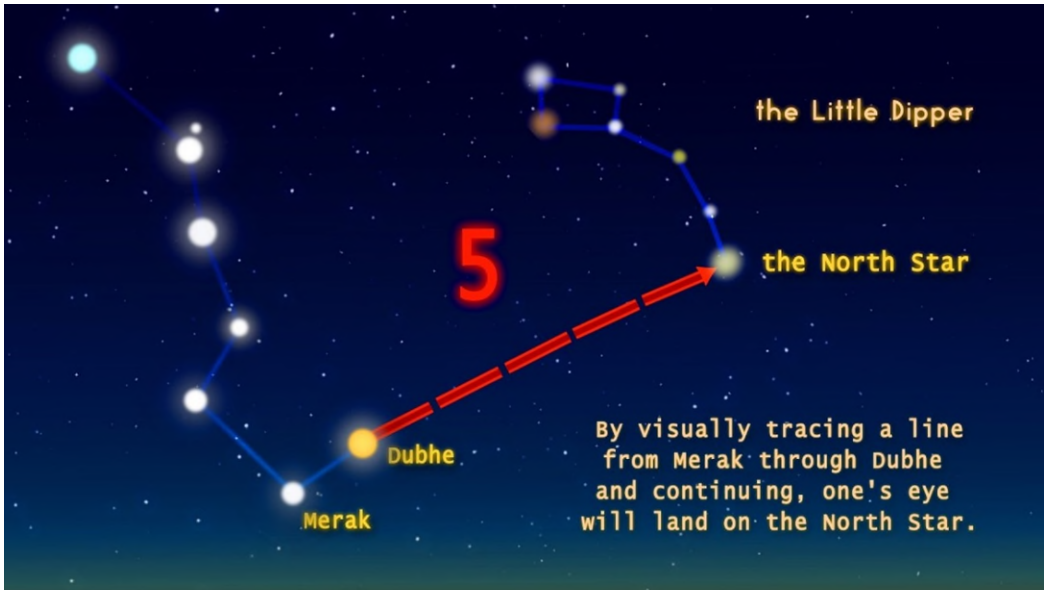



**Figure 5-3 Identifying Polaris or the North Star**

### 5.3.7.4 Using the Sun

You may also use an analog watch and the sun to determine direction in the northern hemisphere. Point the hour hand directly at the sun and then bisect the angle between the hour hand and 12 o’clock. This imaginary line will run north/south. In the northern hemisphere, if the sun is directly behind you, you are generally facing north.

### 5.3.7.5 Using the Moon

Mentally draw a line that connects the horns of a crescent moon and then extend this line down to the horizon. In northern latitudes this will give an approximate indication of south, in southern latitudes the line will give an approximate indication of north. It works best when the moon is high in the sky and not too near the horizon, when significant errors are possible.

## 5.3.8 Signals

During daylight hours it is important to find a way to signal to others—a fire is best. A signal mirror is effective for signaling aircraft. Flash the mirror along the horizon regardless of whether a plane is in view. If you must move, be sure to leave markers that searchers can follow. A distress signal can be three fires or piles of rocks in a triangle, three blasts on a whistle, or three flashes of a light, in succession followed by a one-minute pause and repeated until a response is received. Three blasts or flashes is the appropriate response.

The Morse Code emergency signal (SOS) may be sent with a flashlight and consists of three dots followed by three dashes followed by three dots. The dashes should be twice as long as the dots. Messages or signal letters may be drawn in the snow.

## 5.3.9 Food and Water

In a wilderness survival situation, it is possible to live for extended periods of time on little or no food. Research shows that a healthy individual can survive with no side effects on 500 calories a day, plenty of water and a comfortable resting place., During cold weather or periods of heightened activity, more food is required to maintain a normal body temperature. Water is extremely important. Two to 3 cups of water are required each day to stay healthy. It is wise to conserve the water in your body by reducing activities that may promote water loss.

Finding water during the summer months is easier than winter. Running water, such as remotely located springs or streams are preferred but should still be filtered or boiled before consuming. Water in stagnant areas such as sloughs and ponds MUST be boiled for at least 3 minutes or treated with appropriate purification or water filtration equipment. In areas where no surface water is available, dig into damp soil to below the water table and allow this muddy water to settle and become clear. Water may also be found on the dew of plants, by collecting rainwater or in fish juices.

During the winter months it is wise to look for water under ice. Melting ice, as opposed to snow, is more fuel efficient. Remember that hardpacked snow will yield more water than light, fluffy snow. Do not eat snow because it tends to dehydrate the body.

If water is not readily available, try to limit your food consumption to carbohydrates, because proteins use more water to digest. Keep in mind that all fur-bearing animals and grass seeds are edible. Avoid eating any plant without the proper training and knowledge of edible plant species. Remember, rescue is very likely, starvation is not.

Take extra care when consuming seafood. Try to avoid mussels during the summer months because they contain certain toxins that are not present during the winter. Sea urchins, a prickly purple or green sea creature, may be consumed by breaking them open and eating the red or yellow eggs inside. Steamed snails, clams and limpets,

frogs, snakes, lizards, and birds are also edible. Remove the head, entrails, and skin before adding them to the pot.

### 5.3.10 First Aid and Health

When journeying into the wilderness, it is important to carry a complete first-aid kit with a manual. It is also wise to take a first-aid course prior to departure. A good diet, cleanliness, and appropriate clothing will lower the risk of harmful situations. When setting out for your journey remember to pack a wide range of clothing and extra footwear.

## 5.4 Mining

Projects at mining sites may have site specific safety requirements and may require site-specific (client) training. Confirm the regulatory agency that has jurisdiction over your operations. Both active and inactive sites, as well as reclamation and tailings management, may fall under MSHA jurisdiction. This will determine training and oversight requirements. This training must be arranged by the PM prior to entry to the site. In addition, many mining sites are under the jurisdiction of MSHA and require additional training. See the PM or your H&S representative for these requirements. Depending on the type of mine and potential for exposure, additional medical surveillance may be needed if staff are potentially exposed to certain metals or radioactive materials. Contact Corp H&S if staff medical surveillance program needs modified.

## 5.5 Railroad

Requirements for safe work on rail projects are provided in the Arcadis Railroad Safety Handbook which should be consulted prior to commencing work within 25 ft of the center line of a railroad track. The following is a general summary of requirements applying to all work within 25 ft of a railroad track:

- Arcadis expects 100% compliance with all applicable railroad regulations and H&S standards related to railroad work, even if the work in the vicinity of the railroad track is not under contract to a railroad. Refer to the Arcadis Railroad Safety Handbook for details;
- Only properly trained staff are permitted to be within 4 ft of the rails. There are no exceptions to this rule. In addition to training, security clearance through eRailsafe may also be required when prescribed by the client or railroad having authority over the track where the work will be conducted;

**Rail Crossing Locator** is an app that identifies all rail crossings in the United States. This is an excellent tool for spill response and for railroad work permitting.

- Except as permitted by the railroad having authority over the track, use of personal electronic devices (e.g. cell phones, computer tablets, headphones) within 25 ft of the rails is prohibited;
- A ready method of communication with the railroad Point of Contact (POC) will be maintained when working within 25 ft of the rails;
- All required PPE will be worn at all times while on railroad property;
- All required badges will be worn and displayed at all times while on railroad property; and,
- Work on or in vicinity of railroad tracks will be subject to requirements specified in Section 8.0 of the Arcadis Railroad Safety Handbook unless a client rail safety program is in place and is being followed by Arcadis staff on the project.



Did You Know? Arcadis Standard ARC HSSP002 “Railroad Workplace” requirements and recommendations for use when working around railroads.

## 5.6 Water Operations Work

The potential for drowning is an additional hazard when working on a watercraft, water intake, water discharge structures, dock facilities, or any location over/near water. Arcadis worker working in areas unprotected by passive fall protection systems (OSHA-specified railings or nets), where the danger of drowning exists, must wear a U.S. Coast Guard-approved Type I (offshore) life jacket, Type II (near shore), or Type III (calm, inland water) buoyant work vest, commonly referred to as a personal flotation device (PFD). However, this requirement can be superseded with the use of 100 percent fall protection. If an worker cannot fall into the water as a result of use of active or passive fall protection, there is no danger of drowning, then a PFD is not required.



Did You Know? Arcadis Standard ARC HSFS002 “Water Operations” includes requirements and recommendations for working on or near water.

The following pre-planning and precautions must be taken where the danger of drowning exists:

- Complete a Water Operations Risk Assessment Form. The completion of the Water Operations Risk Assessment Form process will be used to assess the hazards, identify safety critical equipment requirements, outline training requirements and identify methods for prompt, safe rescue and notification methods.
- Every worker involved with water-based work will be required to take water awareness training which emphasizes the implementation of the contents of this standard. The operator/skipper of any Arcadis boat/vessel must complete a USCG boating safety training course prior to conducting boating work on the project.
- Arcadis workers must be provided with and use a Type I, II, or III PFD. The use of non-inherently buoyant and recreational PFDs is prohibited. These PFDs, where required, will be worn by each person while working on docks, barges, watercraft, or similar facilities.
- If working on the water in a boat, employee(s) must prepare a float plan. The float plan will be submitted daily to the PM or SSO, with a copy remaining onboard the vessel.
- If performing construction or demolition work over water, personal fall protection may be required. In cases where employees could fall in the water, regardless of fall protection equipment or the use of PFDs, OSHA requires At least one lifesaving skiff immediately available for prompt rescue.
- Equip each dock with throwable flotation devices capable of supporting an alert person in the water, with 90 feet of ½-inch nylon rope attached for every 200 feet of the length of the dock.
- Equip floating barges with safety equipment and emergency supplies to cope with any possible demooring. Minimum equipment shall include the following:
  - Mooring lines;
  - Signaling equipment;
  - Repair equipment; and,
  - Boat hooks



**US Coast Guard** is an app that is an excellent resource for boating regulations and boating safety. Includes the ability to prepare a float plan and share it, which is referenced in the Arcadis Standard ARC HSFS002 “Water Operations”.

## 5.6.1 Items Required

Watercraft must be equipped with safety equipment and emergency supplies to cope with any foreseeable problem. Minimum safety equipment and emergency supplies include the following:

- Mooring lines;
- Signaling equipment;
- Repair equipment;
- Boat hooks;
- Paddles or push poles;
- Spare parts (e.g., spark plugs, drive gear keys);
- Fire extinguisher;
- Flares;
- Air horn; and,
- Items listed by the watercraft operator

Each dock must be equipped with:

- Emergency first-aid kit
    - Basket-type stretcher with bridle and rope attached;
    - Appropriate firefighting equipment; and,
    - Sufficient numbers of throwable floatable devices;
- An observer will be assigned whenever work is being done around the dock from a watercraft. The observer must maintain communication with workers and with the operations supervisor; and,
- Adequate lighting must be provided at all times.

## 5.6.2 Equipment

The following apply to fall protection equipment that may be used when conducting project activities over/near water:

- No repair of safety harnesses and lanyards is allowed;

- Safety harnesses or lanyards must be a minimum of 1.3 cm diameter (½-inch) nylon or equivalent, with nominal breaking strength of 6,000 pounds;
- Lanyards will be no longer than 6 feet;
- Lanyards will have a locking snap hook on both ends;
- Lifelines will be a minimum of ¾-inch diameter or equivalent, with a maximum breaking strength of 6,000 pounds;

A personal fall arrest system must limit the maximum arresting force on an worker to 1,800 pounds. The following requirements apply to horizontal (static) anchor lines:

- Steel cables are recommended for horizontal (static) anchor lines;
- Steel cables must have a minimum breaking strength of 6,000 pounds or five times the live load, whichever is greater;
- Installation must be overseen by a qualified individual;
- The minimum diameter for steel cable static lines is 3/8 inch; and,
- Turnbuckles must be used to keep static lines taut.

## 5.6.3 Inspection of Equipment

### 5.6.3.1 Vessel Safety inspections

Vessel safety inspections are required prior to each day or shift of operations.

### 5.6.3.2 Completed Vessel Safety Inspection Forms

Completed Vessel Safety Inspection Forms will be provided to the Arcadis Site Supervisor and will be maintained in the project files.

Fall protection equipment used around water will be inspected before each use. Quarterly inspections will be documented. The following defects, as a minimum, are cause for destruction of the equipment:

- Cracked, dry, or rotten leather;
- Nylon or cord that has worn thin;
- Cuts or worn places deep enough to weaken the strap or belt;
- Broken stitches at buckles, D-rings, or snaps;
- A snap with weak springs behind the tongue or defective tongues that have been bent or sprung;
- Loose tongues in buckles;

- Cracked, bent, or heavily worn buckles; D-rings; or snaps; and,
- Other wear, damage, or defect that could affect the protection afforded by the assembly

## 5.6.4 Records

Records requirements for watercraft operations are presented below:

- Equipment inspection records should be retained for 1 year plus the current year.
- Watercraft operator qualifications and any required licenses will be kept onsite for as long as they are valid, plus 1 year.

## 5.6.5 Working Near or on Water/Ice

Due to the high-risk nature, cold-water work activities will need to be discussed directly with Corporate Health & Safety to confirm that proper planning and hazard controls are used.

Workers must wear U.S. Coast Guard-approved (Type I or II) PFD (e.g., life jacket) when:

- Working on travelling in or on floating equipment (e.g., boats, barges, rubber rafts, or other watercraft);
- Working close to fast-flowing water or water that is deeper than 4 feet (e.g., lakes or reservoirs), where the work could result in slipping or falling into the water (circumstances may require the use of lifelines);
- Working on ice near open water (circumstances may require the use of lifelines or cold-water immersion suits). Cold-water immersion gasp reflex is an involuntary response to being submerged in cold water. It can occur in water that is 60º F or colder, resulting in sudden drowning;
- Before travelling or working on river or lake ice, determine ice thickness and type (blue or white) using an ice auger; and,
- Only trained and experienced workers are permitted to calculate load limits for ice.

## 5.6.6 Boating Operations Safety

Requirements applicable to motorboats include the following:

- Persons operating motorboats must be trained in boating safety by a recognized organization.
- The maximum number of workers and weight that can safely be transported must be posted on all vessels used for Arcadis projects;
- Vessels must be inspected prior to use;

- The number of workers on a vessel should not exceed the number of personal flotation devices (PFDs) aboard;
- US Coast Guard approved, marine type fire extinguishers, are required on motorized boats. A fire extinguisher appropriate for the hazard will be maintained on the watercraft if open flames, gasoline-powered equipment, or heat-generating devices are used.
- Each boat will have sufficient room, freeboard, and stability to safely carry cargo and passengers, with consideration given to the weather and water conditions in which the boat is operated. The load should not exceed the rated limit of the vessel;
- A first-aid kit shall be maintained in the watercraft. The first-aid kit will have water-resistant housing to protect the kit contents.
- The following equipment is required on board a motorboat:
  - Two oars;
  - Oar locks attached to gunwales or the oars;
  - One ring buoy with at least 90 feet of 3/8-inch diameter solid braid polypropylene (or equivalent) line attached;
  - PFDs must be U.S. Coast Guard-approved Type I, II, and III. The use of non-inherently buoyant and recreational PFDs is prohibited.
  - Navigation lights (if a skiff lacks permanent mounted navigation lights, use portable battery-operated lights).

The following are general requirements for all manually operated watercraft:

- Workers operating watercraft will be sufficiently trained and have the experience necessary to safely operate the watercraft being used;
- The watercraft will be inspected and documented prior to use and/or daily by the worker designated to operate the watercraft;
- Where possible, select a watercraft for project work that has flotation integrated into the boat design capable of maintaining watercraft buoyancy in the event of capsize;
- All occupants of the watercraft will wear PFDs. PFDs must be US Coast Guard approved Type I, II, and III. The use of non-inherently buoyant and recreational PFDs is prohibited.
- When loading the watercraft, equipment and supplies must be evenly distributed. When possible, load the watercraft from the side instead of the end. Equipment and supplies should be secured in a manner that will

prevent shifting while the watercraft is in motion. Equipment and supplies loaded and secured should not exceed the maximum rated weight capacity of the vessel;

- Access and egress from watercraft should always be from the side instead of from the ends;
- Standing, changing places and sudden movement in the watercraft should be avoided. Go to the shore to make adjustments in position and equipment location;
- If anchors are used, attach them to the bow and stern of the watercraft, not the sides;
- Interior vessel bottoms of metal or plastic should be covered with an anti-slip coating;
- Adequate lighting must be available during night work. Navigation lighting is required if the watercraft is operated in navigable waters;
- Oars and oarlocks must be in good condition;
- A first-aid kit should be maintained in the watercraft. The first-aid kit will have water resistant housing to protect kit contents; and,
- A fire extinguisher appropriate for the hazard will be maintained on e watercraft if open flames, gasoline powered equipment, or heat-generating devices are used.

### 5.6.7 Additional Requirements for Inflatable Watercraft

The following requirements are applicable to inflatable watercraft:

- Equipment with sharp edges or points must be adequately protected while stored or used on the inflatable watercraft. Collecting fish using the hook-and-line method should not be employed while using inflatable watercraft;
- Equipment with hot surfaces should not be used with inflatable watercraft; and,
- Whenever possible, inflatable watercraft should be inflated using mechanical means.

## 5.7 Process Safety Management

***NOTE:*** *This section of the handbook is not meant to replace requirements set forth in the Arcadis Process Safety Management Health and Safety Standard (ARC HSFS014). This section of the handbook is meant as a quick reference only. All requirements set forth in the procedure must be confirmed prior to working on a project involving the Process Safety Management (PSM) standard.*

Specific training is required to comply with ARC HSFS014. Target audiences include supervisors, operators, onsite workers, maintenance workers, engineers and contractors/visitors. The PSM standard will address required

training for each category of worker/contractor/visitor and describe how this training must be provided. All training will be documented and maintained onsite.



Did You Know? Arcadis Standard ARC HSFS014 “Process Safety Management” includes requirements and recommendations on identifying and controlling hazards associated with chemicals used in processes.

## 5.8 Industrial Hygiene and Monitoring Equipment

All work activities are to be evaluated using qualitative and/or quantitative methods, as appropriate, to reduce or eliminate exposure hazardous substances to the lowest feasible levels. Arcadis shall identify the most appropriate control mechanisms to adequately mitigate the risks identified following the hierarchy of controls.



Did You Know? Arcadis Standard ARC HSIH009 “Industrial Hygiene” includes guidance on Arcadis’ Industrial Hygiene processes, which includes worker exposure monitoring.

### 5.8.1 Personal and Workplace Exposure Monitoring

Air monitoring will be conducted to determine employee exposure to airborne constituents. The monitoring results will dictate work procedures and selection of PPE. The Arcadis SSO will be responsible for using air monitoring results to determine appropriate H&S precautions for Arcadis personnel and subcontractors. Air monitoring results will be recorded in field notebooks or in an air monitoring log provided in the HASP. The purpose of monitoring is to document the presence or absence of COCs. Therefore, it is as important to record zero value results, as it is to record any concentration greater than zero.

Workplace monitoring will be performed as needed to assess and obtain worker exposure levels to COCs. All records regarding occupational exposure measurements will be communicated to affected workers and maintained in the applicable project and corporate files.

## 5.8.2 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations will be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibration details must be documented on a calibration log. The type and LOT number of calibration gases must be noted, as well. All completed H&S documentation/forms must be reviewed by the Site Supervisor and maintained in the project files.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer's procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer's procedures. When applicable, only manufacturer-trained and/or authorized workers will perform instrument repairs or preventive maintenance.

Workers operating air monitoring equipment must be aware of correction factors when in compound-specific environments. For example, a PID with a 10.6 eV bulb, calibrated with isobutylene, would need to be "corrected" by a factor of 6 in an acetaldehyde environment (a 100-ppm reading would actually be 600 ppm acetaldehyde). The Arcadis Standard HASP template auto calculates correction factors for chemicals LISTED in the workbook.

If an instrument is found to be inoperative or is suspected of giving erroneous readings, the Site Supervisor is responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The Site Supervisor will be responsible for confirming that a replacement unit is obtained and/or repairs are initiated on the defective equipment.

## 5.8.3 General Hazard Exposure Information

For all field work requiring air monitoring to assess worker exposure levels, the HASP will identify constituents of concern (COCs) and establish action levels and control measures. Action levels for COCs established in the HASP are based on sound industrial hygiene practices, following recognized standard-setting authorities. Table 5-2 shows the typical agencies and terminology used in HASPs.

## 5.8.4 COC and Radiation Exposure

Arcadis has established specific procedures for COCs and radiation exposures. This handbook will only make reference to these exposure potentials; therefore, all employees are directed to Arcadis standards to receive more information.

**Table 5-2 Regulatory Acronyms**

| Hazard | Guideline | Explanation | Sources for Values |
|---|---|---|---|
| **Inhalation of Airborne Contaminants** | TLV: Threshold Limit Value | One of three categories of chemical exposure levels, defined as follows: | |
| | TLV-TWA: Threshold Limit Value-Time- Weighted Average | The time-weighted average concentration for a normal 8-hour workday and a 40-hour work week, to which nearly all workers may be repeatedly exposed without adverse effect. Should be used as an exposure guide rather than an absolute threshold. | ACGIH |
| | TLV-STEL: Threshold Limit Value-Short-Term Exposure Limit | A 15-minute time-weighted average exposure that should not be exceeded at any time during the workday. | ACGIH |
| | TLV-C: Threshold Limit Value-Ceiling | The concentration that should not be exceeded, even instantaneously. | ACGIH |
| | PEL: Permissible Exposure Limit | Time-weighted average and ceiling concentrations similar to (and in many cases derived from) the threshold limit values published in 1968. | OSHA |
| | REL: Recommended Exposure Limit | Time-weighted averages and ceiling concentrations based on NIOSH evaluations. | NIOSH |
| | Immediately Dangerous to Life or Health | The maximum level from which a worker could escape without any escape-impairing symptoms or any irreversible health effects. | NIOSH |
| **Dermal Absorption of Chemicals through Airborne or Direct Contact** | Designation “skin” | The designation “skin” in the ACGIH, OSHA, and NIOSH references indicates that a substance may be readily absorbed through the intact skin; however, it is not a threshold for safe exposure. Direct contact with a substance designated “skin” should be avoided. | ACGIH /OSHA /NIOSH |
| **Dermal Irritation** | | Many substances irritate skin. Consult standard references. | |
| **Carcinogens** | TLV: Threshold Limit Value | Some carcinogens have an assigned TLV. | ACGIH |

| Hazard | Guideline | Explanation | Sources for Values |
|---|---|---|---|
| | PEL: Permissible Exposure Limit | OSHA has individual standards for some specific carcinogens. | OSHA |
| | REL: Recommended Exposure Limit | NIOSH makes recommendations regarding exposures to carcinogens. | NIOSH |



Did You Know? The project HASP will have important information relating to the chemicals of concern at a project site. Arcadis Standard ARC HSIH004 "Ionizing Radiation" includes requirements and recommendations for use when working around ionizing radioactive sources.

## 5.9 Scientific SCUBA Diving

Scientific SCUBA diving may be used as a field sampling method to collect sediments, organisms, or information on submerged habitats, or document underwater features (e.g., photography, videography, cartography). When considering scientific diving as a data collection method, several unique H&S issues must be considered. The Arcadis Scientific Diving Program (ASDP), and the Diving Control Board (DCB) which oversees ASDP operations, provide a framework that brings Arcadis's companywide attention to safety of the dynamic environments and hazards unique to working underwater.

The Arcadis DCB consists of experienced scientific divers and H&S specialists familiar with scientific SCUBA diving who are responsible for developing requirements and procedures for scientific diving work done at Arcadis. The DCB maintains a Diving Safety Manual (DSM) that establishes the organization of the ASDP; dictates standards for training, medical monitoring and equipment; and presents general diving procedures. The DCB evaluates potential risks and develops a strategy to safely complete scientific diving operations for Arcadis projects. Once approved by the DCB, a project involving scientific diving is carried out by qualified Arcadis workers enrolled in the ASDP.

Some general considerations and safety procedures for scientific SCUBA diving follow. All Arcadis scientific diving projects must:

- Be cleared by the DCB and carried out by members of the ASDP;

- Have a site-specific dive plan approved by the Diving Safety Officer;
- Have a safety diver ready to enter the water when diving operations are underway;
- Prepare JSAs specific to facilities and conditions onsite; and,
- Conduct a walk-through of diver rescue procedures prior to beginning work

All workers diving for Arcadis will meet the following requirements:

- Arcadis employees will be enrolled in the ASDP
- Have a diving certification from an internationally recognized dive training organization;
- Complete a physical exam specific to the Arcadis Scientific Diving Program;
- Complete in-water checkout procedures outlined in the DSM and observed by a member of the DCB;
- Be approved by the DCB;
- Maintain current first aid, CPR and AED training; and,
- Maintain a dive log of all work-related diving activity.

The minimum diving and safety-related equipment required at scientific diving project sites includes:

- Standard SCUBA gear, certified by a qualified technician with the last 12 months;
- Full face masks with communication capabilities, certified by a qualified technician;
- A cutting device for each diver (EMT shears, blunt-tipped knife with hard sheath) with lock-out/tag-out procedure (if necessary);
- DOT & CGA-compliant SCUBA cylinders containing a breathing matrix meeting CGA Grade E standards;
- Carbon monoxide test kit for SCUBA cylinders;
- First-aid kit;
- Automated external defibrillator; and,
- Emergency oxygen kit (at least one member of team must be trained in emergency oxygen administration)

## 5.9.1 Diving Procedures

The following general procedures have been established for scientific diving projects conducted by Arcadis:

- Before each dive, conduct a pre-dive briefing presenting tasks, hazards, anticipated depth and duration of the dive, and review the dive plan;
- Always maintain the buddy system (i.e., two divers in visual, voice, or physical contact);

- Follow site-specific JSAs (e.g., entering/exiting the water, donning/doffing gear, scientific diving);
- Before entering the water, perform a pre-dive buddy check (i.e., tank pressure, gear, and physical and mental state);
- Follow safe descent and ascent procedures;
- Maintain communications with dive buddy (and surface tender when using communications equipment); and,
- Conduct post-dive debriefing; review dive and identify new/unanticipated hazards; develop controls prior to next dive.

## 5.9.2 Emergency Preparedness

H&S procedures for scientific diving require a thorough hazard assessment of site and water conditions. The examples listed below represent a fraction of the procedures governing safe diving practices:

- Everyone has STOP WORK authority;
- A safety diver will be on standby when divers are in the water;
- A site-specific Diver Rescue JSA must be developed, and diver rescue drills conducted onsite to refine the JSA (at least one drill per field event);
- An emergency response plan must be developed that includes the nearest decompression chamber capable of treating decompression injuries and a transport plan.
- In most cases, notification of diving activities should be provided to local emergency responders to facilitate a coordinated response effort.

Project-specific requirements will be developed by the project team in conjunction with the DCB, and documented in the HASP and site-specific dive plan, where appropriate. The ASDP operates under the Guidelines for Scientific Diving, established by OSHA (29CFR1910 Subpart T Appendix B), and is not qualified or insured to operate as a commercial diving program. Commercial diving firms are subcontracted on Arcadis projects requiring commercial diving. On these projects, the DCB will serve as the diving safety reviewer on the subcontractor's dive plan and the site-specific HASP (at a minimum). Please engage the DCB on Arcadis projects with a commercial diving component.

More information on the ASDP, procedures for bringing a project to the DCB for review, the DSM, and representative project examples are available from the Dive Control Board. For more information, please contact the Arcadis Corporate H&S Department (anacorphs@arcadis.com) to be connected with the appropriate member(s) of the Dive Control Board.

# 5.10 Oil and Gas Sector Work

All work on oil and gas project sites requires detailed HASPs and may require specific client training or site training by the client. Depending on the job requirements and tasks performed, workers may be exposed to other hazards as presented in this handbook (e.g. PSM, Water Operations Work). In addition, special PPE may be required, including the use of flame-retardant clothing and protective footwear. COCs are site dependent, but often include benzene (possibly requiring special training and industrial hygiene monitoring) and hydrogen sulfide. Before work is conducted on oil and gas sector work, a detailed HASP must be developed and approved, and client requirements must be met.

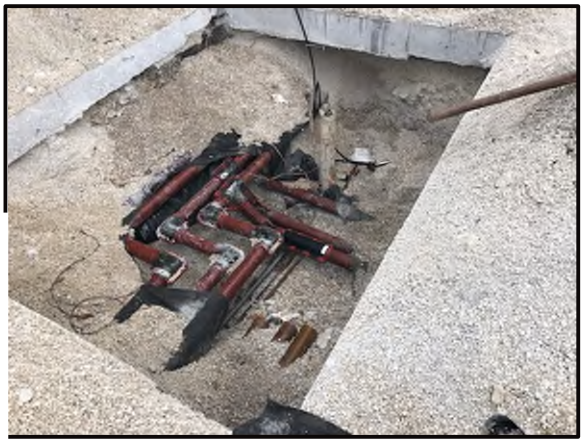
## 5.10.1 Retail Petroleum Sites

Work for oil and gas clients often involves various activities at current and abandoned retail petroleum sites. Workers are often exposed to a high volume of motor vehicle traffic, which presents an elevated risk of being struck. Establishing a safe work zone is critical. The project team must be diligent in preparing an adequate TSP based upon site conditions. Utilizing work vehicles as barricades in heavy traffic flow conditions is often warranted.



Did You Know? Arcadis Standard ARC HSIH003 “Benzene” includes requirements and recommendations for use when working around benzene. Arcadis Standard ARC HSIH007 “Hydrogen Sulfide” includes requirements and recommendations for use when working around hydrogen sulfide.

Underground and overhead utilities must be considered when completing work at retail petroleum sites. Prior to performing intrusive work, teams must complete the Utilities Clearance Checklist, found in the Arcadis Health and Safety Standard ARC HSFS019 “Utility Location and Clearance”. See Section 3.36.2 Product Lines and Underground Storage Tanks for additional information.



Pea gravel is often used in trenches containing petroleum product piping. Piping networks are often located near or between product dispensers and/or underground storage tanks. If pea gravel is encountered during intrusive work, always Stop Work to determine if product piping is present.

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**Attachment F**
SDSs

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

**Printing date:** 31.12.2013 **Revision:** 31.12.2013

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

· **1.1 Product identifier**

· **Trade name: ALCONOX**

· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.

· **Application of the substance / the mixture:** Cleaning material/ Detergent

· **1.3 Details of the supplier of the Safety Data Sheet**

· **Manufacturer/Supplier:**
Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040

· **Further information obtainable from:** Product Safety Department

· **1.4 Emergency telephone number:**
ChemTel Inc.
(800)255-3924, +1 (813)248-0585

## 2 Hazards identification

· **2.1 Classification of the substance or mixture**

· **Classification according to Regulation (EC) No 1272/2008**



GHS05 corrosion

Eye Dam. 1; H318: Causes serious eye damage.



GHS07

Skin Irrit. 2; H315: Causes skin irritation.

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



**Xi; Irritant**

R38-41: Irritating to skin. Risk of serious damage to eyes.

· **Information concerning particular hazards for human and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

· **Classification system:**
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.
The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

· **2.2 Label elements**

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

(Contd. on page 2)

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

**Printing date:** 31.12.2013 **Revision:** 31.12.2013

**Trade name: ALCONOX**

(Contd. of page 1)

· **Hazard pictograms**



GHS05

· **Signal word:** Danger

· **Hazard-determining components of labelling:**
sodium dodecylbenzene sulfonate
· **Hazard statements**
H315: Causes skin irritation.
H318: Causes serious eye damage.
· **Precautionary statements**
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P264: Wash thoroughly after handling.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310: Immediately call a POISON CENTER or doctor/physician.
P321: Specific treatment (see on this label).
P362: Take off contaminated clothing and wash before reuse.
P332+P313: If skin irritation occurs: Get medical advice/attention.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
· **Hazard description:**
· **WHMIS-symbols:**
D2B - Toxic material causing other toxic effects



· **NFPA ratings (scale 0 - 4)**




Health = 1
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**




Health = 1
Fire = 0
Reactivity = 0

| · **HMIS Long Term Health Hazard Substances** |
|---|
| None of the ingredients is listed. |

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

(Contd. on page 3)

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

**Printing date:** 31.12.2013 **Revision:** 31.12.2013

**Trade name: ALCONOX**

(Contd. of page 2)

## 3 Composition/information on ingredients

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

· **Dangerous components:**

| | | |
|---|---|---|
| CAS: 68081-81-2 | sodium dodecylbenzene sulfonate<br>Xn R22; Xi R36<br>Acute Tox. 4, H302; Eye Irrit. 2, H319 | 10-25% |
| CAS: 497-19-8<br>EINECS: 207-838-8<br>Index number: 011-005-00-2 | Sodium Carbonate<br>Xi R36<br>Eye Irrit. 2, H319 | 2,5-10% |
| CAS: 7722-88-5<br>EINECS: 231-767-1 | tetrasodium pyrophosphate<br>substance with a Community workplace exposure limit | 2,5-10% |
| CAS: 151-21-3<br>EINECS: 205-788-1 | sodium dodecyl sulphate<br>Xn R21/22; Xi R36/38<br>Acute Tox. 4, H302; Acute Tox. 4, H312; Skin Irrit. 2, H315; Eye Irrit. 2, H319 | 2,5-10% |

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

## 4 First aid measures

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

## 5 Firefighting measures

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:**
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

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· **5.2 Special hazards arising from the substance or mixture:** No further relevant information available.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
· **Additional information:** No further relevant information available.

## 6 Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures**
Product forms slippery surface when combined with water.
· **6.2 Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **6.3 Methods and material for containment and cleaning up:**
Pick up mechanically.
Clean the affected area carefully; suitable cleaners are:
Warm water
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

## 7 Handling and storage

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

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

## 8 Exposure controls/personal protection

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

· **8.1 Control parameters**

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

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

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the skin.
Avoid contact with the eyes and skin.
· **Respiratory protection:**
Not required under normal conditions of use.
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.
· **Protection of hands:**


Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
· **Material of gloves**
Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber, NR
Neoprene gloves
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**


Safety glasses

· **Body protection:** Protective work clothing

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## 9 Physical and chemical properties

| | |
|---|---|
| · **9.1 Information on basic physical and chemical properties** | |
| · **General Information** | |
| · **Appearance:** | |
| **Form:** | Powder |
| **Colour:** | White |
| · **Odour:** | Odourless |
| · **Odour threshold:** | Not determined. |
| · **pH-value (10 g/l) at 20 °C:** | 9,5 (- NA for Powder form) |
| · **Change in condition** | |
| **Melting point/Melting range:** | Not Determined. |
| **Boiling point/Boiling range:** | Undetermined. |
| · **Flash point:** | Not applicable. |
| · **Flammability (solid, gaseous):** | Not determined. |
| · **Ignition temperature:** | |
| **Decomposition temperature:** | Not determined. |
| · **Self-igniting:** | Product is not self-igniting. |
| · **Danger of explosion:** | Product does not present an explosion hazard. |
| · **Explosion limits:** | |
| **Lower:** | Not determined. |
| **Upper:** | Not determined. |
| · **Vapour pressure:** | Not applicable. |
| · **Density at 20 °C:** | 1,1 g/cm³ |
| · **Relative density** | Not determined. |
| · **Vapour density** | Not applicable. |
| · **Evaporation rate** | Not applicable. |
| · **Solubility in / Miscibility with water:** | Soluble. |
| · **Partition coefficient (n-octanol/water):** | Not determined. |
| · **Viscosity:** | |
| **Dynamic:** | Not applicable. |
| **Kinematic:** | Not applicable. |
| · **Solvent content:** | |
| **Organic solvents:** | 0,0 % |
| **Solids content:** | 100 % |
| · **9.2 Other information** | No further relevant information available. |

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## 10 Stability and reactivity

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

## 11 Toxicological information

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

## 12 Ecological information

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

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· **vPvB:** Not applicable.
· **12.6 Other adverse effects:** No further relevant information available.

## 13 Disposal considerations

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

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

## 14 Transport information

| | |
|---|---|
| · **14.1 UN-Number**<br>· **DOT, ADR, IMDG, IATA, ICAO** | Not Regulated |
| · **14.2 UN proper shipping name**<br>· **DOT, ADR, IMDG, IATA, ICAO** | Not Regulated |
| · **14.3 Transport hazard class(es)**<br>· **DOT, ADR, IMDG, IATA, ICAO**<br>· **Class** | Not Regulated |
| · **14.4 Packing group**<br>· **DOT, ADR, IMDG, IATA, ICAO** | Not Regulated |
| · **14.5 Environmental hazards:**<br>· **Marine pollutant:** | No |
| · **14.6 Special precautions for user** | Not applicable. |
| · **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code** | Not applicable. |
| · **UN "Model Regulation":** | Not Regulated |

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## 15 Regulatory information

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

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

· **Proposition 65 (California):**

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

· **Carcinogenic Categories**

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

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· **Canada**

| · **Canadian Domestic Substances List (DSL)** | |
|---|---|
| All ingredients are listed. | |
| · **Canadian Ingredient Disclosure list (limit 0.1%)** | |
| None of the ingredients is listed. | |
| · **Canadian Ingredient Disclosure list (limit 1%)** | |
| 497-19-8 | Sodium Carbonate |
| 7722-88-5 | tetrasodium pyrophosphate |
| 151-21-3 | sodium dodecyl sulphate |

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

## 16 Other information

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

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

R21/22: Harmful in contact with skin and if swallowed.
R22: Harmful if swallowed.
R36: Irritating to eyes.
R36/38: Irritating to eyes and skin.

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

*Material Safety Data Sheet Collection*
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**Hydrochloric Acid**
**HYD2200**

## Section 1 - Chemical Product and Company Identification 61

**Material Name:** Hydrochloric Acid **CAS Number:** 7647-01-0
**Chemical Formula:** ClH
**Structural Chemical Formula:** HCl
**EINECS Number:** 231-595-7
**ACX Number:** X1002202-3
**Synonyms:** 4-D BOWL SANITIZER; ACIDE CHLORHYDRIQUE; ACIDO CLORHIDRICO; ACIDO CLORIDRICO; ANHYDROUS HYDROCHLORIC ACID; ANHYDROUS HYDROGEN CHLORIDE; AQUEOUS HYDROGEN CHLORIDE; BOWL CLEANER; CHLOORWATERSTOF; CHLOROHYDRIC ACID; CHLOROWODOR; CHLORURE D'HYDROGENE; CHLORURE D'HYDROGENE ANHYDRE; CHLORURO DE HIDROGENO; CHLORWASSERSTOFF; CLORURO DE HIDROGENO ANHIDRO; EMULSION BOWL CLEANER; EPA PESTICIDE CHEMICAL CODE 045901; HYDROCHLORIC ACID; HYDROCHLORIC ACID GAS; HYDROCHLORIDE; HYDROGEN CHLORIDE; HYDROGEN CHLORIDE (HCL); HYGEIA CREME MAGIC BOWL CLEANER; MURIATIC ACID; MURIATIC ACID); NOW SOUTH SAFTI-SOL BRAND CONCENTRATED BOWL CLEANSE WITHMAGIC ACTIO; PERCLEEN BOWL AND URINAL CLEANER; SPIRITS OF SALT; VARLEY'S OCEAN BLUE SCENTED TOILET BOWL CLEANER; VARLEY POLY-PAK BOWL CREME; WHITE EMULSION BOWL CLEANER; WUEST BOWL CLEANER SUPER CONCENTRATED
**General Use:** Hydrogen chloride is used to produce pharmaceutical hydrochlorides; vinyl chloride from acetylene; alkyl chlorides from olefins and arsenious chloride from arsenious oxide; electronic grade for etching semiconductor crystals. Used in the chlorination of rubber; in organic reactions involving isomerization, polymerization and alkylation; as a catalyst and condensing agent; for making chlorine where economical; in the separation of cotton from wool and cotton de-linting; as flux in the babbitt type of metal alloy; etching semi-conductor crystals.
Hydrochloric acid is used for pickling and heavy duty cleaning of metal parts; rust and scale removal. The production of chlorides; neutralizing bases; a laboratory reagent. For hydrolyzing starch and proteins in preparations for food. As a catalyst and solvent in organic synthesis. As "spirits of salts" for cleaning of lime and masonry from new brickwork. As flux or flux component for soldering; manufacture of "killed spirits".

## Section 2 - Composition / Information on Ingredients

| Name | CAS | % |
|---|---|---|
| hydrogen chloride | 7647-01-0 | > 99.0 |

**OSHA PEL**
Ceiling: 5 ppm, 7 mg/m$^3$.

**NIOSH REL**
Ceiling: 5 ppm (7 mg/m$^3$).

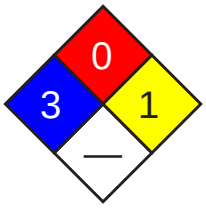
**DFG (Germany) MAK**
TWA: 5 ppm; PEAK: 5 ppm.

**ACGIH TLV**
Ceiling: 2 ppm.

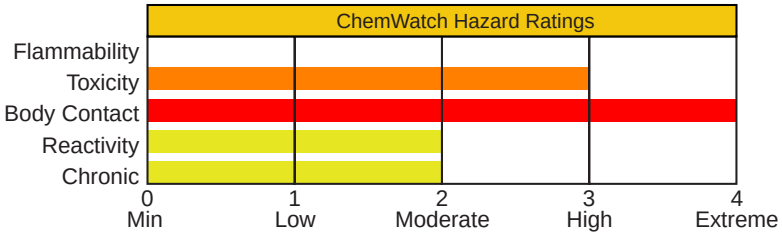
**IDLH Level**
50 ppm.

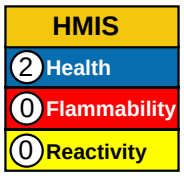
**EU OEL**
TWA: 5 ppm; STEL: 10 ppm.

## Section 3 - Hazards Identification



Fire Diamond




**ANSI Signal Word**

**Danger!**


Corrosive Compressed Gas

### ☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; characteristic suffocating, pungent odor. Corrosive. Stored as compressed gas which may cause frostbite. Chronic Effects: erosion of teeth.

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## Potential Health Effects

**Target Organs:** eyes, skin, respiratory system, liver (in animals)
**Primary Entry Routes:** inhalation, skin contact, eye contact
**Acute Effects**

**Inhalation:** The vapor is extremely discomforting to the upper respiratory tract, may cause severe mucous membrane damage and may be harmful if inhaled.
Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary edema.
A single severe exposure may cause coughing and choking; bleeding of nose, inflammation and occasionally ulceration of the nose, throat and larynx. Fluid on the lungs followed by generalized lung damage may follow.
Breathing of vapor may aggravate asthma and inflammatory or fibrotic pulmonary disease.
High concentrations cause necrosis of the tracheal and bronchial epithelium, pulmonary edema, atelectasis and emphysema and damage to the pulmonary blood vessels and liver.
Inhalation hazard is increased at higher temperatures.
The vapor from heated material is extremely discomforting to the upper respiratory tract and lungs if inhaled.
Continued severe exposure can result in pulmonary edema and corrosion of tissues in the nose and throat.

**Eye:** Hydrogen Chloride: The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Hydrochloric Acid: Eye contact is extremely painful and may cause rapid corneal damage. The liquid is extremely corrosive to the eyes and is capable of causing severe damage with loss of sight.
The vapor is highly discomforting and may be corrosive to the eyes. The vapor from heated material is extremely discomforting to the eyes.

**Skin:** The material is corrosive to the skin and may cause chemical burns.
Toxic effects may result from skin absorption. Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.
The vapor is discomforting to the skin.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.
The liquid is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal if swallowed in quantity. Ingestion may result in nausea, abdominal irritation, pain and vomiting.

**Carcinogenicity:** NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Chronic exposure may cause discoloration or erosion of the teeth, bleeding of the nose and gums; and ulceration of the nasal mucous membranes.
Repeated exposures of animals to concentrations of about 34 ppm produced no immediate toxic effects.
Workers exposed to hydrochloric acid suffered from gastritis and a number of cases of chronic bronchitis have also been reported.
Repeated or prolonged exposure to dilute solutions may cause dermatitis. Repeated exposure to low vapor concentrations can cause skin tenderness, bleeding of the nose and gums, chronic bronchitis, gastritis.

## Section 4 - First Aid Measures




**Inhalation:** Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

**Ingestion:** Contact a Poison Control Center. Rinse mouth out with plenty of water. Do NOT induce vomiting. Give a glass of water.

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

**Note to Physicians:** For acute or short-term repeated exposures to strong acids:
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

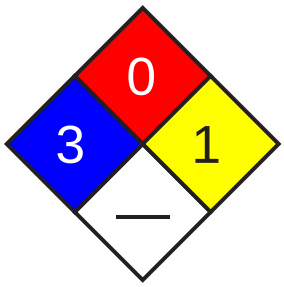
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3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.
INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.
SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.
EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

## Section 5 - Fire-Fighting Measures

**Flash Point:** Nonflammable
**Autoignition Temperature:** Not applicable
**LEL:** Not applicable
**UEL:** Not applicable
**Extinguishing Media:** Water spray or fog; foam; Bromochlorodifluoromethane (BCF) (where regulations permit); Dry agent; Carbon dioxide.

See DOT ERG



Fire Diamond

**General Fire Hazards/Hazardous Combustion Products:** Noncombustible liquid. Will not burn, but heat produces highly toxic fumes/vapors.
Heating may cause expansion or decomposition leading to violent rupture of containers. Decomposes on heating and produces toxic fumes of hydrogen chloride. Decomposition may produce toxic fumes of chlorine.
Reacts with metals producing flammable/explosive hydrogen gas. Contact with moisture or water may generate heat causing ignition. Reacts vigorously with alkalis. Moderate fire hazard when in contact with reducing agents.
**Fire Incompatibility:** Reacts with metals producing flammable/explosive hydrogen gas.
Avoid reactions with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate, unsaturated organics, metal acetylides, sulphuric acid.
Note: Compatibility with plastics should be confirmed prior to use.
**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Cool fire-exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire. Equipment should be thoroughly decontaminated after use. Water spray or fog may be used to disperse vapor. Do not approach cylinders suspected to be hot. If safe to do so, stop flow of gas.

## Section 6 - Accidental Release Measures

**Small Spills:** DO NOT touch the spill material. Clean up all spills immediately. Wear fully protective PVC clothing and breathing apparatus. Contain and absorb spill with sand, earth, inert material or vermiculite. Use soda ash or slaked lime to neutralize. Collect residues and place in labeled plastic containers with vented lids. Clear area of personnel and move upwind. Avoid breathing vapors and contact with skin and eyes. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Water spray or fog may be used to disperse vapor.

See DOT ERG

**Large Spills:** Contact fire department and tell them location and nature of hazard. Clear area of personnel and move upwind. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Stop leak if safe to do so. Remove leaking cylinders to a safe place if possible. Release pressure under safe, controlled conditions by opening the valve. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Shut off all possible sources of ignition and increase ventilation. Water spray or fog may be used to disperse vapor. Use soda ash or slaked lime to neutralize.
Collect and seal in labeled drums for disposal. Wash spill area with large quantities of water. If contamination of

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drains or waterways occurs, advise emergency services. After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing. DO NOT touch the spill material. Contain and absorb spill with sand, earth, inert material or vermiculite.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist and vapor, breathing vapors and contact with skin and eyes.
Avoid physical damage to containers. Use in a well-ventilated area. Wear protective clothing and gloves when handling containers. Handle and open container with care.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Local exhaust ventilation may be required for safe working, i.e. to keep exposures below required standards; otherwise, PPE is required.
Keep dry. Reacts violently with water.
Transport containers on a trolley. Avoid sources of heat. DO NOT transfer gas from one cylinder to another.

**Recommended Storage Methods:** Packaging as recommended by manufacturer. Check that containers are clearly labeled.
Cylinder. Ensure the use of equipment rated for cylinder pressure. Ensure the use of compatible materials of construction. Valve protection cap to be in place until cylinder is secured, connected. Cylinder must be properly secured either in use or in storage. Cylinder valve must be closed when not in use or when empty. Segregate full from empty cylinders. WARNING: Suckback into cylinder may result in rupture. Use back-flow preventive device in piping.
Hydrochloric acid: Packs of 2.5 litres or less require a child-resistant closure. Glass container or Plastic carboy or Polylined drum.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** If risk of overexposure exists, wear air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
If risk of inhalation or overexposure exists, wear NIOSH-approved respirator or work in fume hood. Hydrogen chloride vapors will not be adequately absorbed by organic vapor respirators.

**Personal Protective Clothing/Equipment:**

**Eyes:** Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Neoprene gloves; rubber gloves. Nitrile gloves.
Safety footwear. Rubber boots.
Hydrochloric acid: Barrier cream and Neoprene gloves or Elbow length PVC gloves. Nitrile gloves.
PVC boots or PVC safety gumboots.

**Respiratory Protection:**
Exposure Range >5 to <50 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 50 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: white

**Other:** Ensure there is ready access to a safety shower; Eyewash unit.
Acid-resistant overalls. Full protective suit. Operators should be trained in procedures for safe use of this material.

**Glove Selection Index:**

BUTYL ..... Best selection
BUTYL/NEOPRENE ..... Best selection
HYPALON ..... Best selection
NEOPRENE..... Best selection
NEOPRENE/NATURAL..... Best selection
NITRILE+PVC ..... Best selection
PE/EVAL/PE ..... Best selection
SARANEX-23 ..... Best selection
VITON/NEOPRENE ..... Best selection
PVC..... Best selection

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NITRILE ..... Best selection
NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
NAT+NEOPR+NITRILE ..... Poor to dangerous choice for other than short-term immersion

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Hydrogen chloride: Colorless, corrosive gas. Pungent suffocating odor. White fumes in moist air. Soluble in methanol, ethanol, ether and benzene.
Hydrochloric acid: Clear to light yellow (orange tint for inhibited grades) fuming corrosive liquid with sharp, suffocating odor.

**Physical State:** Hydrogen chloride: Compressed gas; Hydrochloric acid: Liquid
**Odor Threshold:** 0.26 to 0.3 ppm
**Vapor Pressure (kPa):** < 24.8 at 25 °C
**Vapor Density (Air=1):** 1.268 at 20 °C
**Formula Weight:** 36.461
**Specific Gravity ($H_2O$=1, at 4 °C):** < 1.19 at 20 °C
**Evaporation Rate:** Slow

**pH:** Hydrochloric acid: < 1
**Boiling Point:** -85 °C (-121 °F)
**Freezing/Melting Point:** -114.44 °C (-173.992 °F)
**Volatile Component (% Vol):** 100
**Decomposition Temperature (°C):** Not applicable
**Water Solubility:** 56.1 g/100 cc hot water at 60 °C

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Decomposes in the presence of moisture to produce corrosive acid. May generate sufficient heat to ignite combustible materials. Presence of heat source and direct sunlight (ultra-violet radiation). Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.
**Storage Incompatibilities:** Hydrogen chloride: Segregate from most common metals and their alloys, alkalis, unsaturated organics, fluorine, metal carbides, metal acetylides, potassium permanganate and sulfuric acid. Compatibility with plastics should be confirmed prior to use.
Hydrochloric acid: Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates. Avoid storage with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate. Reacts with zinc, brass, galvanized iron, aluminum, copper and copper alloys.

## Section 11 - Toxicological Information

**Toxicity**
Inhalation (human) $LC_{Lo}$: 1300 ppm/30 m
Inhalation (human) $LC_{Lo}$: 3000 ppm/5 m
Inhalation (rat) $LC_{50}$: 3124 ppm/60 m
Inhalation (rat) $LC_{50}$: 4701 ppm/30 m
Oral (rat) $LD_{50}$: 900 mg/kg

**Irritation**
Eye (rabbit): 5 mg/30 s - mild

See *RTECS* MW 4025000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** No data found.
**Ecotoxicity:** $TL_m$ Gambusia affinis (mosquito fish) 282 ppm/96 hr (fresh water) /Conditions of bioassay not specified; Lethal Lepomis macrochirus (bluegill sunfish) 3.6 mg/l/48 hr /Conditions of bioassay not specified; $LC_{50}$ Cockle 330 to 1,000 mg/l/48 hr /Conditions of bioassay not specified; $LC_{50}$ Carassius auratus (goldfish) 178 mg/l (1 to 2 hr survival time) /Conditions of bioassay not specified; $LC_{50}$ Shore crab 240 mg/l/48 hr /Conditions of bioassay not specified; $LC_{50}$ Shrimp 100 to 330 ppm/48 hr (salt water) /Conditions of bioassay not specified; $LC_{100}$ Trout 10 mg/l 24 hr /Conditions of bioassay not specified
**Biochemical Oxygen Demand (BOD):** none

## Section 13 - Disposal Considerations

**Disposal:** Recycle wherever possible. Consult manufacturer for recycling options. Treat and neutralize at an effluent treatment plant. Bury residue in an authorized landfill. Decontaminate empty containers with a lime slurry. Return empty containers to supplier or bury empty containers at an authorized landfill.
Return empty cylinders to supplier.

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## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Note:** This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

**Shipping Name and Description:** Hydrogen chloride, anhydrous
**ID:** UN1050
**Hazard Class:** 2.3 - Poisonous gas
**Packing Group:**
**Symbols:**
**Label Codes:** 2.3 - Poison Gas, 8 - Corrosive
**Special Provisions:** 3
**Packaging:** **Exceptions:** None **Non-bulk:** 304 **Bulk:** None
**Quantity Limitations:** **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** Forbidden
**Vessel Stowage:** **Location:** D **Other:** 40




**Shipping Name and Description:** Hydrochloric acid
**ID:** UN1789
**Hazard Class:** 8 - Corrosive material
**Packing Group:** II - Medium Danger
**Symbols:**
**Label Codes:** 8 - Corrosive
**Special Provisions:** A3, A6, B3, B15, IB2, N41, T8, TP2, TP12
**Packaging:** **Exceptions:** 154 **Non-bulk:** 202 **Bulk:** 242
**Quantity Limitations:** **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 30 L
**Vessel Stowage:** **Location:** C **Other:**




**Shipping Name and Description:** Hydrochloric acid
**ID:** UN1789
**Hazard Class:** 8 - Corrosive material
**Packing Group:** III - Minor Danger
**Symbols:**
**Label Codes:** 8 - Corrosive
**Special Provisions:** IB3, T4, TP1, TP12
**Packaging:** **Exceptions:** 154 **Non-bulk:** 203 **Bulk:** 241
**Quantity Limitations:** **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
**Vessel Stowage:** **Location:** C **Other:**




## Section 15 - Regulatory Information

**EPA Regulations:**

**RCRA 40 CFR:** Not listed
**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 5000 lb (2268 kg)
**SARA 40 CFR 372.65:** Listed
**SARA EHS 40 CFR 355:** Listed
**RQ:** 5000 lb
**TPQ:** 500 lb
**TSCA:** Listed

## Section 16 - Other Information

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*Material Safety Data Sheet Collection*
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## Section 1 - Chemical Product and Company Identification 61

**Material Name:** Nitric Acid **CAS Number:** 7697-37-2
**Chemical Formula:** $HNO_3$
**Structural Chemical Formula:** $HNO_3$
**EINECS Number:** 231-714-2
**ACX Number:** X1002177-5
**Synonyms:** ACIDE NITRIQUE; ACIDO NITRICO; AQUA FORTIS; AZOTIC ACID; AZOTOWY KWAS; ENGRAVER'S ACID; ENGRAVERS ACID; HYDROGEN NITRATE; KYSELINA DUSICNE; NITAL; NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH >70% NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH NOT >70% NITRICACID; NITROUS FUMES; NITRYL HYDROXIDE; RED FUMING NITRIC ACID (RFNA); SALPETERSAURE; SALPETERZUUROPLOSSINGEN; WHITE FUMING NITRIC ACID (WFNA)
**General Use:** Manufacture of organic and inorganic nitrates and nitro compounds for fertilizers, dye intermediates and many organic chemicals.
Used for etching and cleaning metals.
Operators should be trained in procedures for safe use of this material.

## Section 2 - Composition / Information on Ingredients

| Name | CAS | % |
|---|---|---|
| nitric acid | 7697-37-2 | >95 |

**OSHA PEL**
TWA: 2 ppm; 5 mg/m$^3$.

**ACGIH TLV**
TWA: 2 ppm; STEL: 4 ppm.

**EU OEL**
STEL: 2.6 mg/m$^3$ (1 ppm).

**NIOSH REL**
TWA: 2 ppm (5 mg/m$^3$); STEL: 4 ppm (10 mg/m$^3$).

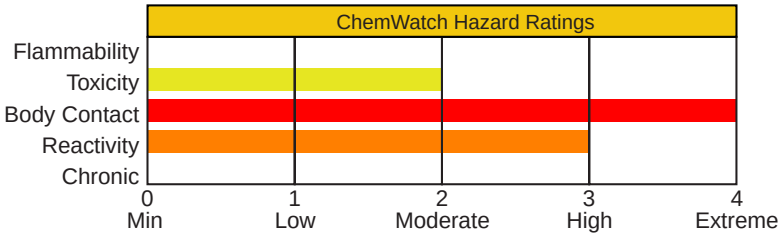
**IDLH Level**
25 ppm.

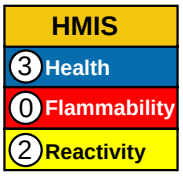
**DFG (Germany) MAK**
TWA: 2 ppm; PEAK: 2 ppm.

## Section 3 - Hazards Identification



Fire Diamond




**ANSI Signal Word**

**Danger!**


Corrosive

### ☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear to yellow fuming liquid; acrid, suffocating odor. Corrosive. Other Acute Effects: lung damage. Chronic Effects: tooth erosion, bronchitis. Strong oxidizer.

### Potential Health Effects

**Target Organs:** eyes, skin, respiratory system, teeth
**Primary Entry Routes:** inhalation, ingestion, skin contact, eye contact
**Acute Effects**
**Inhalation:** The vapor is extremely discomforting and corrosive to the upper respiratory tract and lungs and the material presents a hazard from a single acute exposure or from repeated exposures over long periods.
Inhalation hazard is increased at higher temperatures.
Reactions may occur following a single acute exposure or may only appear after repeated exposures.

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Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later.
The material may produce respiratory tract irritation which produces an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Unlike most organs the lung can respond to a chemical insult or agent by first trying to remove or neutralize the irritant and then repairing the damage. The repair process, which initially developed to protect mammalian lungs from foreign matter and antigens, may however, cause further damage the lungs when activated by hazardous chemicals. The result is often the impairment of gas exchange, the primary function of the lungs.
Inhalation of nitric acid mist or fumes at 2 to 25 ppm over an 8 hour period may cause pulmonary irritation and symptoms of lung damage.
Only several minutes of exposure to concentrated atmosphere i.e. 200 ppm may cause severe pulmonary damage and even fatality. Death may be delayed for several days.
Exposure to nitric acid fumes (with concurrent inhalation of nitrogen dioxide and nitric oxide) may elicit prompt irritation of the upper respiratory tract leading to coughing, gagging, chest pain, dyspnea, cyanosis if concentrations are sufficiently high and duration of exposure sufficiently long, pulmonary edema.

**Eye:** The liquid is extremely corrosive to the eyes and contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.
The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis.
Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The material may produce moderate eye irritation leading to inflammation.
Repeated or prolonged exposure to irritants may produce conjunctivitis.
Eye contact with concentrated acid may give no pain, whilst diluted solution causes intense pain and both can cause permanent eye damage or blindness. Burns may result in shrinkage of the eyeball, symblepharon (adhesions between tarsal and bulbar conjunctivae), permanent corneal opacification, and visual impairment leading to blindness.

**Skin:** The liquid is extremely corrosive to the skin and contact may cause tissue destruction with severe burns.
Bare unprotected skin should not be exposed to this material.
The vapor is highly discomforting to the skin.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.
Skin contact causes yellow discoloration of the skin, blisters and scars that may not heal. The skin may be stained bright-yellow or yellowish brown due to the formation of xanthoproteic acid. Dilute solutions may harden the epithelium without producing overt corrosion.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.
The material is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal.
Even a small amount causes severe corrosion of the stomach, burning pain, vomiting and shock, possibly causing non-healing scarring of the gastrointestinal tract and stomach. Death may be delayed 12 hours to 14 days or to several months. Such late fatalities are attributed to a chemical lobular pneumonitis secondary to aspiration. Survivors show stricture of the gastric mucosa and subsequent pernicious anemia.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Prolonged or repeated overexposure to low concentrations of vapor may cause chronic bronchitis, corrosion of teeth, even chemical pneumonitis.

## Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.




**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Immediately transport to hospital or doctor. DO NOT delay.

**Skin Contact:** Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor. DO NOT delay.

**Ingestion:** Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.
Immediately transport to hospital or doctor. DO NOT delay.

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

**Note to Physicians:** For acute or short-term repeated exposures to strong acids:

1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

INGESTION:

1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:

1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.

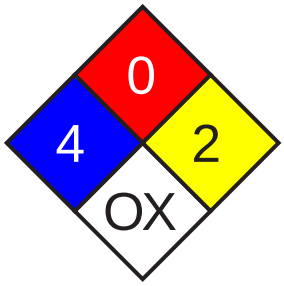
EYE:

1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

## Section 5 - Fire-Fighting Measures

**Flash Point:** Nonflammable
**Autoignition Temperature:** Not applicable
**LEL:** Not applicable
**UEL:** Not applicable
**Extinguishing Media:** Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.

See DOT ERG



Fire Diamond

**General Fire Hazards/Hazardous Combustion Products:** Will not burn but increases intensity of fire.
Heating may cause expansion or decomposition leading to violent rupture of containers.
Heat affected containers remain hazardous.
Contact with combustibles such as wood, paper, oil or finely divided metal may cause ignition, combustion or violent decomposition.
May emit irritating, poisonous or corrosive fumes.
Decomposes on heating and produces toxic fumes of nitrogen oxides ($NO_x$) and nitric acid.

**Fire Incompatibility:** Oxidizing agents as a class are not necessarily combustible themselves, but can increase the risk and intensity of fire in many other substances.
Reacts vigorously with water and alkali.
Avoid reaction with organic materials/compounds, powdered metals, reducing agents and hydrogen sulfide ($H_2S$) as ignition may result.
Reacts with metals producing flammable/explosive hydrogen gas.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
Extinguishers should be used only by trained personnel.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
If fire gets out of control withdraw personnel and warn against entry.
Equipment should be thoroughly decontaminated after use.

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## Section 6 - Accidental Release Measures

**Small Spills:** Dangerous levels of nitrogen oxides may form during spills of nitric acid.
Wear fully protective PVC clothing and breathing apparatus.
Clean up all spills immediately. No smoking, bare lights, ignition sources.
Avoid all contact with any organic matter including fuel, solvents, sawdust, paper or cloth and other incompatible materials, as ignition may result.
Avoid breathing dust or vapors and all contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with dry sand, earth, inert material or vermiculite. DO NOT use sawdust as fire may result.
Scoop up solid residues and seal in labeled drums for disposal.
Neutralize/decontaminate area.
Use soda ash or slaked lime to neutralize.

See DOT ERG

**Large Spills:** DO NOT touch the spill material. Restrict access to area.
Clear area of personnel and move upwind. Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, flames or ignition sources. Increase ventilation.
Contain spill with sand, earth or other clean, inert materials.
NEVER use organic absorbents such as sawdust, paper, cloth; as fire may result. Avoid any contamination by organic matter.
Use spark-free and explosion-proof equipment.
Collect any recoverable product into labeled containers for possible recycling. DO NOT mix fresh with recovered material.
Collect residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains. Decontaminate equipment and launder all protective clothing before storage and reuse.
If contamination of drains or waterways occurs advise emergency services.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist. Do not allow clothing wet with material to stay in contact with skin.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

**Recommended Storage Methods:** Stainless steel drum. Check that containers are clearly labeled.
Packaging as recommended by manufacturer.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** Use in a well-ventilated area.
Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

**Personal Protective Clothing/Equipment:**

**Eyes:** Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Bare unprotected skin should not be exposed to this material. Impervious, gauntlet length gloves i.e., butyl rubber gloves or Neoprene rubber gloves or wear chemical protective gloves, e.g. PVC.

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Wear safety footwear or safety gumboots, e.g. Rubber.

**Respiratory Protection:**

Exposure Range >2 to <25 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 25 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

**Other:** Operators should be trained in procedures for safe use of this material.

Acid-resistant overalls or Rubber apron or PVC apron.

Ensure there is ready access to an emergency shower.

Ensure that there is ready access to eye wash unit.

Ensure that there is ready access to breathing apparatus.

**Glove Selection Index:**

BUTYL ..... Best selection
HYPALON ..... Best selection
NEOPRENE..... Best selection
NEOPRENE/NATURAL..... Best selection
PE/EVAL/PE ..... Best selection
SARANEX-23 ..... Best selection
NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
PVC..... Poor to dangerous choice for other than short-term immersion
NITRILE+PVC..... Poor to dangerous choice for other than short-term immersion

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Clear, colorless to slightly yellow liquid. Sharp strong odor.
CAUTION: exothermic dilution hazard.
HIGHLY CORROSIVE. Corrosive to most metals. Powerful oxidizing agent.
Darkens to brownish color on aging and exposure to light.

**Physical State:** Liquid
**Odor Threshold:** 0.75 to 2.50 mg/m$^3$
**Vapor Pressure (kPa):** 8.26
**Vapor Density (Air=1):** 1.5
**Formula Weight:** 63.02
**Specific Gravity ($H_2O$=1, at 4 °C):** 1.3-1.42
**pH:** < 1

**pH (1% Solution):** 1
**Boiling Point:** 83 °C (181 °F) at 760 mm Hg
**Freezing/Melting Point:** -42 °C (-43.6 °F)
**Volatile Component (% Vol):** 100 (nominal)
**Decomposition Temperature (°C):** Not applicable
**Water Solubility:** Soluble in all proportions

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Presence of heat source and direct sunlight. Storage in unsealed containers. Hazardous polymerization will not occur.

**Storage Incompatibilities:** Segregate from reducing agents, finely divided combustible materials, combustible materials, sawdust, metals and powdered metals.

Avoid contamination of water, foodstuffs, feed or seed.

Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

## Section 11 - Toxicological Information

**Toxicity**

Oral (human) $LD_{Lo}$: 430 mg/kg
Inhalation (rat) $LC_{50}$: 2500 ppm/1 hr
Unreported (man) $LD_{Lo}$: 110 mg/kg

**Irritation**

Nil reported

See *RTECS* QU 5775000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** No data found.

**Ecotoxicity:** $LC_{50}$ Starfish 100-300 mg/l/48 hr /Aerated water conditions; $LC_{50}$ Shore crab 180 mg/l/48 hr /Static, aerated water conditions; $LC_{50}$ Cockle 330-1000 mg/l/48 hr /Aerated water conditions

**BCF:** no food chain concentration potential

**Biochemical Oxygen Demand (BOD):** none

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## Section 13 - Disposal Considerations

**Disposal:** Recycle wherever possible. Special hazards may exist - specialist advice may be required.
Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize at an approved treatment plant.
Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
Puncture containers to prevent reuse and bury at an authorized landfill.

## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Note:** This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

**Shipping Name and Description:** Nitric acid *other than red fuming, with more than 70 percent nitric acid*




**ID:** UN2031
**Hazard Class:** 8 - Corrosive material
**Packing Group:** I - Great Danger
**Symbols:**
**Label Codes:** 8 - Corrosive, 5.1 - Oxidizer
**Special Provisions:** B47, B53, T10, TP2, TP12, TP13
**Packaging:** **Exceptions:** None **Non-bulk:** 158 **Bulk:** 243
**Quantity Limitations:** **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 2.5 L
**Vessel Stowage:** **Location:** D **Other:** 44, 66, 89, 90, 110, 111

**Shipping Name and Description:** Nitric acid *other than red fuming, with not more than 70 percent nitric acid*




**ID:** UN2031
**Hazard Class:** 8 - Corrosive material
**Packing Group:** II - Medium Danger
**Symbols:**
**Label Codes:** 8 - Corrosive
**Special Provisions:** B2, B47, B53, IB2, T8, TP2, TP12
**Packaging:** **Exceptions:** None **Non-bulk:** 158 **Bulk:** 242
**Quantity Limitations:** **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 30 L
**Vessel Stowage:** **Location:** D **Other:**

**Shipping Name and Description:** Nitric acid, red fuming




**ID:** UN2032
**Hazard Class:** 8 - Corrosive material
**Packing Group:** I - Great Danger
**Symbols:** + - Override definitions
**Label Codes:** 8 - Corrosive, 5.1 - Oxidizer, 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
**Special Provisions:** 2, B9, B32, B74, T20, TP2, TP12, TP13, TP38, TP45
**Packaging:** **Exceptions:** None **Non-bulk:** 227 **Bulk:** 244
**Quantity Limitations:** **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** Forbidden
**Vessel Stowage:** **Location:** D **Other:**

## Section 15 - Regulatory Information

**EPA Regulations:**
**RCRA 40 CFR:** Not listed
**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
**SARA 40 CFR 372.65:** Listed
**SARA EHS 40 CFR 355:** Listed
**RQ:** 1000 lb
**TPQ:** 1000 lb
**TSCA:** Listed

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## Section 16 - Other Information

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*Material Safety Data Sheet Collection*
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

**Sodium Hydroxide**
**SOD4950**

## Section 1 - Chemical Product and Company Identification 61

**Material Name:** Sodium Hydroxide
**CAS Number:** 1310-73-2
**Chemical Formula:** HNaO
**Structural Chemical Formula:** NaOH
**EINECS Number:** 215-185-5
**ACX Number:** X1000118-8
**Synonyms:** CAUSTIC SODA; CAUSTIC SODA,BEAD; CAUSTIC SODA,DRY; CAUSTIC SODA,FLAKE; CAUSTIC SODA,GRANULAR; CAUSTIC SODA,SOLID; HYDROXYDE DE SODIUM; LEWIS-RED DEVIL LYE; LYE; NATRIUMHYDROXID; NATRIUMHYDROXYDE; SODA LYE; SODA,CAUSTIC; SODA,HYDRATE; SODIO(IDROSSIDO DI); SODIUM HYDRATE; SODIUM HYDROXIDE; SODIUM HYDROXIDE,BEAD; SODIUM HYDROXIDE,DRY; SODIUM HYDROXIDE,FLAKE; SODIUM HYDROXIDE,GRANULAR; SODIUM HYDROXIDE,SOLID; SODIUM(HYDROXYDE DE); WHITE CAUSTIC
**General Use:** Component of alkali cleaners. Manufacture of soap, pulp and paper; rayon. Chemical manufacture. Neutralizing agent in petroleum refining; manufacture of aluminum, detergents, textile processing, refining of vegetable oils. Laboratory reagent, for organic fusion, etching of metal. Used for regenerating ion exchange resins, lye peeling of fruits and vegetables in the food industry.

## Section 2 - Composition / Information on Ingredients

| Name | CAS | % |
|---|---|---|
| sodium hydroxide | 1310-73-2 | >98 |

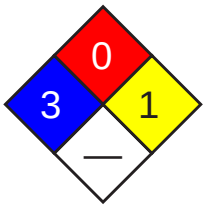
**OSHA PEL**
TWA: 2 mg/m$^3$.

**NIOSH REL**
Ceiling: 2 mg/m$^3$.

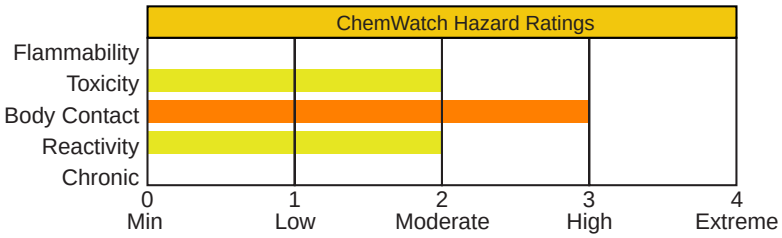
**ACGIH TLV**
Ceiling: 2 mg/m$^3$.

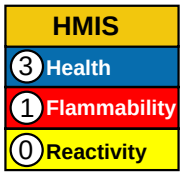
**IDLH Level**
10 mg/m$^3$.

## Section 3 - Hazards Identification



Fire Diamond




**ANSI Signal Word**

**Danger!**


Corrosive

### ☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White, odorless, hydroscopic flakes, lumps, or pellets. Corrosive, causes severe burns to eyes/skin/respiratory tract. Chronic Effects: dermatitis. Reacts with water.

### Potential Health Effects

**Target Organs:** eyes, digestive system, respiratory system, skin
**Primary Entry Routes:** ingestion, inhalation, skin contact, eye contact
**Acute Effects**
**Inhalation:** Generated dust may be highly discomforting and corrosive to the upper respiratory tract if inhaled and is capable of causing severe burns to the upper respiratory tract.

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The material may produce respiratory tract irritation which produces an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Unlike most organs the lung can respond to a chemical insult or agent by first trying to remove or neutralize the irritant and then repairing the damage. The repair process, which initially developed to protect mammalian lungs from foreign matter and antigens, may however, cause further damage the lungs when activated by hazardous chemicals. The result is often the impairment of gas exchange, the primary function of the lungs.

Severe acute dust inhalation exposure may be fatal due to spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis and severe pulmonary edema.

Symptoms of overexposure include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting.

**Eye:** The solid/dust is extremely corrosive to the eyes and is capable of causing severe damage with loss of sight. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Skin:** The solid/dust is highly discomforting and extremely corrosive to the skin and is capable of causing severe burns and ulceration.

Bare unprotected skin should not be exposed to this material. The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Burns are not immediately painful; onset of pain may be delayed minutes or hours; thus care should be taken to avoid contamination of gloves and boots. A 5% aqueous solution applied to the skin of rabbits for 4 hours produced severe necrosis. Instillation of a 1% solution into the conjunctival sac failed to produce ocular or conjunctival injury in rabbits provided the eye was promptly irrigated with copious amounts of water.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.

The solid is extremely corrosive to the gastrointestinal tract and may be fatal if swallowed.

Ingestion may result in severe burns to the mouth, throat and stomach, pain, nausea and vomiting, swelling of the larynx and subsequent suffocation, perforation of the gastrointestinal tract.

A 1% aqueous solution (pH 13.4) failed to cause gastric, esophageal or other damage in rabbits.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

## Section 4 - First Aid Measures

**Inhalation:** If dust is inhaled, remove to fresh air. Encourage patient to blow nose to ensure clear breathing passages. Ask patient to rinse mouth with water but to not drink water. Seek immediate medical attention.




**Eye Contact:** DO NOT delay. Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids. Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** DO NOT delay. Immediately flush body and clothes with large amounts of water, using safety shower if available. Quickly remove all contaminated clothing, including footwear. Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

In case of burns: Quickly immerse affected area in cold running water for 10 to 15 minutes. Bandage lightly with a sterile dressing. Treat for shock if required. Lay patient down. Keep warm and rested. Transport to hospital or doctor.

**Ingestion:** DO NOT delay. Contact a Poison Control Center. If swallowed, do NOT induce vomiting. Give a glass of water.

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

**Note to Physicians:** For acute or short-term repeated exposures to highly alkaline materials:

1. Respiratory stress is uncommon but presents occasionally because of soft tissue edema.
2. Unless endotracheal intubation can be accomplished under direct vision, cricothyroidotomy or tracheotomy may be necessary.
3. Oxygen is given as indicated.
4. The presence of shock suggests perforation and mandates an intravenous line and fluid administration.
5. Alkali corrosives damage occurs by liquefaction necrosis whereby the saponification of fats and solubilization of proteins allow deep penetration into the tissue. Alkalis continue to cause damage after exposure.

INGESTION:

1. Milk and water are the preferred diluents. No more than 2 glasses of water should be given to an adult.
2. Neutralizing agents should never be given since exothermic heat reaction may compound injury.

* Catharsis and emesis are absolutely contra-indicated.

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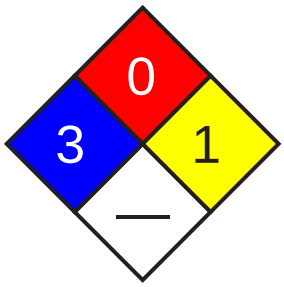
* Activated charcoal does not absorb alkali.
* Gastric lavage should not be used.
Supportive care involves the following.
1. Withhold oral feedings initially.
2. If endoscopy confirms transmucosal injury start steroids only within the first 48 hours.
3. Carefully evaluate the amount of tissue necrosis before assessing the need for surgical intervention.
4. Patients should be instructed to seek medical attention whenever they develop difficulty in swallowing (dysphagia).
SKIN AND EYE: Injury should be irrigated for 20-30 minutes. Eye injuries require saline.

## Section 5 - Fire-Fighting Measures

**Extinguishing Media:** Use extinguishing media suitable for surrounding area.

See DOT ERG

**General Fire Hazards/Hazardous Combustion Products:** Noncombustible.
Not considered to be a significant fire risk, however containers may burn.
Solid in contact with water or moisture reacts violently, and solutions are highly alkaline and may cause severe skin burns.



Fire Diamond

**Fire Incompatibility:** Avoid reaction with strong oxidizers, strong acids, organic materials/compounds.
In presence of moisture, the material is corrosive to aluminum, zinc and tin producing highly flammable hydrogen gas.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
Use fire fighting procedures suitable for surrounding area.
Do not approach containers suspected to be hot.
Cool fire exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Avoid spraying water onto liquid pools.
Equipment should be thoroughly decontaminated after use.

## Section 6 - Accidental Release Measures

**Small Spills:** DO NOT touch the spill material. Slippery when spilt.
Clean up all spills immediately.
Control personal contact by using protective equipment.
Use dry clean up procedures and avoid generating dust.
Place in suitable containers for disposal.

See DOT ERG

**Large Spills:** DO NOT touch the spill material. Slippery when spilt.
Keep dry. Reacts violently with water.
Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
Shut off all possible sources of ignition and increase ventilation.
Stop leak if safe to do so.
Use dry clean up procedures and avoid generating dust. Collect recoverable product into labeled containers for recycling. Collect residues and seal in labeled drums for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing dust. Avoid contact with skin and eyes.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
Local exhaust ventilation may be required for safe working, i.e. to keep exposures below required standards, otherwise PPE is required.
Handle and open container with care.
Keep dry. Reacts violently with water.
WARNING: Contact with water generates heat.

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Avoid contact with incompatible materials.
Avoid physical damage to containers.
Keep containers securely sealed when not in use.
Always wash hands with soap and water after handling. Work clothes should be laundered separately. Launder contaminated clothing before reuse. Use good occupational work practice. Observe manufacturer's storing and handling recommendations.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

**Recommended Storage Methods:** Plastic bag or Packaging as recommended by manufacturer. Glass container. Polyethylene or polypropylene container or Polylined drum.
DO NOT use aluminum, galvanized or tin-plated containers.
Check that containers are clearly labeled.

**Storage Requirements:** Keep dry. Reacts violently with water.
Store in original containers. Keep containers securely sealed. Store in a cool, dry, well-ventilated area. Store away from incompatible materials and foodstuff containers. Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.
DO NOT use aluminum, galvanized or tin-plated containers.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** Use in a well-ventilated area DO NOT handle directly. Wear gloves and use scoop/tongs/tools. If risk of overexposure exists, wear NIOSH approved respirator.
If conditions are such that worker exposure potential is high, wear full-face air-supplied breathing apparatus and full protective suit.

**Personal Protective Clothing/Equipment:**

**Eyes:** Safety glasses with side shields Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** DO NOT handle directly. Wear gloves and use scoop/tongs/tools.
Elbow length PVC gloves or Butyl rubber gloves or Neoprene rubber gloves.
Safety footwear.

**Respiratory Protection:**
Exposure Range >2 to <10 $mg/m^3$: Air Purifying, Negative Pressure, Half Mask
Exposure Range 10 to unlimited $mg/m^3$: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)

**Other:** Overalls. PVC apron. PVC protective suit may be required if exposure severe.
Eyewash unit. Ensure there is ready access to a safety shower.

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** White hygroscopic, odorless, pellets, flakes, sticks or solid cast mass. Explosive boiling and spitting will occur if added to hot water. Reacts violently with acids. CAUSTIC alkali. Soluble in alcohol, ether, glycerol.

**Physical State:** Divided solid
**Vapor Pressure (kPa):** Negligible
**Formula Weight:** 40
**Specific Gravity ($H_2O$=1, at 4 °C):** 2.12 at 20 °C
**pH:** Not applicable
**pH (1% Solution):** 12.7
**Boiling Point:** 1390 °C (2534 °F)
**Freezing/Melting Point:** 318.4 °C (605.12 °F)
**Water Solubility:** 1 g dissolves in 0.9 ml water

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Vigorously exotherms when mixed with water. In the presence of moisture, highly corrosive to aluminum, zinc and tin.
HIGHLY reactive: with ammonium salts evolves ammonia gas. Rapidly picks up moisture from the air and with carbon dioxide in air forms sodium carbonate.
Presence of incompatible materials and storage in unsealed containers.
Product is considered stable under normal handling conditions.
Hazardous polymerization will not occur.

**Storage Incompatibilities:** Keep dry. Reacts violently with water.
Segregate from water, strong oxidizers, strong acids, organic materials, ammonium compounds, nitro compounds and trichlorethylene.

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## Section 11 - Toxicological Information

**Toxicity**
No data reported

**Irritation**
Skin (rabbit): 500 mg/24h SEVERE
Eye (rabbit): 0.05 mg/24h SEVERE
Eye(rabbit):1 mg/24h SEVERE
Eye(rabbit):1 mg/30s rinsed-SEVERE

See *RTECS* WB 4900000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** No data found.
**Ecotoxicity:** $LC_{100}$ Cyprinus carpio 180 ppm/24 hr at 25 deg; $TL_m$ mosquito fish 125 ppm/96 hr (freshwater) ; $TL_m$ Bluegill 99 mg/L/48 hr (tap water)
**Biochemical Oxygen Demand (BOD):** none
**Octanol/Water Partition Coefficient:** log $K_{ow}$ = too low to be measured

## Section 13 - Disposal Considerations

**Disposal:** Recycle wherever possible or consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize with dilute acid at an effluent treatment plant.
Recycle containers, otherwise dispose of in an authorized landfill.

## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):




**Shipping Name and Description:** Sodium hydroxide, solid
**ID:** UN1823
**Hazard Class:** 8 - Corrosive material
**Packing Group:** II - Medium Danger
**Symbols:**
**Label Codes:** 8 - Corrosive
**Special Provisions:** IB8, IP2, IP4
**Packaging:** **Exceptions:** 154 **Non-bulk:** 212 **Bulk:** 240
**Quantity Limitations:** **Passenger aircraft/rail:** 15 kg **Cargo aircraft only:** 50 kg
**Vessel Stowage:** **Location:** A **Other:**

## Section 15 - Regulatory Information

**EPA Regulations:**
**RCRA 40 CFR:** Not listed
**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
**SARA 40 CFR 372.65:** Not listed
**SARA EHS 40 CFR 355:** Not listed
**TSCA:** Listed

## Section 16 - Other Information

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RUST-OLEUM CORP -- LABOR SAVER MARKING PAINTS, 2533 -- 8010-00N021794

========== Product Identification ==========

Product ID:LABOR SAVER MARKING PAINTS, 2533
MSDS Date:09/29/1987
FSC:8010
NIIN:00N021794
MSDS Number: BLRYV
=== Responsible Party ===
Company Name:RUST-OLEUM CORP
Address:11 HAWTHORN PARKWAY
City:VERNON HILLS
State:IL
ZIP:60061
Country:US
Info Phone Num:312-367-7700
Emergency Phone Num:312-864-8200
Preparer's Name:MJS
CAGE:08882
=== Contractor Identification ===
Company Name:RUST-OLEUM CORP
Address:11 HAWTHORN PARKWAY
Box:City:VERNON HILLS
State:IL
ZIP:60061-1583
Country:US
Phone:847-367-7700
CAGE:08882

========== Composition/Information on Ingredients ==========

Ingred Name:PROPANE
CAS:74-98-6
RTECS #:TX2275000
Fraction by Wt: 16-18%
OSHA PEL:1000 PPM
ACGIH TLV:ASPHYXIANT; 9192

Ingred Name:PROPANE, 2-METHYL-; (ISOBUTANE). VP: 40 PSIA. LEL: 1.9%
CAS:75-28-5
RTECS #:TZ4300000
Fraction by Wt: 10-12%

Ingred Name:TITANIUM DIOXIDE
CAS:13463-67-7
RTECS #:XR2275000
Fraction by Wt: 0-8%
OSHA PEL:15 MG/M3 TDUST
ACGIH TLV:10 MG/M3 TDUST; 9293

Ingred Name:SUPP DATA:CAUSE BLINDNESS IF INGESTED.
RTECS #:9999999ZZ

Ingred Name:METHYL ALCOHOL (METHANOL) (SARA III)
CAS:67-56-1
RTECS #:PC1400000
Fraction by Wt: 0-4%
OSHA PEL:S,200PPM/250STEL
ACGIH TLV:S,200PPM/250STEL; 93
EPA Rpt Qty:5000 LBS
DOT Rpt Qty:5000 LBS

Ingred Name:TOLUENE (SARA III)
CAS:108-88-3
RTECS #:XS5250000
Fraction by Wt: 0-18%
OSHA PEL:200 PPM/150 STEL
ACGIH TLV:50 PPM; 9293
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

Ingred Name:HEXANE (N-HEXANE)
CAS:110-54-3
RTECS #:MN9275000
Fraction by Wt: 6-10%
OSHA PEL:500 PPM

ACGIH TLV:50 PPM; 9293
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:XYLENES (O-,M-,P- ISOMERS)  (SARA III)
CAS:1330-20-7
RTECS #:ZE2100000
Fraction by Wt: 5-20%
OSHA PEL:100 PPM/150 STEL
ACGIH TLV:100 PPM/150STEL;9192
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

Ingred Name:ETHYLENE GLYCOL  (SARA III)
CAS:107-21-1
RTECS #:KW2975000
Fraction by Wt: 0-4%
OSHA PEL:C 50 PPM
ACGIH TLV:C 50 PPM,VAPOR; 9192
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:VM&P NAPHTHA. VP: 2 @ 20C. LEL: 0.9%
CAS:64742-89-8
Fraction by Wt: 1-3%
OSHA PEL:300 PPM;400 PPM STEL
ACGIH TLV:300 PPM

========== Hazards Identification ==========

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:YES  Skin:NO  Ingestion:YES
Reports of Carcinogenicity:NTP:NO  IARC:NO  OSHA:NO
Health Hazards Acute and Chronic:(ACUTE) INHAL: ANESTHETIC, IRRIT OF RESP TRACT/ACUTE NERV SYS DEPRESS CHARACT BY HDCH, DIZZ, STAG, CONFUSN, UNCON/ COMA. SKIN/EYE: PRIMARY IRRITANT WHICH DEFATS SKIN & CAN LEAD TO DERMAT W/ RPTD OVERE XP. INGEST: GI IRRIT, NAUS, VOMIT & DIARR. (CHRONIC) RPTS HAVE SHOWN RPTD & PRLNGD OCCUP OVEREXP TO (SEE EFTS OF OVEREXP
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:HLTH HAZ: SOLV W/PERM BRAIN & NERV SYS DMG. OVEREXP TO XYLOL & TOLUENE IN LAB ANIMALS HAS SHOWN LIVER, KIDNEY, SPLEEN & EYE DMG AS WELL AS ANEMIA. IN HUMANS, OVEREXP HAS BEEN FOUND TO CAUSE LIVER & CA RDIAC ABNORMALITIES. OVEREXP TO HEXANE IN HIGH VAP CONC (1000-1500 PPM) OVER A PERIOD OF SEV MONTHS HAS BEEN (SUPP DATA)
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

========== First Aid Measures ==========

First Aid:INHAL: REMOVE FROM EXPOS, RESTORE BRTHG & NOTIFY MD. EYE: FLUSH IMMED W/LRG AMTS OF WATER FOR AT LEAST 15 MIN. NOTIFY MD. SKIN: WASH AFFECTED AREA W/SOAP & WATER, REMOVE CONTAM CLTHG & WASH BEFORE REU SE. WASH HANDS BEFORE EATING/SMOKING. INGEST: DO NOT INDUCE VOMIT. KEEP PERSON WARM, QUIET & GET MD. ASPIR OF MATL IN LUNGS CAN CAUSE CHEM PNEUM WHICH CAN BE FATAL.

========== Fire Fighting Measures ==========

Flash Point Method:TCC
Flash Point:<0F,<-18C
Lower Limits:SEE INGRED
Extinguishing Media:NFPA CLASS B EXTINGUISHERS (CO2, DRY CHEMICAL OR FOAM).
Fire Fighting Procedures:WEAR NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP . WATER SPRAY MAY BE INEFFECTIVE. WATER MAY BE USED TO COOL CLSD CNTNRS TO PVNT PRESS BUILDUP (SUPP DATA)
Unusual Fire/Explosion Hazard:KEEP CNTNRS TIGHTLY CLSD. ISOLATE FROM HEAT, ELEC EQUIP, SPARKS & OPEN FLAME. CLSD CNTNRS MAY EXPLODE WHEN EXPSD TO EXTREME HEAT. DO NOT APPLY TO HOT SURFACES.

========== Accidental Release Measures ==========

Spill Release Procedures:REMOVE ALL SOURCES OF IGNITION, VENTILATE AREA AND REMOVE WITH INERT ABSORBENT AND NONSPARKING TOOLS.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

========== Handling and Storage ==========

Handling and Storage Precautions:DO NOT STORE ABOVE 120F. DO NOT PUNCTURE.
Other Precautions:INTENTIONAL MISUSE BY DELIBERATELY CONCENTRATING AND INHALING CONTENTS CAN BE HARMFUL OR FATAL.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:USE NIOSH/MSHA APPROVED CHEMICAL CARTRIDGE RESPIRATOR (TC23C) TO REMOVE SOLID AIRBORNE PARTICLES OF OVERSPRAY AND ORGANIC VAPORS DURING SPRAY APPLICATION. IN CONFINED AREAS: USE NIOSH/MSHA APPROVED SU PPLIED-AIR RESPIRATOR OR HOODS (TC19C).
Ventilation:PROVIDE GENERAL OR LOCAL EXHAUST VENT IN VOLUME & PATTERN TO KEEP TLV OF MOST HAZ INGREDS BELOW ACCEPTABLE LIMIT.
Protective Gloves:IMPERVIOUS GLOVES .
Eye Protection:CHEMICAL WORKERS GOGGLES .
Other Protective Equipment:NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices:WASH HANDS BEFORE EATING OR SMOKING.
Supplemental Safety and Health
FIRE FIGHT PROC: AND POSSIBLE AUTOIGNITION OR EXPLOSION. IF WATER IS USED, FOG NOZZLES ARE PREFERRED. EFTS OF OVEREXP: SHOWN TO CAUSE PERIPHERAL POLYNEUROPATHY WHICH HAS THE POTENTIAL OF BECOMING IRRE VERSIBLE. OVEREXP TO METHYL ALCOHOL HASBEEN SHOWN TO AFFECT CNS, ESPECIALLY OPTIC NERVE. MAY BE FATAL OR (SEE ING 10)

========== Physical/Chemical Properties ==========

HCC:F2
Boiling Pt:B.P. Text:<0F,<-18C
Vapor Pres:SEE INGRED
Vapor Density:HVR/AIR
Evaporation Rate & Reference:SLOWER THAN ETHER
Appearance and Odor:NONE SPECIFIED BY MANUFACTURER.

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
STRONG OXIDIZING AGENTS.
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:BY OPEN FLAME - CO AND CO2.

========== Disposal Considerations ==========

Waste Disposal Methods:DISPOSE OF ACCORDING TO LOCAL, STATE AND FEDERAL REGULATIONS. DO NOT INCINERATE CLOSED CONTAINERS.

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*Material Safety Data Sheet Collection*
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Issue Date: 2006-06

**Zinc Acetate**
**ZIN1180**

## Section 1 - Chemical Product and Company Identification 61

**Material Name:** Zinc Acetate **CAS Number:** 557-34-6
**Chemical Formula:** $C_4H_8O_4Zn$
**Structural Chemical Formula:** $Zn(C_2H_3O_2)_2$
**EINECS Number:** 209-170-2
**ACX Number:** X1013450-6
**Synonyms:** ACETIC ACID,ZINC SALT; ACETIC ACID,ZINC SALT (8CI,9CI); ACETIC ACID,ZINC(II) SALT; DICARBOMETHOXYZINC; ZINC ACETATE; ZINC DIACETATE
**General Use:** Preserving wood; as mordant in textile dyeing; manufacture of glazes for painting on porcelain; as a laboratory reagent in testing for albumin, tannin, urobilin, phosphate, blood; as an astringent.
Also as a cross-linking agent for polymers; and fuel additive.

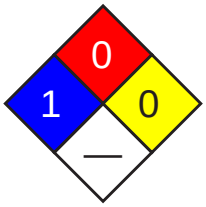
## Section 2 - Composition / Information on Ingredients

| Name | CAS | % |
|---|---|---|
| zinc acetate | 557-34-6 | 98 min. |

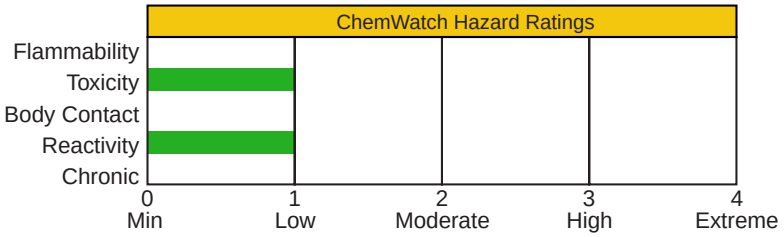
**OSHA PEL** **NIOSH REL**

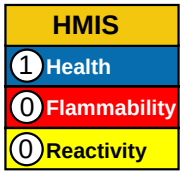
**ACGIH TLV**

## Section 3 - Hazards Identification



Fire Diamond




**ANSI Signal Word**

**Caution**

### ☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White crystals; faint acetous (vinegar) odor. Irritating to eyes/skin/respiratory tract. Also causes: upon ingestion: nausea, vomiting, headache, abdominal pain.

### Potential Health Effects

**Target Organs:** eyes, skin, respiratory system, digestive system
**Primary Entry Routes:** ingestion, inhalation, skin contact, eye contact
**Acute Effects**

**Inhalation:** Not normally a hazard due to nonvolatile nature of product. The dust may be highly discomforting to the upper respiratory tract.
The heat decomposition products of zinc acetate cause irritation to mucous membranes, coughing. Severe and chronic exposure to zinc oxide fumes may result in "metal fume fever"; a disabling but transient disease.

**Eye:** The dust may be highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.
Very dilute preparations of zinc acetate have been used as eye drops

**Skin:** The material is moderately discomforting to the skin if exposure is prolonged.
Open cuts, abraded or irritated skin should not be exposed to this material.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.
The material is highly discomforting to the gastrointestinal tract and may be harmful if swallowed.

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Soluble zinc salts produces irritation and corrosion of the alimentary tract (in a manner similar to copper salts) with pain, vomiting, etc.
Delayed deaths have been ascribed to inanition (weakness and extreme weight loss resulting from prolonged and severe food insufficiency) following severe strictures of the esophagus, and pylorus.
Ingestion may cause irritation or burning of the digestive tract, nausea and vomiting, and watery or bloody diarrhea.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** No human exposure data available. For this reason, health effects described are based on experience with chemically-related materials.

## Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

**Ingestion:** Rinse mouth out with plenty of water.
Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

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

**Note to Physicians:**

1.Absorption of zinc compounds occurs in the small intestine.
2.The metal is heavily protein bound.
3.Elimination results primarily from fecal excretion.
4.The usual measures for decontamination (Ipecac Syrup, lavage, charcoal or cathartics) may be administered, although patients usually have sufficient vomiting not to require them.
5.$CaNa_2EDTA$ has been used successfully to normalise zinc levels and is the agent of choice.

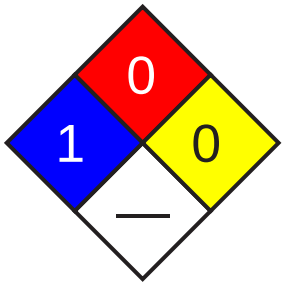
## Section 5 - Fire-Fighting Measures

**Flash Point:** Nonflammable
**LEL:** Not applicable
**UEL:** Not applicable

**Extinguishing Media:** There is no restriction on the type of extinguisher which may be used.

**General Fire Hazards/Hazardous Combustion Products:** Noncombustible. Slight explosion hazard when exposed to strong oxidizers.
Decomposes on heating and produces acrid smoke and toxic fumes of carbon monoxide (CO), carbon dioxide ($CO_2$) and zinc oxide.

**Fire Incompatibility:** Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
An exothermic reaction may occur in contact with sulfuric oleum.



Fire Diamond

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves. Prevent spillage from entering drains or waterways.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

## Section 6 - Accidental Release Measures

**Small Spills:** Clean up all spills immediately. Avoid contact with skin and eyes.
Wear impervious gloves and safety glasses.
Use dry clean-up procedures and avoid generating dust.
Vacuum up or sweep up.
Place spilled material in clean, dry, sealable, labeled container.

**Large Spills:** Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves. Prevent spillage from entering drains or waterways.
Stop leak if safe to do so. Avoid generating dust.

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Collect recoverable product into labeled containers for recycling.
Collect residues and seal in labeled drums for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
If contamination of drains or waterways occurs, advise emergency services.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing dust.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
Avoid contact with incompatible materials.
Avoid contact with moisture.
Handle and open container with care.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use.
Avoid physical damage to containers.
Always wash hands with soap and water after handling. Work clothes should be laundered separately.

**Recommended Storage Methods:** Multi-ply paper bag with sealed plastic liner or heavy gauge plastic bag. Check that all containers are clearly labeled and free from leaks. Packing as recommended by manufacturer.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** None required when handling small quantities. OTHERWISE: Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved dust respirator.
Correct fit is essential to obtain adequate protection.

**Personal Protective Clothing/Equipment:**

**Eyes:** Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Barrier cream and PVC gloves.
Safety footwear.

**Other:** Overalls. Ensure there is ready access to a safety shower.
Eyewash unit.

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Available in both the anhydrous and more commonly the dihydrate form. Both forms are available as monoclinic crystals with an acetic acid odor. Both forms are very soluble in water and slightly soluble in alcohol.

**Physical State:** Divided solid
**Vapor Pressure (kPa):** Not applicable
**Vapor Density (Air=1):** Not applicable
**Formula Weight:** 183.5
**Specific Gravity ($H_2O$=1, at 4 °C):** 1.84
**Evaporation Rate:** Not applicable
**pH:** Not applicable
**pH (1% Solution):** 5 - 6
**Boiling Point:** Decomposes at 200 °C (392 °F)
**Freezing/Melting Point:** 237 °C (458.6 °F)
**Volatile Component (% Vol):** Not applicable
**Decomposition Temperature (°C):** 250-400
**Water Solubility:** 1 g soluble in 23 ml water

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Product is considered stable. Hazardous polymerization will not occur.
**Storage Incompatibilities:** Avoid storage with oxidizers.

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## Section 11 - Toxicological Information

**Toxicity**
Oral (rat) $LD_{50}$: 2510 mg/kg
Oral (rat) $LD_{50}$: 2170 mg/kg

**Irritation**
Skin (rabbit): 500 mg/24h - mild
Eye (rabbit): 20 mg/24h - moderate

See *RTECS* AK 1500000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** No data found.
**Ecotoxicity:** $TL_m$ Pimephales promelas (fathead minnow) 0.88 ppm/96 hr (soft water) /Conditions of bioassay not specified
**BCF:** zinc accumulates in some organisms

## Section 13 - Disposal Considerations

**Disposal:** Recycle wherever possible or consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Bury residue in an authorized landfill.
Recycle containers where possible, or dispose of in an authorized landfill.

## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Shipping Name and Description:** None

## Section 15 - Regulatory Information

**EPA Regulations:**
**RCRA 40 CFR:** Not listed
**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
**SARA 40 CFR 372.65:** Listed as Compound
**SARA EHS 40 CFR 355:** Not listed
**TSCA:** Listed

## Section 16 - Other Information

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