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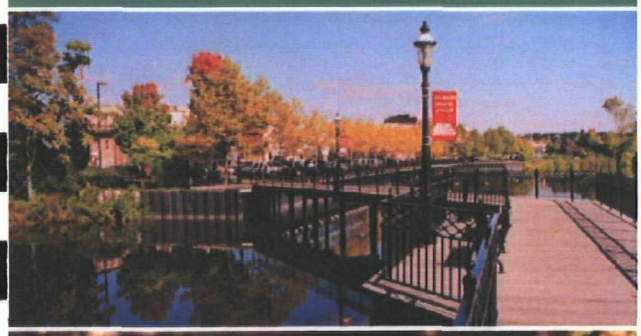
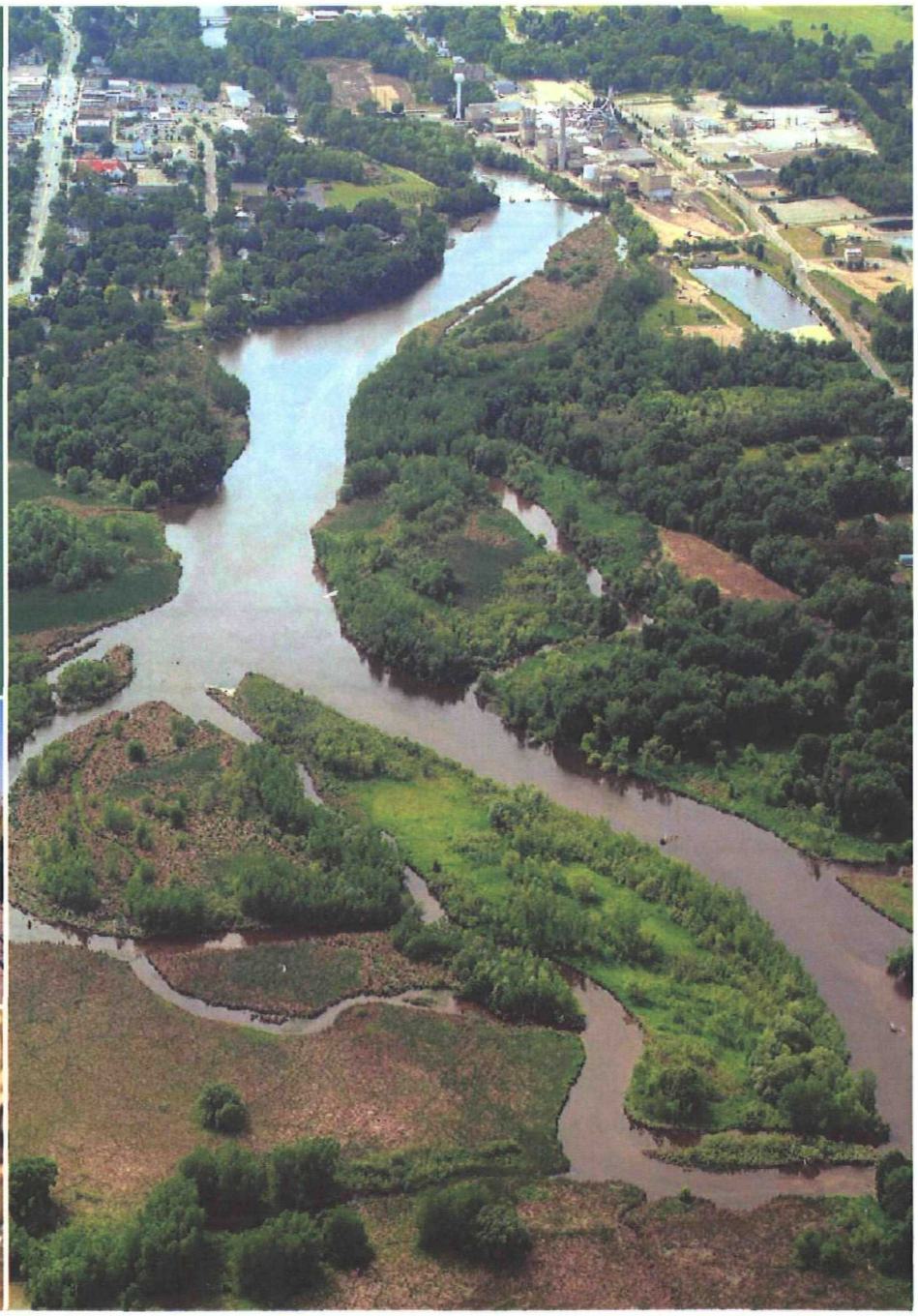
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Multi-Area Health and Safety Plan (Rev. 1) Addendum 6: Willow Boulevard/A-Site Landfill Operable Unit

Kalamazoo River Study Group

March 2010





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SEDIMENTS

Subject:
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Multi-Area Health and Safety Plan (Rev. 1) Addendum 6:
Willow Boulevard/A-Site Landfill Operable Unit 2

Date:
March 10, 2010

Contact:
Pat McGuire

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315.671.9233

Email:
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Our ref:
B0064581/B0064582

Dear Mr. Berkoff:

On behalf of Georgia-Pacific LLC (Georgia-Pacific), please find enclosed Addendum 6 (Addendum) to the *Multi-Area Health and Safety Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site – Revision 1* (Multi-Area HSP – Rev. 1). The Draft Addendum was submitted to the United States Environmental Protection Agency (USEPA) on October 27, 2009. The USEPA provided no comments on the Addendum and gave conditional approval of the document on January 25, 2010.

The Multi-Area HSP (Rev. 1) and its associated addenda provide a mechanism for establishing safe working practices while conducting activities at the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site), and Addendum 6 is specifically developed for the Willow Boulevard/A-Site Landfill Operable Unit. Three hard copies of the Addendum are provided, along with a CD containing a PDF version of the entire Multi-Area HSP (Rev. 1). The complete Multi-Area HSP (Rev. 1) also includes five other previously-approved addenda:, including Addendum 1: Working in Proximity of Crane Operations, Addendum 2: Change to the Acceptable Types of PFDs, Addendum 3: Change to Thermal-Protective Clothing Requirement, Addendum 4: Diving Operations at Plainwell Dam Project, and Addendum 5: Plainwell No. 2 Dam Area Time-Critical Removal Action. Additional copies are being sent as presented in the cc list below.

Sincerely,

ARCADIS

Pat McGuire
Project Coordinator

Enclosures:
Michael Berkoff: 3 hard copies, each with a CD

Copies:

Chief, Environmental Enforcement Section: Letter only - document available upon request
Director, Superfund Division: Letter only - document available upon request
Nicole Wood-Chi, USEPA: Letter only - document available upon request
Leslie Kirby-Miles, USEPA: Letter only - document available upon request
Anthony Audia, USEPA: Letter only - document available upon request
Paul Bucholtz, MDNRE: 1 hard copy and 1 CD
Kristi Zakrzewski, MDNRE: 1 hard copy and 1 CD
Judith Alfano, MDNRE: Letter only - document available upon request
Sharon Hanshue, MDNRE: Letter only - document available upon request
Lisa Williams, U.S. Fish and Wildlife Service: Letter only - document available upon request
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Mark Brown, Waterviews, LLC: Letter only – document available upon request
Richard Gay, Weyerhaeuser Company: 1 CD
Martin Lebo, Weyerhaeuser Company: 1 CD
Kathy Huibregtse, RMT, Inc.: 1 CD
Michael Erickson, P.E., ARCADIS: 1 hard copy and 1 CD

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Infrastructure, environment, buildings

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Multi-Area Health and Safety Plan (Rev. 1) Addendum 6: Willow Boulevard/A-Site Landfill Operable Unit

Georgia-Pacific LLC

March 2010

ARCADIS

Michael J. Erickson, P.E.
Principal in Charge

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Charles P. Webster, CSP
Health and Safety Manager

Multi-Area Health and Safety Plan (Rev. 1) Addendum 6: Willow Boulevard/A-Site Landfill Operable Unit

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

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Date:
March 2010

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1. Introduction

1.1 General

On September 30, 2009 Georgia-Pacific LLC (Georgia-Pacific) entered into an agreement with the U.S. Environmental Protection Agency (USEPA) that will govern the next phase of work at the Willow Boulevard/A-Site Landfill Operable Unit (WB/A-Site OU) (Figure 1-1). The WB/A-Site OU is Operable Unit 2 of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site), located in Kalamazoo and Allegan Counties, Michigan.

A Statement of Work (SOW), included as an attachment to the Consent Decree for the Design of Certain Response Actions at Operable Unit 2 of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, describes the proposed design and remedial action work at the WB/A-Site OU. The Remedial Action is estimated to begin in the Spring of 2011, and removal activities and initial planting of vegetation are estimated to be completed by the end of 2012.

The Consent Decree requires development and submission of a Health and Safety Plan (HSP) designed to protect onsite personnel and area residents from physical, chemical, and hazards posed by the Remedial Action. . USEPA agreed that Georgia-Pacific could submit an addendum to the *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan* (Multi-Area HSP; ARCADIS BBL 2007) to satisfy this requirement. This *Multi-Area Health and Safety Plan – Addendum 6* (Addendum) – which describes the health and safety risk analysis for the proposed activities, provides a description of required environmental monitoring and personal protective equipment (PPE), required medical monitoring, work area controls (i.e., decontamination and contaminant control), and contingency and emergency planning – has been developed to meet the requirements of the activities to be performed under the above referenced Consent Decree.

1.2 Objective

The objective of this Addendum is to provide a mechanism for establishing safe working practices while conducting the Remedial Action activities. The safety organization, procedures, and PPE have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incidents. Table 1-1 (located at the end of this Addendum) presents an activity hazard summary table for the WB-A/Site OU.

1.2.1 Remedial Action Activities

As described in the Consent Decree, the objectives of the WB/A-Site OU Remedial Action are to protect public health and the environment at the WB/A-Site OU by the design and implementation of remedial actions at the site. The following field activities are anticipated:

- Pre-Design Investigation
  - Site reconnaissance
  - Installation of borings
- Surveying Activities
- Mobilization
- Sediment and Soil Excavation Operations
  - Confirmation sampling
  - Mitigation activities
- Material Transport and Consolidation at WB/A-Site OU
- Installation of Cover System
  - Part 115 cap
  - Groundwater monitoring network
  - Landfill gas monitoring system and cutoff trench
  - Permanent Erosion and sedimentation controls
- Fencing
- Sheet Pile Wall Removal

- Personnel and Equipment Decontamination
- Site Restoration and Demobilization
- Environmental Monitoring
- Construction Oversight

1.3 Applicability of the Multi-Area HSP

The Willow Boulevard and A-Site landfills served as disposal sites for paper residuals from the King Highway Landfill until 1975 and 1987, respectively. The presence of polychlorinated biphenyls (PCBs) in soils within the WB/A-Site OU as a result of the disposal operations is the primary impetus for the Remedial Action.

The Remedial Action at the WB/A-Site OU will be performed using similar construction techniques as the Former Plainwell Impoundment Time Critical Removal Action (TCRA), completed between 2007 and 2009. The Former Plainwell Impoundment TCRA was conducted under the Multi-Area HSP and associated Addenda 1 through 4. Over 200,000 man hours of work were performed at the Former Plainwell Impoundment with one recordable incident. The Remedial Action at the WB/A-Site OU will be performed following the health and safety guidelines established in the Multi-Area HSP and associated addenda.

1.4 Policy Statement

The policy of ARCADIS is to provide a safe and healthy work environment. No aspect of operations is of greater importance than the prevention of injury and illness. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS will take every reasonable step to eliminate or control hazards to minimize the possibility of injury, illness, or incident.

This Addendum prescribes the procedures that must be followed during activities conducted as part of the Remedial Action at the WB/A-Site OU. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Coordinator (PC) and the Health and Safety Manager (HSM). This Addendum will be reviewed periodically to ensure that it is current and technically correct. Any changes in WB/A-Site OU conditions and/or the scope of work covered under the Consent Decree will require the review and modification (if necessary) of this Addendum - such changes will be completed in the form of a revision to this Addendum.

The provisions of this plan are mandatory for all ARCADIS personnel assigned to the WB/A-Site OU. Subcontractors will prepare their own site-specific/project-specific HSP that must meet the basic requirements of the Multi-Area HSP. All visitors to ARCADIS work areas at the WB/A-Site OU must read and abide by the requirements of this plan.

2. Roles and Responsibilities

2.1 All ARCADIS Personnel

All ARCADIS personnel must adhere to the procedures outlined in the Multi-Area HSP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner conflicting with these procedures. The PC has the authority to dismiss any person from the WB/A-Site OU who violates the procedures identified in this Addendum and the Multi-Area HSP.

All ARCADIS personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in the Multi-Area HSP prior to initiating WB/A-Site OU activities. In addition, all onsite personnel will attend an initial hazard briefing prior to beginning work at the WB/A-Site OU.

The roles of ARCADIS personnel are outlined in the following subsections. A summary table for key project personnel and contacts is provided in Table 2-1 below.

Table 2-1 – Key Personnel

Role	Name	Address/Telephone No.
ARCADIS Personnel		
Principal in Charge (PIC)	Michael J. Erickson, P.E.	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1924 Cell: 734.604.7044
WB/A-Site OU Project Coordinator (PC)	Patrick N. McGuire	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
Engineer of Record (ER)	William Rankin, P.E.	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
Health and Safety Officer (HSO)	Jay D. Keough, CIH	8 South River Road Cranbury, NJ 08512 Phone: 609.860.0590 ext. 101 Cell: 908.492.5674

Role	Name	Address/Telephone No.
Health and Safety Manager (HSM)	Charles P. Webster, CSP	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
Health and Safety Supervisor	Ben Lawrence	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.229.8594 Cell: 734.732.0586
Site Supervisor (SS)	EJ Suardini	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1955 Cell: 734.276.2566
Client Personnel		
Georgia-Pacific LLC	Garry Griffith, P.E..	951 County Street Milan, MI 48160-9610 Phone: 734.439.1205 Cell: 734.735.0780
USEPA Region 5 Personnel		
Remedial Project Manager (PM)	Michael Berkoff	77 W. Jackson Blvd (SR-6J) Chicago, IL 60604 Phone: 312.353.8983
Michigan Department of Natural Resources and Environment (MDNRE) Personnel[1]		
MDNRE PM	Paul T. Bucholtz	Remediation Division 525 W. Allegan St., 3rd Floor South Lansing, MI 48933 Phone; 517.373.8174

[1] The Michigan Departments of Environmental Quality and Natural Resources (MDEQ and MDNR, respectively) merged on January 17, 2010 into the new Michigan Department of Natural Resources and Environment (MDNRE).

2.2 ARCADIS Personnel

2.2.1 Principal in Charge, Project Coordinator, and Engineer of Record

The Principal in Charge (PIC) is responsible for promoting health and safety in all aspects of the project and empowering the PC and Engineer of Record (ER) to implement the requirements of this Addendum.

The PC and ER are responsible for verifying that activities are completed in accordance with the requirements of this Addendum. It is also the responsibility of the PC and ER to perform the following duties:

- Consult with the HSO on WB/A-Site OU health and safety issues
- Review Loss Prevention Observation reports (Appendix A of the Multi-Area HSP)
- Verify that all incidents and near-misses are thoroughly investigated and reported to Georgia-Pacific within 24 hours of notification
- Approve, in writing, addenda or modifications to this Addendum
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance

In addition, the PC is responsible for confirming that the Site Supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this Addendum.

2.2.2 Other ARCADIS Personnel

All other personnel roles are outlined in Sections 2.2.2 to 2.2.5 of the Multi-Area HSP document.

2.3 Other Roles and Responsibilities

Further information on Contractor Qualified Safety Personnel, Stop Work Authority, Short-Service Employee Program, Visitors, and the ARCADIS Near-Miss Reporting Hotline can be found in Sections 2.3 to 2.8 of the Multi-Area HSP document.

3. Project Hazards and Control Measures

3.1 Field Activities, Hazards, and Control Procedures

The scope of work for the WB/A-Site OU Remedial Action includes the activities outlined in Section 1.2.1. The activity hazards at the WB/A-Site OU, provided below and in Table 1-1, identify potential health, safety, and environmental hazards associated with each type of field activity. Job Loss Analyses (JLAs) (formerly known as Job Safety Analyses [JSAs][2], and additional to those provided in the Multi-Area HSP) are also provided in Appendix A. It is intended that these JLAs will be updated as necessary prior to construction, when the full project design is known and understood. Because of the complex and changing nature of field projects, the SS must continually inspect the WB/A-Site OU to identify hazards that may affect onsite personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PC whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep onsite personnel informed of the changing conditions, and the PC will write and/or approve addenda or revisions to this Addendum as necessary.

Many of the field activities, hazards, and control procedures are similar to those outlined in the Multi-Area HSP main text. The Multi-Area HSP has therefore been referenced where applicable.

3.1.1 Pre-Design Investigation

3.1.1.1 Site Reconnaissance

Site reconnaissance activities are likely to occur during the pre-design phases of the project and will generally involve walking or driving across the WB/A-Site OU to evaluate existing conditions. Hazards may be associated with the terrain of the WB/A-Site OU and environmental conditions.

Hazards – Walking surfaces may involve slip, trip, or fall hazards. Slippery walking surfaces can increase the possibility of slips and falls. The immediate proximity of the WB/A-Site OU to the Kalamazoo River and Davis Creek increases the possibility of slipping and falling into the

[2] Updates to the ARCADIS Health and Safety system in September 2009 resulted in changes to several terms used throughout the Multi-Area HSP (ARCADIS BBL 2007). Job Safety Analyses (JSAs) are now referred to as Job Loss Analyses (JLAs), and Near Misses are now referred to as Near Losses. Only the terms have been updated -- the definition and purpose of each element of the health and safety program remain unchanged.

river itself and drowning. Several areas around the WB/A-Site OU are also low-lying and prone to flooding, which again increases the risk of drowning by falling into bodies of water. The paper residuals create potentially large desiccation cracks and produce uneven walking surfaces increasing the possibility of tripping and falling.

Environmental hazards may include flora and fauna such as poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues such as sunburn, lightning, rain, tornados, and heat or cold-related illnesses; and pathogens such as rabies, Lyme disease, and blood-borne pathogens.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel should take extra care during periods of heavy rainfall, when the river is more prone to flooding, possibly avoiding visiting the WB/A-Site altogether.

3.1.1.2 Installation of borings

A subsurface investigation (i.e., a drilling program) will be completed to evaluate soil conditions in order to perform a slope stability analysis for the final build-out berm slope geometry of the WB/A-Site OU and to delineate waste limits throughout the WB/A-Site OU for grading and cap construction. Soil sampling activities will consist of collecting samples for field analysis using a drill rig with hollow-stem auger and/or geoprobe units. The physical hazards from sampling are associated with the heavy equipment used to collect the samples, and the environment in which the samples are collected.

Refer to Section 3.2.6.2 of the Multi-Area HSP for a discussion of the potential hazards associated with land-based drilling that include heavy equipment operations, working near underground and overhead utility lines, and use of specialized tools and equipment. As detailed in Section 3.2.6.2 of the Multi-Area HSP, the driller is responsible for safe operation of the drill rig and must follow all hazard and control procedures, including procedures for equipment decontamination. Additional hazards related to handling of soil samples are outlined below.

Hazards –The environmental conditions under which the sampling is conducted may present chemical hazards including contact with soil containing PCBs and contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection/probing, potential hazards associated with working near water are a concern. A number of samples will be collected from the shoreline - the primary hazard of working near the river is drowning. A number of borings will be located near to the sheet pile wall along the north side of the A-Site, which may lead to the hazards of falling from height into the river and drowning.

The flora and fauna of the WB/A-Site OU may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may exacerbate these hazards by causing wet, muddy, slick walking surfaces, and unstable soil.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods. To control dermal exposure during soil sampling/probing activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders. It is also anticipated that a temporary guardrail will be installed along the length of the sheet pile wall on the north side of the A-Site to prevent falls into the river.

3.1.1.3 Pre-Design Soil Sampling

Pre-design soil sampling will be conducted throughout the WB/A-Site OU to verify the extent of PCB contamination. Soil sampling activities consist of collecting samples for field and laboratory analysis using hand-augering techniques. The physical hazards from sampling are associated with the sample collection methods, the equipment used to collect the samples, and the environment in which the samples are collected.

Hazards – The primary physical hazards associated with soil sampling include muscle strains, sprains, and eye injuries. The environmental conditions under which the sampling is conducted may present chemical hazards including contact with soil containing PCBs and contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection, potential hazards associated with working near water will be a concern. A number of samples will be collected from the shoreline and in the area east of Davis Creek - the primary hazard of working near water is drowning.

The flora and fauna of the WB/A-Site OU may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may exacerbate these hazards by causing wet, muddy, slick walking surfaces, and unstable soil.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods. To control dermal exposure during soil sampling activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders.

3.1.2 Surveying Activities

Surveying activities for the WB/A-Site OU will include survey of boring and monitoring well locations from the pre-design investigation, as well as survey of the site subsequent to the Remedial Action. Surveying involves the transportation, set up, and use of survey equipment (e.g., Global Positioning System [GPS] unit, survey rod).

Hazards – The primary physical hazards associated with these specific procedures include muscle strains, sprains, and potential eye hazards along with water hazards (through working in close proximity to water) such as immersion in cold water or drowning. The conditions under which the procedures are conducted may present chemical and physical hazards. Slips, trips and falls can occur at any time based upon the terrain covered. Potential chemical hazards may include contact with media containing PCBs and potential contact with chemicals used for equipment decontamination.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – To control dermal exposure during surveying activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment. Prior to initiating each activity, the Site conditions will be discussed with

onsite personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in Section 4, General Safety Practices, and in task-specific sections of the Multi-Area HSP. Specifically, Section 4.22 contains information on water hazards and safety practices including mandatory use of floatation equipment. Air monitoring information is included in Section 6, Air Monitoring. As detailed in 3.1.1.2, it is also anticipated that a temporary guardrail will be installed along the length of the sheet pile wall on the north side of the A-Site to prevent falls into the river.

3.1.3 Mobilization

Refer to Section 3.2.1 of the Multi-Area HSP for a discussion of the potential hazards associated with mobilization including heavy equipment operations, increased traffic, working near the river, and other physical and environmental hazards.

3.1.4 Sediment and Soil Excavation Operations

3.1.4.1 Excavation activities

Refer to Section 3.3.3 of the Multi-Area HSP for a discussion of the potential hazards associated with sediment and soil removal operations including heavy equipment operations, materials handling, working near the river, exposure to WB/A-Site OU contaminants, and other physical and environmental hazards.

3.1.4.2 Confirmation Sampling

Confirmation soil and sediment sampling will be conducted throughout the WB/A-Site OU to verify that PCBs have been removed to the site-specific cleanup criteria. Soil sampling activities consist of collecting samples for field and laboratory analysis using Lexan® tubing, driven until refusal, or hand-augering techniques. The physical hazards from sampling are associated with the sample collection methods, the equipment used to collect the samples, and the environment in which the samples are collected.

Hazards – The primary physical hazards associated with soil and sediment sampling include muscle strains, sprains, and eye injuries. The environmental conditions under which the sampling is conducted may present chemical hazards including contact with soil containing PCBs and contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection, potential hazards associated with working near water will be a concern. A number of samples will be collected from the shoreline and in the area east of Davis Creek - the primary hazard of working near water is drowning.

The flora and fauna of the WB/A-Site OU may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may exacerbate these hazards by causing wet, muddy, slick walking surfaces, and unstable soil.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods. To control dermal exposure during sediment soil/probing activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders.

3.1.4.3 Mitigation Activities

Refer to Section 3.3.3.6 of the Multi-Area HSP for a discussion of the potential hazards associated with mitigation activities including heavy equipment operations, materials handling, working near the river, and other physical and environmental hazards.

3.1.5 Material Transport and Consolidation at WB/A-Site OU

Following excavation activities, the excavated material will be staged and dewatered, if necessary, and then moved away from the river, where it will be consolidated prior to capping. The majority of excavated materials will be transported fully within the site; however, some materials will be excavated from areas away from the site that will require transportation via public roads (including the area around monitoring well AMW-3). Section 3.3.4 of the Multi-Area HSP discusses the potential hazards and controls pertaining to this work including working surfaces, heavy equipment operations, materials handling, exposure to WB/A-Site OU contaminants, and increased traffic.

3.1.6 Installation of Cover System

3.1.6.1 Part 115 Cap Installation

Capping activities will involve import of clean materials which will be placed over the consolidated contaminated material. Hazards and Controls are similar to those discussed in Section 3.1.5 Material Transport and Consolidation.

3.1.6.2 Groundwater Monitoring Network

Monitoring wells will be analyzed periodically to evaluate groundwater elevations throughout the site. The hazards and safety procedures for groundwater sampling are included in the following sections. The physical hazards of this operation are primarily associated with the methods and procedures for monitoring the wells and sample locations.

Hazards – The primary hazards associated with determining groundwater elevations are not potentially serious; however, the conditions under which the wells are monitored may present physical hazards. The hazards directly associated with monitoring wells are generally limited to strains/sprains and potential eye hazards. Potential chemical hazards may include contact with media containing PCBs and potential contact with chemicals used for equipment decontamination. In addition to the safety hazards specific to sample collection, hazards associated with working on, in, or near water, will be a concern.

The flora and fauna of the Site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Controls – To control dermal exposure during sampling activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders.

3.1.6.3 Landfill Gas Monitoring System and Cutoff Trench

A landfill gas monitoring system and cutoff trench will be installed to determine the extent of gas generation and migration at each landfill cap. The hazards and safety procedures for installation of this system are included in the following sections. The physical hazards are

primarily associated with the potentially explosive conditions created by confinement of methane gas in concentrations above the lower explosive limit.

Hazards – The primary hazards associated with installation of a landfill gas monitoring system and cutoff trench are primarily associated with the exposure of personnel to a potentially difficult breathing environment and potentially explosive conditions due to the build-up of methane gases, materials handling, and hand-labor activities. Unstable trenches could collapse, resulting in possible injury and death. Materials handling and hand-labor activities may cause blisters, sore muscles, joint and skeletal injuries, and contusion and laceration hazards. The work area itself presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. In addition, rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces. A falling-from-height hazard is introduced due to excavation of the trench. A drowning hazard is associated with working on or near the River.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating gas monitoring system and trench installation activities, the operation will be reviewed with all onsite personnel. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Restrictions will be placed on performing hot work at the site (welding, torch cutting, etc.), using sparking tools, and smoking will be forbidden on site. The use of air quality meters will be employed to identify potentially hazardous breathing or explosive environments during excavation/trenching activities. Trenches must be inspected regularly and following rain or other such weather event that could affect the integrity of the excavation. Inspections must be performed by a Competent Person as defined in the ARCADIS Excavation and Trenching Procedure (ARC HSCS005). It is not anticipated that there will be a need for personnel to enter any trenches; however, if necessary, personnel should not enter into trenches that have not been inspected and approved as safe by the designated Competent Person. Soil piles and materials will be kept a minimum of two feet from the edge. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods or performing work in the trench for long periods. Mechanical assistance should be provided for large lifting tasks. Personnel should maintain a safe walking distance from the edge; at least two feet. Any excavations left open and unattended will be marked and protected by the contractor.

3.1.6.4 Permanent Erosion and Sedimentation Controls

After complete removal of contaminated materials, erosion control measures will be implemented to include topsoil placement, seeding, and erosion control matting as required.

Hazards – The hazards of this phase of activity are primarily associated with materials handling and unloading, and hand-labor activities. Materials handling and hand-labor activities may cause blisters, sore muscles, joint and skeletal injuries, and contusion and laceration hazards. The work area itself presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. In addition, rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces. A drowning hazard is associated with working on or near the River.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating erosion control installation activities, the operation will be reviewed with all onsite personnel. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Mechanical assistance should be provided for large lifting tasks.

3.1.7 Sheet Pile Wall Removal

The sheet pile wall that runs along the northern bank of the A-Site is anticipated to be cut off at the median river water level and the cut sections removed from the project area. Sheet pile removal activities may involve exposure to physical and health hazards.

Hazards – The hazards of this phase of activity are associated with manual materials handling, overhead work (sheet pile removal and lifting), hot work (removal of sheet pile by torch cutting), excavation hazards, and drowning hazards. Manual materials handling and project area preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. Removal of the sheet pile wall may expose personnel to hot work activities, underground and overhead utilities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from

scattered debris, irregular walking surfaces, or elevated work. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Working in and around the River also presents a drowning hazard.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating each activity, the Site conditions and JLAs will be discussed with onsite personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in the Multi-Area HSP in Section 4, General Safety Practices, and in task-specific sections. Decisions regarding PPE and air monitoring will be based on the potential chemical and physical hazards at the Site, and measurements and observations made prior to and during work activities. Equipment will be inspected and in proper working condition. Mechanical assistance will be provided for large lifting tasks. Avoidance of biological hazards, as discussed in Section 4, General Safety Practices, of the Multi-Area HSP will be implemented. Personnel conducting observation activities will do so from a safe distance. Any required hot work will be performed using the appropriate PPE equipment, including gloves and face shields. Additionally, no hot work will be conducted on any surface covered with a protective coating whose flammability is not known. Noise may also present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 A-weighted decibels (dBA), requiring the use of hearing protection.

3.1.8 Personnel and Equipment Decontamination

Refer to Section 3.2.3 of the Multi-Area HSP for a discussion of decontamination of non-disposable equipment and the primary potential hazard - release of hazardous materials.

3.1.9 Site Restoration and Demobilization

Refer to Section 3.2.4 of the Multi-Area HSP for a discussion of the potential hazards associated with restoration and demobilization including heavy equipment operation, materials handling, working near the river, and other environmental and physical hazards.

3.1.10 Environmental Monitoring

Refer to Sections 3.3.5.1, 3.3.5.3, and 3.3.5.4 of the Multi-Area HSP for a discussion of the potential hazards associated with air, groundwater, and surface water monitoring including hazards associated with the sample collection methods, sampling equipment, and the environment in which the samples are collected (e.g., sampling near the river).

3.1.11 Construction Oversight

Refer to Section 3.2.5 of the Multi-Area HSP for a discussion of the potential physical and health hazards associated with construction oversight including working around heavy equipment, material handling, and environmental hazards.

3.2 Chemical Hazards

Refer to Section 3.4 of the Multi-Area HSP for a discussion of the potential chemical hazards related to inhalation, ingestion, and skin or eye contact with materials that are impacted by PCBs.

Table 3-1 provides supplemental information to that of the Chemical Hazard Table provided in the Multi-Area HSP, which includes data on methane. A Material Data Sheet is also included in Appendix B.

4. Sections of Multi-Area HSP Applicable to WB/A-Site OU Remedial Action

Compliance with the following sections of the Multi-Area HSP is required for the WB/A-Site OU Remedial Action:

- General Safety Practices – Outlined in Section 4 of the Multi-Area HSP
- Personal Protective Equipment – Outlined in Section 5 of the Multi-Area HSP
- Air Monitoring – Outlined in Section 6 of the Multi-Area HSP
- Work Zones and Decontamination – Outlined in Section 7 of the Multi-Area HSP
- Training and Medical Surveillance – Outlined in Section 8 of the Multi-Area HSP
- Emergency Procedures – Outlined in Section 9 of the Multi-Area HSP. Figure 9-2 in the Multi-Area HSP identifies a route to the hospital (Borgess Emergency and Trauma Center [north of the site]) that would be applicable for the WB/A-Site OU.

5. ARCADIS Policies/Procedures

ARCADIS Health and Safety Procedures applicable to this project are listed below. These procedures should be reviewed by the project manager, task manager and site personnel. The Health and Safety Officer should be contacted with any questions concerning the procedures. In the event that there is conflicting information between the policies and information provided in this addendum or the Multi-Area HSP, the rules that provide the most protection to the worker will be followed.

- ARC HSCS005 – Excavation and Trenching
- ARC HSFS019 – Utility Location
- ARC HSGE007 – Hazard Communication
- ARC HSGE024 – Motor Vehicle
- ARC HSIS008 – Hearing Conservation
- ARC HSGE004 – First Aid / Cardiopulmonary Resuscitation (CPR)
- ARC HSMS010 – Incident Reporting and Investigation
- ARC HSGE015 – Personal Protective Equipment (PPE)

6. ARCADIS Field Health & Safety Handbook

The Field Health and Safety Handbook is an ARCADIS document containing information about topic-specific health and safety requirements for the field. This handbook contains relevant general topics and is used as part of the overall health and safety program. Where applicable, the information provided in the handbook will be used as an informational source in conjunction with the Multi-Area HSP. Field Health and Safety Handbook sections applicable to this project include:

II. Health and Safety Administration

- A. ARCADIS Responsibilities
- B. Employee Responsibilities
- C. Visitors
- D. Communications
- E. HARC Process (ARCHSMS002)
- F. Incident Investigation (ARCHSMS010)
- G. Near-miss Reporting
- H. Stop Work Authority
- I. Short-service Employee Program
- J. Workplace Violence and Harassment
- K. Drug and Alcohol Awareness
- L. Emergency Action Plan
- M. WorkCare
- N. Subcontractors
- O. Regulatory Inspections (ARCHSG013)
- P. Recordkeeping and Postings

III. General Field Health & Safety Requirements

- A. Daily Safety Meetings/Tailgates
- B. Department of Transportation – HAZMAT Transportation/Dangerous Goods (ARCHSGED02)
- C. First-aid/CPR
- D. Blood-borne Pathogens (ARCHSIH005)
- E. General Health and Safety Rules and Safe Work Permits
- F. General Housekeeping, Personal Hygiene and Field Sanitation
- G. Site Security, Work Zone and Decontamination for HAZWOPER Sites
- H. Personal Safety and Other Unique Site Conditions
- I. Severe Weather
- J. Fire Prevention
- K. Hazard Communication
- L. Noise
- M. Heat and Cold Stress
- N. Biological Hazards
- P. Medical Surveillance (ARCHSGE010)
- R. Personal Protective Equipment (ARCHSGE015)

S. Travel Safety-Domestic and International (ARCHSGE022)
T. Vehicle Safety Inspection
U. Driving
V. Trailer Safety
Y. Confined Spaces (ARCHSSF003)
BB. Fall Protection (ARCHSFS007)
CC. Hand and Power Tools
DD. Vegetation Management
EE. Ergonomics
FF. Site Storage of Hazardous Chemicals, Gases and Solvents
GG. HAZWOPER and HAZMAT Response (ARCHSSF012)
II. Drum and Other Material Handling
JJ. Ladders (Portable/Fixed)
KK. Signs, Signals and Barricades
LL. Traffic Control (ARCHSFS017)
MM. Utility Location (ARCHSF019)
NN. Backing Safety

IV. General Field Construction Health and Safety Best Management Practices

A. Elevated Work Surfaces
D. Excavation/Trenching (ARCHSCS005)
E. Heavy Equipment (ARCHSCS006)
F. Hoisting and Rigging, Cranes and Derricks
K Welding and Cutting (ARCHSC011)
L. Temporary Working Surfaces
O. Rollover and Overhead Protection
Q. Permit to Work

V. Specific Work Areas, Hazards and Activities

F. Roadway
G. Water Operations Work
I. Industrial Hygiene and Monitoring Equipment
J. Scientific Scuba Diving

7. References

ARCADIS BBL. 2007. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan – Revision 1.* Prepared for the Kalamazoo River Study Group by ARCADIS BBL U.S., Inc. May 2007.

TABLES

ARCADIS

Tables

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.1.1	Site Reconnaissance	Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces.
		Water-related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
3.1.1.2	Installation of borings	Refer to Table 1-1, section reference 3.2.6.2, of the Multi-Area HSP for hazards related to land-based drilling	
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain. A guardrail will be installed along the extent of the sheet pile wall on the north side of the A-Site
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.1.3	Pre-Design Soil Sampling	Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.2	Surveying Activities	Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain. A guardrail will be installed along the extent of the sheet pile wall on the north side of the A-Site
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.3	Mobilization	Refer to Table 1-1, section reference 3.2.1, of the Multi-Area HSP	
3.1.4.1	Sediment and Soil Removal Operations	Refer to Table 1-1, section reference 3.3.3, of the Multi-Area HSP	

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.4.2	Confirmation Sampling	Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.4.3	Mitigation Activities	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		Electrical (overhead and underground utilities)	Maintain proper distance from utility lines (as defined in Section MM of the ARCADIS Employee Field Health and Safety Handbook; Use lockout/tagout
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain
3.1.5	Material Transport and Consolidation at WB/A-Site OU	Refer to Table 1-1, section reference 3.3.4, of the Multi-Area HSP	

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.6.1	Part 115 Cap Installation	Refer to Table 1-1, section reference 3.3.4, of the Multi-Area HSP for details of material transport and consolidation.	
		Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain
3.1.6.2	Groundwater Monitoring Network	Strains/sprains and potential eye hazards.	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Working on, in, or near water.	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards.	Personnel will wear proper clothing and avoid reaching into dark spaces

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.6.3	Landfill Gas Monitoring System and Cutoff Trench	Difficult breathing conditions	Air quality meters will be employed in certain confined areas to identify potentially difficult breathing environments. Work will be scheduled to reduce the likelihood of personnel being in confined spaces for long periods. The ARCADIS Confined Space Procedure will be followed if confined space entry is required.
		Explosion (due to methane gases)	Restrictions will be placed on hot working (welding, torch cutting, etc) and the use of sparking tools. Smoking will be forbidden at the site. Air quality meters will be employed in any area where intrusive activities are being performed to identify potentially explosive environments (where gas levels exceed the Lower Explosive Limit as defined on material data sheets).
		Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Falling from height	All elevated work will be performed in a safe manner and in compliance with all regulations governing such work (including 29 CFR 1926). All personnel exposed to fall hazards shall be trained regarding the nature of the hazards of elevated work prior to assignment.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards.	Personnel will wear proper clothing and avoid reaching into dark spaces

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.6.4	Permanent Erosion and Sedimentation Controls	Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards.	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.7	Sheet pile wall removal	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Excavation Hazards (access and egress, surface stability, vehicular traffic, falling loads, hazardous atmospheres, water accumulation)	Maintain ladders at regular intervals, brace sidewalls, follow traffic safety, do not stand under falling loads, air monitoring, use of sumps and water control structure). Have a competent person (as defined in the ARCADIS Excavation and Trenching Procedure [ARC HSCS005]) inspect daily.
		High Noise	Hearing protection for noises that exceed 85 dBA
		Electrical (overhead and underground utilities)	Maintain proper distance from utility lines (as defined in Section MM of the ARCADIS Employee Field Health and Safety Handbook; Use lockout/tagout
		Hot work activities	Use lockout/tagout and appropriate PPE, including gloves and face shields.

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
		Slip, trip, and fall/unstable soil	Proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Overhead work (sheet pile installation and lifting materials)	Use ladder and aerial lift safety. Do not stand under elevated loads.
		Observation safety	Observe from a safe distance
3.1.8	Personnel and Equipment Decontamination	Refer to Table 1-1, section reference 3.2.3, of the Multi-Area HSP	
3.1.9	Site Restoration and Demobilization	Refer to Table 1-1, section reference 3.2.4, of the Multi-Area HSP	
3.1.10	Environmental Monitoring	Refer to Table 1-1, section references 3.3.5.1, 3.3.5.3, and 3.3.5.4, of the Multi-Area HSP	
3.1.11	Construction Oversight	Refer to Table 1-1, section reference 3.2.5, of the Multi-Area HSP	

Notes:
1. PFD – personal flotation device
2. PPE – personal protective equipment
3. USCG – United States Coast Guard

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Multi-Area Health and Safety Plan

Table 3-1 – Chemical Hazard Data Table

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Methane [74-82-8]	12.48	NA	Inh	Simple asphyxiant by displacing air necessary for life. Symptoms include rapid respiration, muscular incoordination, fatigue, dizziness, nausea, vomiting, unconsciousness, death	Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.	NA 1000 ppm NA	NA NA NA	PEL TLV REL	NE

Notes:

1. Table supplements data in Multi-Area HSP Chemical Hazard Table.
2. a = ionization potential
   b = route into body; inh = inhalation, ing = ingestion, abs = absorption, con = contact
   c = time-weighted average
   d = short-term exposure limit
   e = Source for TWA and STEL values.
      PEL = permissible exposure limit (OSHA)
      TLV = threshold limit value (ACGIH)
      REL = recommended exposure limit (NIOSH)
   f = immediately dangerous to life and health
3. ND = Not Detected
4. NA = Not Applicable
5. NE = Not Evaluated

FIGURES

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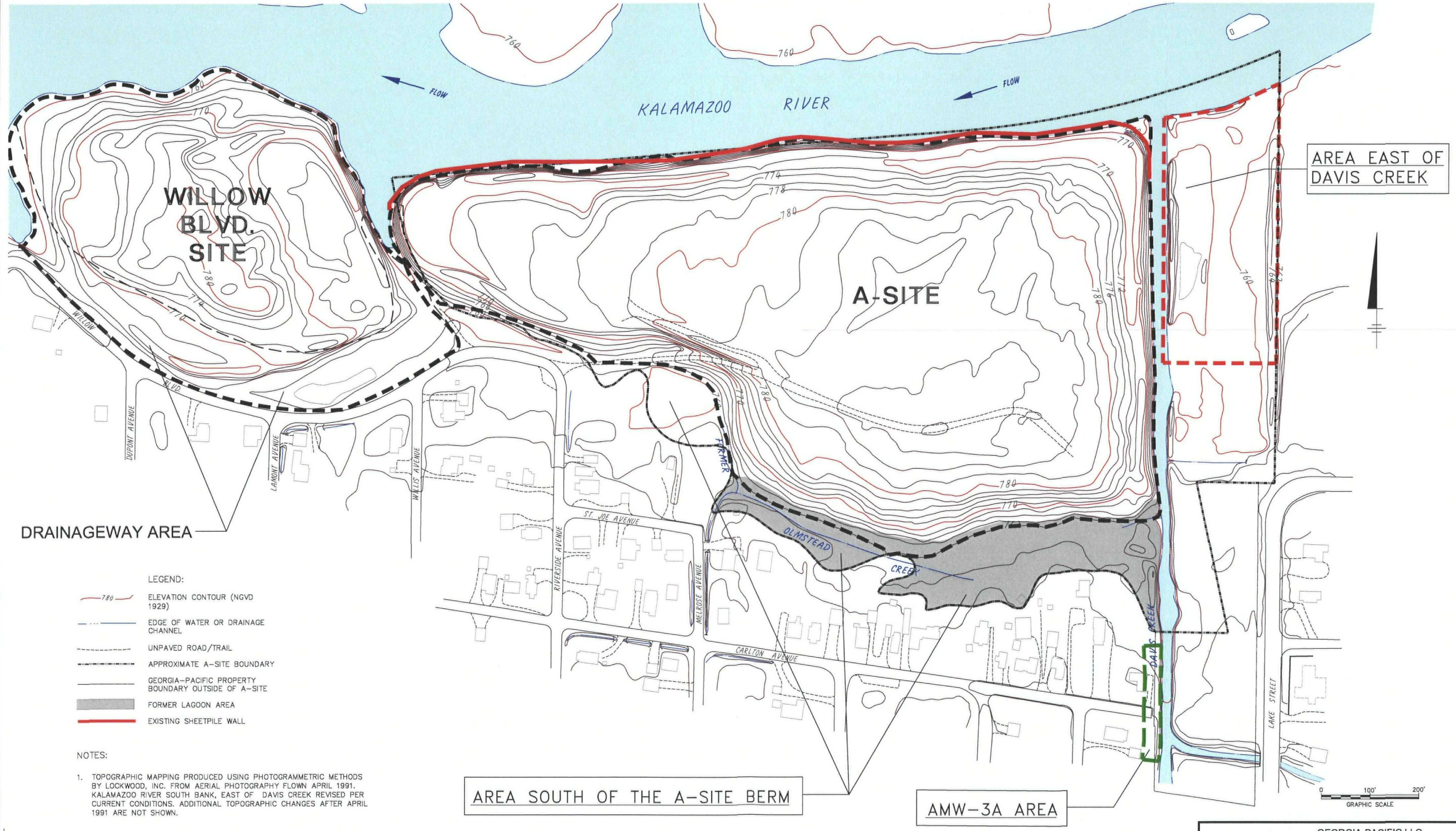
Figures



LEGEND:

- 780 — ELEVATION CONTOUR (NGVD 1929)
- EDGE OF WATER OR DRAINAGE CHANNEL
- UNPAVED ROAD/TRAIL
- APPROXIMATE A-SITE BOUNDARY
- GEORGIA-PACIFIC PROPERTY BOUNDARY OUTSIDE OF A-SITE
- FORMER LAGOON AREA
- EXISTING SHEETPILE WALL

NOTES:

1. TOPOGRAPHIC MAPPING PRODUCED USING PHOTOGRAMMETRIC METHODS BY LOCKWOOD, INC. FROM AERIAL PHOTOGRAPHY FLOWN APRIL 1991. KALAMAZOO RIVER SOUTH BANK, EAST OF DAVIS CREEK REVISED PER CURRENT CONDITIONS. ADDITIONAL TOPOGRAPHIC CHANGES AFTER APRIL 1991 ARE NOT SHOWN.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
MULTI-AREA HEALTH AND SAFETY PLAN - ADDENDUM 6

WILLOW BOULEVARD/A-SITE AND ANCILLARY AREAS

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FIGURE
1-1

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: RLP GMS KMD LD: (Opt) PIC: (Opt) PM: (Read) TM: D. AMBER LYR: ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0064581\0000\00670\DWG\64581G01.dwg LAYOUT: 1-1 SAVED: 6/9/2009 3:41 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 10/8/2009 4:36 PM BY: RITSCHEL, TIMOTHY
XREFS: 64581X03 IMAGES: PROJECTNAME: ----

APPENDIX A

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Appendix A

Job Loss Analysis Sheets

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	526
Job Name	Environmental-Other
Task Description	Erosion and Sediment Control Installation
Project Number	B00645810000
Project Name	A-SITE
PIC Name	ERICKSON, MICHAEL
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Creation Date	6/29/2009 07:35:31 PM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer	Suardini, E.J.	10/23/2009	10/23/2009		Bowman, Matthew	True
HASP Reviewer	Webster, Charles	10/23/2009	10/23/2009		Lynch, Edward	True
Reviewer	Mcguire, Patrick	10/23/2009	10/23/2009		Romagnoli, Robert	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Working Outdoors and near water	1	Environmental hazards: sun, heat, cold, thunder/lightning, insects, hazardous plants, snakes, and animals	Avoid work in extreme weather conditions. Stop work if extremem weather is imminent. If lightning or thunder is present, utilize the 30/30 rule. Inspect area for hazardous plants and insects. Wear appropriate clothes for the area and weather. Use sunscreen, if necessary. Monitor for heat and cold stress. Use buddy system.	
		2	Working near water	Avoid slippery terrain when working near water. Wear PFD when working in/near water.	
2	Work zone set up	1	Not informing anyone in your work area what your intentions are.	Communicate your intentions to all affected personnel. Use high visibility cones if necessary.	
		2	Slips, trips, falls	Choose the safest path on which to walk. Continue to scan for any slip, trip, fall hazards.	
		3	Pulled muscles/back strain	Use proper lifting/pulling/pushing techniques when bending over. Use a buddy lift if something is too heavy to lift by one person.	
3	Installation of silt curtain	1	Pinch points/flying debris	Always wear gloves and safety glasses. Never put your hand in a position to be struck by a hammer.	
		2	Muscle strain	Use proper liftinng techniques.	
		3	Being hit by equipment entering work zone	Maintain a visual of your work area. Continue to communicate with anyone in your work zone.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)	Leather or mechanics	Required
Eye Protection	Safety glasses		Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required
Miscellaneous PPE	personal flotation device	For any work over water	Required

Supplies

Type	Supply	Description	Required
Personal	insect repellant		Recommended
Personal	sunscreen		Recommended
Miscellaneous	first aid kit		Recommended

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	503
Job Name	Environmental-Other
Task Description	Gas monitoring System Installation
Project Number	B00645810000
Project Name	A-SITE
PIC Name	DESHIELDS, BRIDGETTE
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Creation Date	6/23/2009 08:56:53 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	7/14/2009			Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	7/14/2009			Erickson, Michael	True
Developer	Amber, Danielle	7/14/2009			Erickson, Michael	True
Developer	Batten, Philip	7/14/2009			Rankin, William	True
HASP Reviewer	Webster, Charles				Lynch, Edward	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Excavation of trench	1	Contact, caught by machinery	Personnel shall remain at least 20 feet away from moving or rotating parts (i.e. excavator bucket, equipment tracks/wheels, vehicle drive shaft, etc.). If required to approach or work in the vicinity of moving equipment, obtain eye contact with equipment operator by using hand signals.	
		2	3rd Party Inhallation Hazard	Monitor air in work area(s) for elevated vapors during excavation activities. Complete (if required) an air monitoring log in addition to air monitoring required for Work Permit.	
		3	Area contamination	Excavated soils should be properly stored on-site. Excavated soils shall be sorted on and covered with polyethylene tarps.	
		4	Trench collapse	Soils and equipment shall remain at least two feet away from the edge of the excavation/trench.	
		5	Fall from height	Personnel should maintain a safe walking distance (at least two feet) from the edge of the excavation/trench. Excavations left open and unattended shall be properly marked and protected.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
2	Installation of monitoring system	1	Exposure to hazardous gases/chemicals	a. Operations shall be described to personnel prior to commencement of work. b. Wear Level D PPE. c. Restrictions shall be placed on performing hot work activities and smoking will be forbidden at the site. d. Air quality meters shall be used to identify potentially hazardous breathing or explosive environments.	
3	Routine monitoring of system	1	Exposure to hazardous gases/chemicals	a. Operations shall be described to personnel prior to commencement of work. b. Wear Level D PPE. c. Restrictions shall be placed on performing hot work activities and smoking will be forbidden at the site. d. Air quality meters shall be used to identify potentially hazardous breathing or explosive environments.	

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)		Required
Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Recommended
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	first aid kit		Recommended

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	504
Job Name	Environmental-Other
Task Description	Methane monitoring in excavations
Project Number	B00645810000
Project Name	A-SITE
PIC Name	ERICKSON, MICHAEL
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Cretaion Date	6/23/2009 09:38:17 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
HASP Reviewer	Webster, Charles	10/23/2009	10/23/2009		Lynch, Edward	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Setup of monitoring equipment	1	Exposure to hazardous breathing or explosive environments	Air quality meters will be used to identify potentially hazardous breathing or explosive environments during excavation/trenching activities.	
		2	Injuries associated with materials handling and hand-labor activities	Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods or performing work in the excavation/trench for long periods.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Dermal Protection	Long sleeve shirt/pants		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)		Required
Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Required

Supplies

Type	Supply	Description	Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
Miscellaneous	First aid kit		Recommended
Communication Device	Mobile phone		Recommended
Personal	eye wash (specify type)		Required

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	525
Job Name	Construction-Heavy equipment operation
Task Description	Sheet pile removal
Project Number	B00645810000
Project Name	A-SITE
PIC Name	ERICKSON, MICHAEL
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Cretaion Date	6/29/2009 06:57:24 PM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer	Suardini, E.J.	10/23/2009	10/23/2009		Bowman, Matthew	True
HASP Reviewer	Webster, Charles	10/23/2009	10/23/2009		Lynch, Edward	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Loading and Unloading Equipment from transport vehicles.	1	Stake or impact hazards from moving equipment	Stand clear of equipment loading or unloading form transport vehicles	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		2	Equipment damage from improper removal or placement on vehicle	Ensure any ramps used are rated for weight and properly placed and secure prior to moving equipment across, ensure trailers being loaded or unloaded are properly secured against movement.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		3	Overhead utility contact for equipment with booms or extensions	Plan position of transport vehicle to maintain safe distance (>20 ft) from all overhead lines and structures, Use spotters since operator focus may be on vehicle alignment with ramps or other ground level distractions.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		4	Ascending/Descending equipment cab.	Do not hurry through task, wear footwear with good tread and ankle support, maintain 3 points of contact while accessing or egress equipment, no jumping off trailers or truck beds.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
2	Pre-operation inspection	1	Pinch hazards to hands	Wear gloves appropriate for hazard while maintaining dexterity. Keep hand in field of vision and watch for and keep hands clear of obvious hazards like door or cover closures. Do not hurry during the removal or placement of covers or equipment components.	
		2	Head injury from striking equipment covers or components	Wear hard hat, stay focused on surroundings, avoid standing or raising up suddenly especially if door cover is overhead.	
		3	Exposure to engine fluids or lubricants	Wear protective gloves, ensure MSDS is available for engine fluids and lubricants, promptly wash exposed skin, contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Awkward body positions and twisting	Plan inspection activity and do not hurry through task, stretch before crawling or squatting. Avoid overreaching.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, ensure equipment is not operational (LOTO if necessary) when accessing engine compartment if intrusion required.	
3	Equipment operation	1	Strike or impact hazards with other workers, equipment or structures.	Keep eyes moving and watch for unanticipated worker movement. Keep workers 15 ft from any extendable area of the equipment, Maintain 360 degrees of awareness and ensure adequate communication method with other workers. All workers to know emergency STOP hand signals. all back up alarms to be functional.	
		2	Utility contact (subsurface or above ground)	Follow utility clearance procedure prior to any intrusive work with equipment. Immediately stop work if any unusual or unanticipated condition encountered.	
		3	Rollovers on slopes or from improper usage	Follow equipment manufacturer instructions for use on slopes or load capacities, wear seatbelt at all times, Ensure all outriggers, if equipped are properly deployed on stable surface.	
		4	Noise from engine or work activity	Wear hearing protection as required, keep equipment well maintained.	
		5	Slips and falls from accessing or egress from equipment	Maintain 3 points of contact when access or egress equipment, keep any ladder or steps on equipment clean and dry to extent practical, ensure equipment doors, if present, are in good working order.	
		6	Exposure to tools and metal edges and damaged metal resulting in cuts lacerations to hands during maintenance	Wear protective gloves that allow for good dexterity. Mitigate sharp surfaces to extent practical.	
		7	Pinch/crush hazards to hands from doors or covers	wear gloves appropriate for hazard while maintaining dexterity, Watch for and keep hands clear of obvious hazards like door or cover closures. Do not hurry during the removal or placement of covers or equipment components.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
		8	Contact stress to knees and hands	Use padding or knee pads if kneeling on hard surfaces for an extended period of time. Avoid placing weight on hands for extended periods of time.	
		9	Load failure from impact with other equipment or objects	All site workers will be educated in the Emergency Stop Hand Signal. Standard hand signals will be reviewed prior to hoisting activities for all workers *involved in the lift. Lifts to be* performed in a smooth methodical manner and overseen by a Competent Person. All loads to be adequately contained and/or secure to prevent being knocked off and falling to ground	
		10	Worker struck by hazard from spinning or swinging load	tagline required for all loads lifted over knee height to prevent sudden spinning or swinging, number of taglines required to be specified by Competent Person based on size of load lifted. Hard hat required for all activities	
		11	Crush hazard to feet during load placement	Steel toe boot required, stay clear of loads be lowered into place, if close proximity required, be aware of hazard and ensure visibility of surface and feet are not obscured	
		12	Tipping of crane/boom truck form excessive load or boom angle	Competent person shall ensure all loads do not exceed load limits or the boom angle is not exceeded at any time during the lift.	
4	Maintenance	1	Awkward body positions and twisting	Plan inspection activity and do not hurry through task, stretch before crawling or squatting. Avoid overreaching.	
		2	Excessive force turning bolts or lifting heavy components, decontamination activities.	Use automated methods to loosen tigh bolts, do not use excessive force or torque when using hand tools. Do not use "cheater bars"	
		3	Contact with engine fluids or lubricants	Wear protective gloves, ensure MSDS is available for engine fluids and lubricants, promptly wash exposed skin, contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Flying debris during gross decontamination or cleaning activities	Wear adequate eye and face protection when removing soils or solid media form tracks, buckets, or other component of equipment using pressure washer.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, ensure equipment is not operational (LOTO if necessary) when accessing engine compartment if intrusion required.	
		6	Exposure of hands and arms to hot engine components	Take the time to allow the engine to cool, wear protective gloves and forearm protection.	
		7	Struck by moving equipment or boom extensions	Keep at least 15 ft from any extendable area of the equipment, if entering within 15 ft, establish and maintain contact with equipment operator, ear high visibility clothing or work vest.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
5	Working in proximity to heavy equipment	1	Equipment damage from moving equipment	Keep other equipment not required for work outside of heavy equipment work area in all directions. Flag or mark with high visibility markings, cones, etc., any required equipment near the ground	
		2	Noise hazards from equipment operation	Wear hearing protection and increase distance if work activity permits.	

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)		Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs	as needed	Recommended
Miscellaneous PPE	personal flotation device	recommended when working next to water	Recommended
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Miscellaneous	fire extinguisher		Required
Miscellaneous	first aid kit		Required
Personal	eye wash (specify type)		Required

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	499
Job Name	Environmental-Soil sampling/well installation - drill rig
Task Description	Installation of borings and soil sampling
Project Number	B00645810000
Project Name	A-SITE
PIC Name	DESHIELDS, BRIDGETTE
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Cretaion Date	6/22/2009 02:05:34 PM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	7/7/2009	7/7/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	7/7/2009	7/7/2009		Erickson, Michael	True
Developer	Amber, Danielle	7/7/2009	7/7/2009		Erickson, Michael	True
HASP Reviewer	Webster, Charles	7/21/2009	7/17/2009	True	Lynch, Edward	True
Reviewer	Mcguire, Patrick	7/21/2009			Romagnoli, Robert	True

Reviewer Comments

Role	Employee	Approval Status	Completed Date	Comments
HASP Reviewer	Webster, Charles	Approve	07/17/2009	

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Mobilization/Demobilization	1	Vehicle accident	a. Use defensive driving skill and Smith System 5 keys to prevent MVAs. b. Park vehicle in a safe location, away from site traffic if possible.	
2	Conduct Site Safety (Daily Job Briefing)	1	N/A	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 the appropriate secions of the Field Safety & Health Handbook. Ensure that all employees are aware of all hazards and are wearing all necessary PPE. Ensure that all employees are aware of the locations of emergency equipment and contacts	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
3	General site condition assessment	1	Heat/Cold stress	a. Wear appropriate clothing for weather conditions to avoid heat stress, cold stress, sunburn, frostbite. b. Take rest breaks in conditioned space as needed to warm up/cool down.	
		2	Severe/Hazardous weather conditions	a. Check the weather forecast before going on site. b. Take shelter in the field vehicle or other sturdy structure if hazardous weather conditions materialize.	
		3	Slips/Trips/Falls	a. Evaluate site terrain and establish work and travel areas in clear areas. b. Wear appropriate boots with ankle support.	
4	Soil Boring/ Monitoring Well Installation	1	Struck by heavy equipment, hydraulic hoses or moving/rotating parts.	a. Communicate with driller and helper. b. Confirm rig has been inspected and is in working order. c. Know location of emergency shut off switches. d. Be aware of rig movements and hydraulic hoses. e. Do not stand within 15 feet of the drill rig.	
		2	Struck By Falling Objects	a. Check and eliminate overhead obstructions prior to work. b. Wear hard hat at all times.	
		3	Noise Exposure	Hearing protection (either ear plugs or ear muffs) are required when drill rig is operational.	
5	Conduct Site Safety (Daily Job Briefing)	1	Struck by heavy equipment, hydraulic hoses or moving/rotating parts.	a. Do not attempt to sample soil cutting while rig is operating and discharging cuttings. b. Ensure driller has secured hoses to prevent whipping while under pressure.	
		2	Exposure to Impacted Soil and Liquid or Chemical Preservatives.	Wear Kevlar liners under nitrile gloves when sampling and handling broken containers.	
		3	Cuts and Abrasions	Wear Kevlar liners under nitrile gloves when sampling and handling broken containers	
		4	Burns to skin, eyes and/or respiratory system	a. Avoid contact with preservatives. b. Nitrile gloves should be worn when retrieving sampling containers from cooler as preservative may have leaked from containers. Refer to laboratory packing slip for an inventory of preservatives as they can burn skin and eyes on contact. c. Open sampling containers away from face and allow fumes from preservatives to dissipate.	
		5	Back Strains	a. When lifting, keep loads close to body, avoid twisting torso, use legs (not back) to lift loads. b. Request assistance when lifting heavy objects (>50lbs). c. Use cart to transport equipment, coolers, buckets of cuttings. d. Avoid lifting heavy/awkward coolers by leaving cooler on tailgate.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
6	Decontamination of Downhole Equipment	1	Struck by heavy equipment.	Stand a minimum of 15 feet from decontamination activities.	
		2	Eye Irritation	Wear safety glasses at all times to prevent particles that may be dislodged during decontamination from getting into the eye.	
		3	Exposure to impacted soil and water	a. Decontamination waste will be temporarily containerized in drums. b. Wear nitrile gloves when handling and sampling decontamination waste.	
7	Pack Cooler for Shipping	1	Cuts and Abrasions	a. Wear Kevlar liners under nitrile gloves. b. Pack sample containers on ice in bubble wrap to prevent breakage during transport.	
		2	Exposure to chemicals	a. Do not ship leaking coolers. b. Labeling and packaging must be performed by a DOT trained individual.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	boots		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Recommended
Hearing Protection	ear plugs		Recommended
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Recommended
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	first aid kit		Recommended
Personal	insect repellant		Recommended
Personal	sunscreen		Recommended

APPENDIX B

ARCADIS

Appendix B

Material Data Sheet for Methane

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Methane
MSDS 440
MET1340

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Methane **CAS Number:** 74-82-8
Chemical Formula: CH_4
Structural Chemical Formula: CH_4
Synonyms: BIOGAS; FIRE DAMP; MARSH GAS; METHANE; METHANE,COMPRESSED; METHANE,REFRIGERATED LIQUID; METHYL HYDRIDE; R 50; R 50 (REFRIGERANT)
General Use: Constituent of illuminating and cooking gas.
Base raw material for many chemicals, in the manufacture of hydrogen, methanol, methyl chloride, methylene chloride, hydrogen cyanide, ammonia, acetylene, formaldehyde, in organic syntheses.
Operators should be trained in procedures for safe use of this material.

Section 2 - Composition / Information on Ingredients

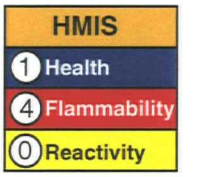
Name	CAS	%
methane	74-82-8	>98

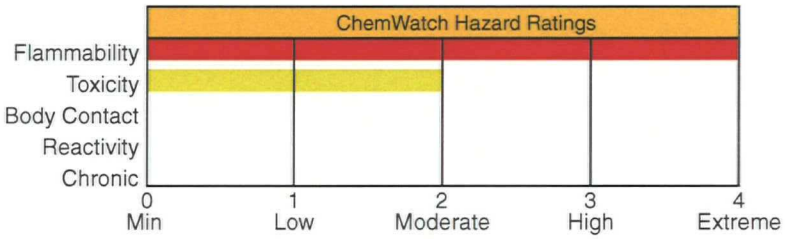
OSHA PEL
No data found.

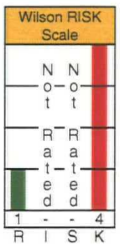
NIOSH REL
No data found.

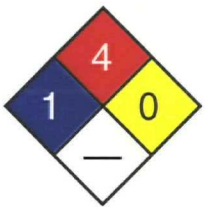
ACGIH TLV
No data found.

Section 3 - Hazards Identification









Fire Diamond

ANSI Signal Word
Danger!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; odorless. Stored as a compressed gas which can cause frostbite. A simple asphyxiant which can displace available oxygen needed for breathing. Extremely flammable.

Potential Health Effects

Primary Entry Routes: inhalation
Target Organs: None reported
Acute Effects
Inhalation: The gas acts as a simple asphyxiant by partially displacing, replacing the air required to support human life.
Symptoms of asphyxia (suffocation) may include headache, dizziness, shortness of breath, muscular weakness, drowsiness and ringing in the ears.

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If the asphyxia is allowed to progress, there may be nausea and vomiting, further physical weakness and unconsciousness and, finally, convulsions, coma and death. Significant concentrations of the non-toxic gas reduce the oxygen level in the air. As the amount of oxygen is reduced from 21 to 14 volume %, the pulse rate accelerates and the rate and volume of breathing increase. The ability to maintain attention and think clearly is diminished and muscular coordination is somewhat disturbed. As oxygen decreases from 14-10% judgement becomes faulty; severe injuries may cause no pain. Muscular exertion leads to rapid fatigue. Further reduction to 6% may produce nausea and vomiting and the ability to move may be lost.

Permanent brain damage may result even after resuscitation at exposures to this lower oxygen level. Below 6% breathing is in gasps and convulsions may occur. Inhalation of a mixture containing no oxygen may result in unconsciousness from the first breath and death will follow in a few minutes.

Eye: The gas is not harmful to the eyes. Contact with liquid may cause burns.

Skin: The gas is non harmful to the skin.

Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.

Ingestion: Not applicable.

Refer to inhalation.

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 long term effects.

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: Not applicable.

Skin Contact: In case of cold burns (frost-bite): Bathe the affected area immediately in cold water for 10 to 15 minutes, immersing if possible and without rubbing.

Do not apply hot water or radiant heat. Apply a clean, dry dressing.

Transport to hospital or doctor.

Ingestion: Refer to procedure for inhalation.

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

Note to Physicians: Treat symptomatically.

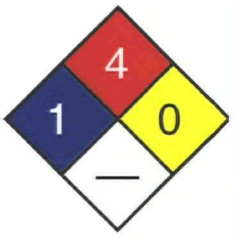
Section 5 - Fire-Fighting Measures

Flash Point: -218 °C

Autoignition Temperature: 537 °C

LEL: 5.0% v/v

UEL: 15% v/v



Fire Diamond

Extinguishing Media: Dry chemical powder; BCF (where regulations permit); carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Flammable gas. Severe vapor explosion hazard, when exposed to flame or spark.

Dangerous hazard when exposed to heat or flame.

Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, emits toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).

Fire Incompatibility: Explosion hazard may follow contact with incompatible materials.

Reacts violently with oxidizing agents such as chlorine.

Contact with chlorine dioxide causes spontaneous explosion.

Contact with liquid fluorine causes spontaneous explosion, even at very low temperatures (-19 °C).

A mixture of liquid methane and liquid oxygen is an explosive.

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.

If safe, switch off electrical equipment until vapor fire hazard removed.

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.

Do not extinguish burning gas. If safe to do so, stop flow of gas.

If flow of gas cannot be stopped, leave gas to burn.

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Section 6 - Accidental Release Measures

Small Spills:

1. Avoid breathing vapor and any contact with liquid or gas. Protective equipment including respirator should be used.
2. Do NOT enter confined spaces were gas may have accumulated.
3. Shut of all sources of possible ignition and increase ventilation.
4. Clear area of personnel.
5. Stop leak only if safe to so do.
6. Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve.
7. Keep area clear of personnel until gas has dispersed.

Large Spills: Contact fire department and tell them location and nature of hazard.
Clear area of personnel and move upwind.
Shut off all possible sources of ignition and increase ventilation.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. May be washed to drain with large quantities of water.
Consider evacuation.
Apply leak detection solution to suspected sites in lines and equipment.
Remove leaking cylinders to a safe place. Fit vent pipes. Release pressure under safe, controlled conditions by opening valve. Burn issuing gas at vent pipes.
Do not exert excessive pressure on valve; do not attempt to operate damaged valve.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Used in closed pressurized systems, fitted with safety relief valve.
Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, bare flames.
Atmospheres must be tested and O.K. before work resumes after leakage.
Obtain a work permit before attempting any repairs.
Do not attempt repair work on lines, vessels under pressure.
Handle and open container with care.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
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.
Avoid generation of static electricity. Ground all lines and equipment.
DO NOT transfer gas from one cylinder to another.
Natural gases contain a contaminant, radon-222, a naturally occurring radioactive gas. During subsequent processing, radon tends to concentrate in liquified petroleum streams and in product streams having similar boiling points.
Industry experience indicates that the commercial product may contain small amounts of radon-222 and its radioactive decay products (radon daughters). The actual concentration of radon-222 and radioactive daughters in process equipment (IE lines, filters, pumps and reactor units) may reach significant levels and produce potentially damaging levels of gamma radiation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon enriched stream or containing internal deposits of radioactive material. Field studies, however, have not shown that conditions exist that expose the worker to cumulative exposures in excess of general population limits. Equipment containing gamma-emitting decay products should be presumed to be internally contaminated with alpha- emitting decay products which may be hazardous if inhaled or ingested.
During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow gamma-radiation to drop to background levels. Protective equipment (including high efficiency particulate respirators (P3) suitable for radionucleotides or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination or inhalation of any residue containing alpha-radiation.

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Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state. [TEXACO].

Recommended Storage Methods: 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.
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: Areas where cylinders are stored require good ventilation and if enclosed need discrete/controlled exhaust ventilation.
Local exhaust ventilation (explosion proof) usually required.
Ventilation should ensure that work place atmospheres do not reach 25% of lower explosive limit.
Respiratory protection in form of air supplied or self contained breathing equipment must be worn if oxygen concentration in the air is suspected to be less than 19%. Cartridge respirators do NOT give protection and may result in rapid suffocation.

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: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:
Exposure Range unlimited: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: asphyxiant - no protection needed unless atmosphere is oxygen deficient

Other: Protective overalls, closely fitted at neck and wrist. Eye-wash unit.
IN CONFINED SPACES:
1. Non-sparking protective boots.
2. Static-free clothing.
3. Ensure availability of lifeline.

Staff should be trained in all aspects of rescue work.
Operators should be trained in correct use & maintenance of respirators.
Ensure that there is ready access to breathing apparatus.
Ensure ready access to a burns first aid kit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, odorless and tasteless gas. Gas has no odor detection level; unless mercaptan odorant is deliberately added. Gas is less dense than air. Burns with a pale, faintly luminous flame. Soluble in alcohol, ether, hydrocarbon and other organic solvents. Packed as a gas under pressure. Sudden release of pressure or leakage may result in generation of a large volume of highly flammable/ explosive gas.
Critical temperature: -82.1 °C. Critical pressure: 4640 kPa.

Physical State: Compressed gas
Vapor Pressure (kPa): Not applicable
Vapor Density (Air=1): 0.55
Formula Weight: 16.04
Specific Gravity (H_2O=1, at 4 °C): 0.422 as liquid
Water Solubility: 0.6 ml in 1 g ethyl alcohol at 20 °C
Evaporation Rate: Not applicable

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: -161.4 °C (-259 °F)
Freezing/Melting Point Range: -182.6 °C (-296.68 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Presence of heat source and ignition source. Presence of elevated temperatures.
Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from oxygen gas and oxidizing agents.

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Section 11 - Toxicological Information

No relevant toxicological data found at time of research.

See NIOSH, *RTECS* PA 1490000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Photolysis, hydrolysis and bioconcentration are not expected to be important environmental fate processes. A K_{oc} of 753 indicates low mobility with water in soil. However, its high vapor pressure would suggest that the gas may permeate through soil. Biodegradation and adsorption may occur in soil and water; however, volatilization is expected to be a far more important environmental fate process in water. Volatilization half lives from a model river and a model environmental pond have been estimated to be 1.17 and 13.89 hr, respectively. It is expected to exist entirely in the vapor phase in the ambient atmosphere. Reaction with hydroxyl radicals is the major sink (half life of 1,908 days).

Ecotoxicity: No data found.

Henry's Law Constant: estimated at 6.58×10^{-1}

BCF: no food chain concentration potential

Biochemical Oxygen Demand (BOD): none

Octanol/Water Partition Coefficient: log K_{ow} = 1.09

Soil Sorption Partition Coefficient: K_{oc} = estimated at 753

Section 13 - Disposal Considerations

Disposal: Discharge to burning flare.

Ensure damaged or non-returnable cylinders are gas-free before disposal.

Return empty or damaged cylinders to supplier.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: METHANE OR NATURAL GAS, COMPRESSED

Hazard Class: 2.1

ID No.: 1971

Packing Group: None

Label: Flammable Gas [2]

Additional Shipping Information: NATURAL GAS, COMPRESSED, with a high methane content

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Not listed

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Research Date:.....1999-11 **Review Date:** 2000-07

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INDUSTRIAL

Subject:
Multi-Area Health and Safety Plan
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Date:
May 2, 2007

Contact:
Michael J. Erickson

Phone:
810.225.1924

Email:
michael.erickson@
arcadis-us.com

Our ref:
B0064524 and
B0064530

Dear Mrs. Kolak and Mr. Borries:

On behalf of the Kalamazoo River Study Group (KRSG), please find enclosed a revised Multi-Area Health and Safety Plan (HSP) (Rev. 1). The Multi-Area HSP was submitted to the United States Environmental Protection Agency (USEPA) on April 9, 2007. The HSP was revised based on USEPA's verbal request on April 17, 2007 for additional detail related to the routes to the hospitals. In addition, since the April 9, 2007 submittal, sediment and soil disposal plans for 2007 were modified. As part of the Time Critical Removal Action (TCRA) activities conducted in 2007, soil and sediment will be transported to one or more off-site licensed disposal facilities. The location of the disposal facility to be used in 2008 has not been determined. The revised HSP includes revisions reflecting this disposal plan modification.

Hard copies of the HSP are provided, along with a CD containing a portable document format (PDF) version of the entire document. Additional copies are being sent on CD as presented in the cc list below.

Sincerely,

ARCADIS of New York, Inc.

Michael J. Erickson, P.E.
Senior Engineer II/ Associate

Enclosures: Mrs. Shari Kolak: 2 hard copies and a copy on CD
Mr. Samuel Borries: 2 hard copies and a copy on CD

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Kalamazoo River Study Group

May 2007

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Allied Paper, Inc./Portage Creek/
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Supplemental Remedial Investigations/
Feasibility Studies

Multi-Area Health and Safety Plan (Rev. 1)

Kalamazoo River Superfund Site

May 2007

ARCADIS BBL

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Multi-Area Health and Safety Plan (Rev. 1)

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Supplemental Remedial Investigations/Feasibility Studies

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Date:
May 2, 2007

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L Site Hot Work Permit

M Confined Space Entry Checklist and Permit

N Float Plan

O Daily Boat Inspection List

P Air Monitoring Log

Q Health and Safety Inspection Form

R Safety Meeting Log

Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
AOC	Administrative Settlement Agreement and Order on Consent
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHSO	Contractor Health and Safety Officer
CHSS	Contractor Health and Safety Supervisor
CO	carbon monoxide
CPM	Contractor Project manager
CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
dBA	A-weighted decibels
DE/CQAO	Design Engineer/Construction Quality Assurance Officer
DEET	diethyltoluamide
DHHS	Department of Health and Human Services
EMS	Emergency Medical Services

EZ	Exclusion Zone
FM	Factory Mutual Engineering Corporation
ft	foot/feet
Georgia-Pacific	Georgia-Pacific Corporation
GFCI	ground fault circuit interrupters
GPS	Global Positioning System
H_2S	hydrogen sulfide
HSP	Health and Safety Plan
HSM	Health and Safety Manager
HSO	Health and Safety Officer
JSA	Job Safety Analysis
KRSG	Kalamazoo River Study Group
kV	kilovolts
LEL	lower explosive limit
LPO	Loss Prevention Observation
LPS	Loss Prevention System
m	meter
MDEQ	Michigan Department of Environmental Quality
MDOT	Michigan Department of Transportation
mg/m^3	milligrams per cubic meter

Mill Properties	former paper mill properties
MSDS	Material Safety Data Sheet
NaCl	sodium chloride
NEC	National Electrical Code
NESC	National Electrical Safety Code
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NRR	Noise Reduction Rating
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PC	Project Coordinator
PCB	polychlorinated biphenyl
PEL	Permissible Exposure Limit
PFD	personal flotation device
PHS	Public Health Service
PIC	Principal-in-Charge
PM	Project Manager
PPE	personal protective equipment
psi	pounds per square inch
PVC	polyvinyl chloride

RMSF	Rocky Mountain Spotted Fever
ROPS	roll-over protective structures
Site	Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
SPSA	Safe Performance Self-Assessment
SOW	Statement of Work
SRI/FS	supplemental remedial investigations and feasibility studies
SS	Site Supervisor
SSE	Short-Service Employee
SZ	Support Zone
TCRA	Time-Critical Removal Action
TLV	Threshold Limit Value
UFPO	underground facilities protection organization
UL	Underwriters Laboratories
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
WCS	water control structure

1. Introduction

1.1 General

On February 21, 2007 Georgia-Pacific Corporation (Georgia-Pacific) and Millennium Holdings, LLC, collectively referred to as the Kalamazoo River Study Group (KRSG), voluntarily entered into two separate agreements (Administrative Settlement Agreements and Orders on Consent [AOCs]) with the U.S. Environmental Protection Agency (USEPA) that will govern the majority of work from this point forward at the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site), located in Kalamazoo and Allegan counties in southwest Michigan (Figure 1-1). One agreement describes a series of supplemental remedial investigations and feasibility studies (SRIs/FSs) that will be carried out over the next several years in Operable Unit (OU) 5 of the Site. OU5 encompasses 80 miles of the Kalamazoo River, including a stretch of Portage Creek from Alcott Street to its confluence with the Kalamazoo River (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. V-W-07-C-864 [SRI/FS AOC]). The second agreement describes the requirements for a Time-Critical Removal Action (TCRA) in the former Plainwell Impoundment (Figure 1-2) of the Kalamazoo River (TCRA AOC, CERCLA Docket No. V-W-07-C-863 [TCRA AOC]). Work on the TCRA will begin in the Spring of 2007, and removal activities and initial planting of vegetation are expected to be completed in the Spring of 2009.

Both the SRI/FS AOC and TCRA AOC require development and submission of a Health and Safety Plan (HSP) to describe the health and safety risk analysis for the proposed activities, a description of required monitoring and personal protective equipment (PPE), required medical monitoring, and work area controls. USEPA has agreed that KRSG may submit one combined HSP to satisfy both agreements. This Multi-Area HSP has been developed to meet the requirements of the activities to be performed under both AOCs.

1.2 Objective

The objective of this Multi-Area HSP is to provide a mechanism for establishing safe working practices while conducting the SRI/FS and TCRA activities. As part of the TCRA activities conducted in 2007, soil and sediment will be transported to one or more off-site licensed disposal facilities. The location of the disposal facility to be used in 2008 has not been determined. The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incident. Table 1-1 presents an activity hazard summary table.

1.2.1 SRI/FS Activities

As described in the Statement of Work (SOW) included as Attachment A to the SRI/FS AOC, the objectives of the SRI/FS activities are to evaluate the nature and extent of hazardous substances, pollutants, or contaminants at and/or from each of the seven Areas defined in OU5 (see Section 1.3.1). The SRI/FS work will also assess the potential risks to human health and the environment posed by these hazardous substances, pollutants, or contaminants, and alternatives for addressing the impacts to human health and the environment at each Area.

Field activities are anticipated to include the following general tasks:

- Site reconnaissance
- Mobilization
- Sediment sampling
- Surface water monitoring
- Shallow soil sampling
- Groundwater monitoring
- Fish sampling
- Bathymetric and topographic surveying
- Decontamination
- Surveying
- Demobilization

1.2.2 Former Plainwell Impoundment TCRA

The USEPA determined that a TCRA is necessary to address polychlorinated biphenyls (PCBs) contamination in the former Plainwell Impoundment. The primary objective of the TCRA construction activities is to remove targeted sediments, River bank soils, and floodplain soils within the former Plainwell Impoundment. Field activities are anticipated to include the following general tasks:

- Mobilization
- Installation, operation, and removal of a water control structure (WCS)
- Removal of the Plainwell Dam
- Sediment and soil removal operations
- Material transport and disposal
- Confirmation sampling
- Decontamination
- Site restoration and demobilization
- Environmental monitoring
- Construction oversight

1.3 Applicability of the Multi-Area HSP

1.3.1 SRI/FS Areas

In the SOW attached to the SRI/FS AOC, specific requirements for the SRI/FS activities are described, and seven distinct Areas within OU5 are defined. The SOW governs work in the following seven Areas of OU5:

- Area 1: Morrow Dam to Plainwell Dam, which includes a stretch of Portage Creek from Alcott Street to its confluence with the Kalamazoo River

- Area 2: Plainwell Dam to Otsego City Dam
- Area 3: Otsego City Dam to Otsego Dam
- Area 4: Otsego Dam to Trowbridge Dam
- Area 5: Trowbridge Dam to the Allegan City Dam
- Area 6: Allegan City Dam to Lake Allegan Dam
- Area 7: Lake Allegan Dam to Lake Michigan

The SOW also requires investigation of former paper mill properties (Mill Properties) to determine whether each Mill Property is a source of potential source of PCBs to the Site. The Mill Properties are as follows:

- Former Bryant Mill
- Former King Mill and the King Street Storm Sewer area
- Former Monarch Mill
- Georgia-Pacific Corporation Kalamazoo Mill and former Hawthorne Mill (These mills are part of OU6[1] of the Site—only the mill investigations will proceed until the terms of the SRI/FS AOC and SOW. The rest of the work at OU6 will continue under separate, pre-existing agreements.)

Although the HSP was developed primarily for work under the Areas and Mill Properties presented above, the HSP may also be applicable to other related areas and activities.

1.3.2 Former Plainwell Impoundment

The former Plainwell Impoundment, which is part of OU5, was formed when the Plainwell Dam was constructed in the early 1900s for the production of hydroelectric power. Power generation

[1] OU6 is defined as the Georgia-Pacific Corporation Kalamazoo Mill Lagoons.

at the dam ceased in the mid-1960s. The presence of PCBs in soils and sediments in the former Plainwell Impoundment that accumulated behind the dam is the primary impetus for the removal action.

1.4 Policy Statement

The policy of ARCADIS BBL is to provide a safe and healthy work environment. No aspect of operations is of greater importance than the prevention of injury and illness. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS BBL will take every reasonable step to eliminate or control hazards to minimize the possibility of injury, illness, or incident.

This Multi-Area HSP prescribes the procedures that must be followed during activities conducted as part of either the SRI/FS or the TCRA in the former Plainwell Impoundment efforts. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Coordinator (PC) and the Health and Safety Officer (HSO). This document will be reviewed periodically to ensure that it is current and technically correct. Any changes in Site conditions and/or the scope of work covered under either the SRI/FS AOC or TCRA AOC will require the review and modification (if necessary) of this Multi-Area HSP. Such changes will be completed in the form of an addendum or a revision to the plan.

The provisions of this plan are mandatory for all ARCADIS BBL personnel assigned to the Site for either the SRI/FS or TCRA work. Subcontractors will prepare their own Site-specific/project-specific HSP that must meet the basic requirements of this Multi-Area HSP. All visitors to ARCADIS BBL work areas at the Site must abide by the requirements of this plan.

1.5 References

This Multi-Area HSP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, USEPA regulations, and ARCADIS BBL health and safety policies and procedures. This plan is based on the guidelines established in the following:

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03) (June 1992)
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, National Institute for Occupational Safety and Health (NIOSH), OSHA, U.S. Coast Guard (USCG), USEPA (Publication 85-115) (October 1985)

- *Title 29 of the Code of Federal Regulations* (CFR), Parts 1910 and 1926

- *Pocket Guide to Chemical Hazards*, Department of Health and Human Services (DHHS), Public Health Service (PHS), Centers for Disease Control (CDC), NIOSH (Publication No. 2005-149) (September 2005)

- *2006 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, American Conference of Governmental Industrial Hygienists (ACGIH) (2006a)

- *Guide to Occupational Exposure Values*, ACGIH (Publication #0384) (2006b)

- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 4thd Ed. (2003)

- *Health and Safety Manual*, ARCADIS BBL, 2006

1.6 Definitions

The following definitions (listed alphabetically) are applicable to this Multi-Area HSP:

- *Contamination Reduction Zone (CRZ)* – Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

- *Exclusion Zone (EZ)* – Any portion of the Site where field work is being conducted and hazardous substances are, or are reasonably suspected to be, present and pose an exposure hazard to on-site personnel.

- *Incident* – All losses, including first aid cases, injuries, illnesses, near-misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.

- *Near-Miss* – An incident in which no injury, illness, motor vehicle accident, equipment or property damage, etc., occurred, but under slightly different circumstances, could have occurred.

- *On-Site Personnel* – All ARCADIS BBL, oversight and subcontractor personnel involved with the TCRA or SRI/FS activities.

- *Project* – All on-site work performed under the SRI/FS AOC or TCRA AOC.
- *Site* – The Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, as shown on Figure 1-1 and described in Section 1.3, where the work under the SRI/FS AOC and TCRA AOC is to be performed by ARCADIS BBL personnel and subcontractors.
- *Subcontractor* – Includes contractor personnel hired by ARCADIS BBL.
- *Support Zone (SZ)* – All areas of the Site, except the EZ and CRZ. The SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.
- *Visitor* – All other personnel, except the on-site personnel.
- *Work Area* – The portion of the Site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area at the Site that is not contaminated, or suspected of being contaminated, the entire work area may be a SZ.

2. Roles and Responsibilities

2.1 All ARCADIS BBL Personnel

All ARCADIS BBL personnel must adhere to the procedures outlined in this Multi-Area HSP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner conflicting with these procedures. After due warnings, the PC will dismiss from the Site any person who violates safety procedures.

All ARCADIS BBL personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this Multi-Area HSP prior to initiating Site activities. In addition, all on-site personnel will attend an initial hazard briefing prior to beginning work at the Site.

The roles of ARCADIS BBL personnel are outlined in the following subsections. A summary table for key project personnel and contacts is provided below.

Table 2-1 – Key Personnel

Role	Name	Address/Telephone No.
ARCADIS BBL Personnel		
SRI/FS Project Coordinator (SRI/FS PC)	Michael J. Erickson, P.E.	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1924 Cell: 734.604.7044
TCRA Project Coordinator (TCRA PC) Design Engineer/Construction Quality Assurance Officer (DE/CQAO)	Stephen Garbaciak Jr., P.E.	30 W. Monroe, Suite 1710 Chicago, IL 60603 Phone: 312.332.4937 ext. 12 Cell: 708.203.0566
Heath and Safety Officer (HSO)	Jay D. Keough, CIH	8 South River Road Cranbury, NJ 08512 Phone: 609.860.0590 ext. 101 Cell: 908.492.5674

Role	Name	Address/Telephone No.
Health and Safety Manager (HSM)	Charles P. Webster, CSP	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
SRI/FS Health and Safety Supervisor	Brian Loomis, CHMM	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1915 Cell: 313.510.6278
TCRA Health and Safety Supervisor	Rich Price	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9247 Cell: 315.439.0542
SRI/FS Site Supervisor (SS)	Brian Loomis, CHMM	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1915 Cell: 313.510.6278
TCRA SS	Rich Price	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9247 Cell: 315.439.0542
Client Personnel		
Georgia-Pacific Corporation	Mark P. Brown, PhD	10 Upland Way Marion MA 02738 Phone: 774.553.5342 Cell: 774.766.0021
Georgia-Pacific Corporation	Chase L. Fortenberry, P.G.	133 Peachtree Street, NE, 9th Floor Atlanta, GA 30303 Phone: 404.652.6166 Cell: 404.539.3509
Millennium Holdings, LLC	Mark E. Tapp	One Houston Center, Suite 700 1221 McKinney Street Houston, TX 77010 Phone: 713.309.7164 Cell: 281.467.0657

Role	Name	Address/Telephone No.
USEPA Region 5 Personnel		
On-Scene Coordinator	Samuel Borries	77 W. Jackson Blvd (SR-6J) Chicago, IL 60604 Phone: 312.353.8360 Cell: 312.802.5336
Remedial Project Manager (PM)	Shari Kolak	77 W. Jackson Blvd (SR-6J) Chicago, IL 60604 Phone: 312.886.6151 Cell: 313.213.9727
Michigan Department of Environmental Quality (MDEQ) Personnel		
MDEQ PM	Paul T. Bucholtz	Remediation & Redevelopment Division 525 W. Allegan St., 3rd Floor South Lansing, MI 48933 Phone; 517.373.8174

2.2 ARCADIS BBL Personnel

2.2.1 Project Coordinator and Design Engineer/Construction Quality Assurance Officer

The SRI/FS Project Coordinator (PC) is responsible for verifying that SRI/FS activities are completed in accordance with the requirements of this Multi-Area HSP and the DE/CQAO is responsible for verifying that former Plainwell Impoundment TCRA project activities are completed in accordance with the requirements of this Multi-Area HSP. The PC and DE/CQAO are responsible for confirming that the Site Supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this Multi-Area HSP. It is also the responsibility of the PC and DE/CQAO to perform the following duties:

- Consult with the HSO on Site health and safety issues
- Review Loss Prevention Observation (LPO) reports (Appendix A)
- Verify that all incidents and near-misses are thoroughly investigated and reported to the KRSG within 24 hours of notification
- Approve, in writing, addenda or modifications to this Multi-Area HSP

- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance

2.2.2 Health and Safety Officer

The HSO or his/her designee (i.e., the HSM) has overall responsibility for the technical health and safety aspects of the project. The HSO or his/her designee must review and approve this Multi-Area HSP. Inquiries regarding ARCADIS BBL health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to the HSM. The HSO or his/her designee must approve changes or addenda to this Multi-Area HSP.

2.2.3 Health and Safety Manager

The HSM is responsible for providing technical support to the PC and SS. Inquiries regarding ARCADIS BBL health and safety procedures, project procedures, and other technical or regulatory issues will be addressed to this individual. The HSM is responsible for investigating injuries, illnesses, and near-miss incidents; assisting in developing corrective action plans; and verifying corrective actions.

2.2.4 Health and Safety Supervisor

The Health and Safety Supervisor (HSS) is responsible for field health and safety issues, including the execution of this Multi-Area HSP. Although the roles and responsibility will be similar, there will be a different HSS for the SRI/FS and TCRA activities. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSS will advise the PC on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary (see Section 6, Air Monitoring). The HSS is the primary Site contact on health and safety matters. It is the responsibility of the HSS to perform the following duties:

- Provide on-site technical assistance, if necessary

- Participate in all incident and near-miss investigations, and confirm that they are reported to the KRSG, HSM, HSO, Principal-in-Charge (PIC)/Project Officer, and PC within 24 hours; the Incident/Near-Miss Investigation Report is provided in Appendix B

- Coordinate Site and personal air monitoring, as required, including equipment maintenance and calibration

- Conduct Site safety orientation training and safety meetings
- Verify that ARCADIS BBL personnel have received the required physical examinations and medical certifications
- Review Site activities with respect to compliance with this Multi-Area HSP
- Maintain required health and safety documents and records
- Assist the SS in instructing field personnel on project hazards and protective procedures
- Review LPO forms

2.2.5 Site Supervisor

The SS is responsible for implementing this Multi-Area HSP, including communicating requirements to on-site personnel. Although the roles and responsibility will be similar, there will be a different SS for the SRI/FS and TCRA. The SS will be responsible for informing the PC of changes in the work plan, procedures, or Site conditions so that those changes may be addressed in this Multi-Area HSP. Other responsibilities are to perform the following duties:

- Consult with the HSS on Site health and safety issues
- Conduct LPOs at the Site (LPO form provided in Appendix A)
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance
- Obtain a Site map, determine and post routes to medical facilities, and post emergency telephone numbers
- Notify local public emergency representatives (as appropriate) of the nature of the Site operations and post their telephone numbers
- Observe on-site personnel for signs of ill-health effects
- Investigate and report any incidents and near-misses to the HSS

- Verify that all on-site personnel have completed applicable training
- Verify that on-site personnel are informed of the physical, chemical, and biological hazards associated with the Site activities and the procedures and protective equipment necessary to control the hazards

2.3 Contractor Qualified Safety Personnel

All on-site Contractors, their personnel, and oversight personnel must understand the requirements established in this Multi-Area HSP. Contractors will prepare their own site-specific HSP, which must be consistent with the requirements of this Multi-Area HSP. Contractor personnel must attend and participate in the daily safety meetings and all other Site safety meetings.

Each Contractor is solely responsible for designating qualified safety personnel to fulfill the respective safety positions outlined in this section. Neither the KRSG nor ARCADIS BBL assumes responsibility for designating a qualified/competent person for Contractor activities. Each Contractor will specifically designate one person and a designated alternate to fill each safety-related position outlined in this section. Each Contractor will provide verification and written certification that personnel are technically qualified to fulfill assigned safety duties.

2.3.1 Contractor Health and Safety Representative

The Contractor Health and Safety Officer (CHSO) is the senior company representative responsible for technical health and safety aspects of the Contractor's operations, including review and approval/acceptance of the Contractor site-specific/task-specific HSP. Each Contractor will name at least one CHSO as a point of contact for ARCADIS BBL. Communications, information requests, and inquiries regarding Contractor safety procedures, project procedures, and other technical or regulatory issues will be addressed to this individual representative from each on-site Contractor.

2.3.2 Contractor Health and Safety Supervisor

Each Contractor will designate a qualified site safety representative and at least one alternate to fulfill the duties of the Contractor Health and Safety Supervisor (CHSS). Each CHSS is responsible for coordinating Site health and safety issues. The CHSS will advise the Contractor on health and safety issues and will establish and oversee the Contractor's air monitoring program, if one is deemed necessary. The CHSS is the primary Site contact on occupational health and safety.

As part of the daily implementation of project activities, responsibilities of the CHSS or designated alternate include, but are not limited to, the following:

- Communicating with Contractor's on-site personnel and ARCADIS BBL concerning health and safety related issues, procedures, or concerns
- Verifying that all Contractor's on-site personnel are made aware of the provisions of the HSP and have been informed of the nature of any physical and/or chemical hazards associated with Site activities
- Maintaining a daily logbook for recording all significant health and safety activities, incidents, and near-misses
- Verifying that all Contractor's on-site personnel and visitors have received the required training, including instructions for safety equipment and PPE use
- Maintaining on -site records of medical clearance and training of all Contractor's on-site personnel
- Suspending work if health- and/or safety-related concerns arise
- Providing on-site technical safety assistance to their personnel
- Implementing the Contractor's on-site and personal air monitoring procedures, including equipment maintenance and calibration, and submitting, when necessary, samples to an American Industrial Hygiene Association (AIHA) accredited laboratory
- Obtaining a Site map, establishing and posting routes to medical facilities and emergency telephone numbers, and arranging emergency transportation to medical facilities
- Notifying local public emergency officers of the nature of Site operations and posting their telephone numbers in an appropriate location at the Site
- Designating, as necessary, a qualified/competent person to comply with OSHA-defined regulations/activities (i.e., excavations, scaffolding, etc.)
- Conducting Site safety orientation training and daily safety meetings for Contractor's on-site personnel

- Verifying that the Contractor's on-site personnel have received the required physical examinations and medical certifications

- Reviewing the Contractor's Site activities with respect to the adequacy of the HSP

- Maintaining required health and safety documents and records at the Site for Contractor's personnel

2.3.3 Contractor's Project Manager

Each Contractor will assign a qualified person to fulfill the role of Contractor Project Manager (CPM). Each CPM is ultimately responsible for ensuring that all project activities are completed in accordance with the requirements and procedures in this Multi-Area HSP. The CPM is responsible for providing their on-site personnel with the equipment, materials, and qualified personnel to implement fully all safety requirements in this Multi-Area HSP.

It is the responsibility of the CPM to:

- Report all accidents, incidents, and near-misses to ARCADIS BBL and the CHSO, and thoroughly investigate all such occurrences on the project

- Approve, in writing, any addenda or modifications of their site-specific HSP

- Suspend work if health- and/or safety-related concerns arise

- Formally review this plan with the CHSO

2.3.4 Contractor Activity-Specific Designated Qualified/Competent Person

Several OSHA standards require activities or roles to be conducted by a designated qualified/competent person (e.g., excavation, scaffolding, etc.). Each Contractor must certify to ARCADIS BBL that designated personnel meet the OSHA requirements of a competent person to be assigned these duties.

2.4 All On-Site ARCADIS BBL Personnel

All on-site ARCADIS BBL personnel must read and acknowledge their understanding of this Multi-Area HSP before commencing work, and abide by the requirements of this Multi-Area

HSP. All on-site ARCADIS BBL and applicable Contractor personnel must sign the HSP Acknowledgement Form after reviewing this Multi-Area HSP.

All ARCADIS BBL personnel will receive training in accordance with applicable regulations. All on-site personnel will be familiar with the requirements and procedures contained in this Multi-Area HSP prior to initiating Site activities. In addition, all on-site personnel will attend an initial hazard briefing (prior to beginning work at the Site) and the daily safety meetings (Section 8.1.4).

All on-site personnel must perform a Safe Performance Self-Assessment (SPSA) prior to beginning each work activity (Section 4.2.1). Safety issues should be either eliminated or mitigated prior to starting work. Risk assessment must also be performed after any near-miss or other incident to determine if it is safe to proceed. On-site personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses, no matter how minor
- Unexpected or uncontrolled release of chemical substances
- Symptoms of chemical exposure
- Unsafe or hazardous situations
- Unsafe or malfunctioning equipment
- Changes in Site conditions that may affect the health and safety of project personnel
- Damage to equipment or property
- Situations or activities for which they are not properly trained
- Near-misses

2.5 Stop Work Authority

Every ARCADIS BBL or Contractor employee at the Site has the responsibility to stop the work of a coworker if the working conditions or behaviors are considered unsafe.

2.6 Short-Service Employee Program

Recognizing that employees who are new to ARCADIS BBL are at a greater risk for incidents, the following guidelines are established to identify those employees and ease their transition. Short-Service Employees (SSEs) will have an assigned field mentor to assist them in adjusting to the project requirements and procedures. SSEs will be identified in the field by wearing an orange hardhat or baseball-type cap.

- ARCADIS BBL employees new to the industry and new to ARCADIS BBL will be designated SSEs for 6 months.
- ARCADIS BBL employees experienced in the industry but new to ARCADIS BBL will be designated SSEs for 3 months.

Additionally, the following apply:

- A crew of two to three may include no more than one SSE
- A crew of five may include no more than two SSEs
- A crew of 10 or more may include no more than three SSEs

2.7 Visitors

All visitors to ARCADIS BBL work areas must abide by the requirements of this Multi-Area HSP, and must check in with the ARCADIS BBL SS. Visitors will be cautioned to avoid skin contact with surfaces, soils, or other materials that may be, or are suspected to be, impacted by PCBs. The potential hazards associated with encountering PCBs at the Site are described in Section 3, Project Hazards and Control Measures.

Visitors requesting to observe work within the ARCADIS BBL work areas must don appropriate PPE prior to entering the work area, and must have the appropriate training and medical clearances to do so. If respiratory protective devices are necessary, visitors who wish to enter the work area must have been respirator trained and fit-tested for a respirator within the past 12 months. Visitors will be escorted at all times within ARCADIS BBL work areas. Unauthorized visitors are not allowed within ARCADIS BBL work areas.

2.8 Near-Miss Reporting Hotline

In an effort to streamline near-miss reporting, especially for employees conducting field work who do not have real-time access to the internet, ARCADIS BBL has established a toll-free Near-Miss Reporting Hotline. The hotline will be checked daily and data will be entered into the ARCADIS BBL Loss Prevention System (LPS) Database, with the caller listed as the primary contact for the event. All entries will be saved and can be accessed by the caller when access to the internet database is available. Calling the hotline does not relieve the caller from the responsibility of following through with the near-miss investigation or of notifying other employees in the office or project team of the occurrence.

THE NEAR-MISS REPORTING NUMBER IS

1-866-242-4304

Callers will be prompted to provide the following information:

- Name and phone number
- Date of near-miss
- Location
- Project number
- A brief description of what happened
- Name of division or office Vice President
- What you think could have happened if this situation had resulted in an injury or damage
- Any other information you think may be important

The intent of this service is to enable employees to phone in near-misses immediately and have the events entered into the ARCADIS BBL LPS Database. Immediately after having a near-miss, an SPSA will be conducted to ensure that it is safe to continue whatever task the

employee was performing. Appendix B provides the Incident/Near-Miss Investigation Report. Immediately reporting and acting on a near-miss can prevent injuries in the future. All on-site personnel are encouraged to help achieve the goal of zero injuries on ARCADIS BBL projects.

3. Project Hazards and Control Measures

3.1 Scope of Work

3.1.1 SRI/FS

Potential scopes of work that will be completed during the SRI/FS field activities include the following tasks:

- Site reconnaissance
- Mobilization
- Sediment sampling
- Surface water monitoring
- Shallow soil sampling
- Groundwater monitoring
- Fish sampling
- Bathymetric and topographic surveying
- Decontamination
- Surveying
- Demobilization

3.1.2 Former Plainwell Impoundment TCRA

The scope of work for the TCRA at the former Plainwell Impoundment includes the following tasks:

- Mobilization

- Installation, operation, and removal of a WCS
- Removal of the Plainwell Dam
- Sediment and soil removal operations
- Material transport and disposal
- Confirmation sampling
- Decontamination
- Site restoration and demobilization
- Environmental monitoring
- Construction oversight

3.2 SRI/FS and Former Plainwell Impoundment TCRA Field Activities, Hazards, and Control Procedures

The Job Safety Analyses (JSAs) for both the SRI/FS and former Plainwell Impoundment TCRA activities provided below identify potential health, safety, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, the SS must continually inspect the Site to identify hazards that may affect on-site personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PC whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep on-site personnel informed of the changing conditions, and the PC will write and/or approve addenda or revisions to this Multi-Area HSP as necessary.

Many of the field activities, hazards, and control procedures discussed in the following sections are applicable to both the SRI/FS and the former Plainwell Impoundment TCRA. Therefore, the field activities, hazards, and control procedures applicable to both the SRI/FS and the former Plainwell Impoundment TCRA will be described first, followed by those applicable only to the SRI/FS, and then by those applicable only to the former Plainwell Impoundment TCRA.

3.2.1 Mobilization

Site mobilization activities for both the SRI/FS and former Plainwell Impoundment TCRA will include, but may not be limited to, the following activities:

- Mobilizing personnel, equipment, and materials
- Verifying Site conditions
- Grading
- Constructing/widening access roads
- Installing erosion and sedimentation controls
- Identifying and relocating, as necessary, aboveground and underground utilities and other installations
- Surveying and bathymetric monitoring
- Clearing and grubbing
- Installation of barge launch and drill pads
- Establishing staging/dewatering and decontamination locations
- Establishing work areas

Project support areas, consisting of temporary trailers, material storage areas, and equipment/vehicle parking areas, will be established to provide critical support services, such as field engineering, health and safety, construction management, equipment maintenance and refueling, equipment and personnel decontamination, worker sanitation, Site security, and access control. A break area will be set up outside of regulated work areas, and fencing and signage will be emplaced around the work areas to secure the Site. Mobilization may involve clearing areas for the SZ and CRZ. During this initial phase, personnel will walk the Site to confirm the existence of anticipated hazards and identify safety and health issues that may have arisen since the writing of this plan.

Hazards – The hazards of this phase of activity are associated with manual materials handling and heavy equipment hazards associated with the installation of temporary on-site facilities/access roads/barge launch pads, lifting overhead loads (crane work), felling trees, drowning hazards, and traffic hazards (trucks bringing equipment to the Site).

Manual materials handling and Site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. Installation of temporary field office and support facilities (e.g., decontamination pad) may expose personnel to electrical hazards, underground and overhead utilities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Truck traffic in the area presents a hazard and working on or near the Kalamazoo River presents a drowning hazard.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.2.2 Surveying Activities

Surveying activities for the SRI/FS and the former Plainwell Impoundment TCRA may include bathymetric surveys, surveying potential access routes to the Kalamazoo River, and surveying structures and associated features along the River (e.g., former dams). Surveying involves the transportation, set up, and use of survey equipment (e.g., Global Positioning System [GPS] unit, survey rod).

Hazards – The primary physical hazards associated with these specific procedures include muscle strains, sprains, and potential eye hazards along with water hazards such as immersion in cold water or drowning. The conditions under which the procedures are conducted may present chemical and physical hazards. Slips, trips and falls can occur at any time based upon the terrain covered. Potential chemical hazards may include contact with media containing PCBs and potential contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to surveying activities, hazards associated with working on, in, or near water or in a boat will be a concern for bathymetric surveys. The primary hazard of working near or on the River is drowning. Of particular concern will be boating safety and operation of other support equipment.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – To control dermal exposure during bathymetric surveying activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment. Prior to initiating each activity, the Site conditions will be discussed with on-site personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in Section 4, General Safety Practices, and in task-specific sections of this Multi-Area HSP. Specifically, Section 4.22 contains information on water and boating hazards and safety practices including mandatory use of floatation equipment. Air monitoring information is included in Section 6, Air Monitoring.

3.2.3 Decontamination

All non-disposable equipment, including boats, sediment and soil sampling equipment, and excavation equipment, will be decontaminated before leaving the work area during both the SRI/FS and the former Plainwell Impoundment TCRA using visual inspection to verify that materials potentially containing PCBs have been removed. In addition, decontamination of water sampling tools may be performed between wells. All operations that have the potential to generate or release hazardous material will be conducted in a controlled area using the appropriate engineering controls. Specific decontamination techniques will be established based on Site conditions. Decontamination procedures will be reviewed with all on-site personnel. A decontamination pad will be constructed on a suitable surface with polyethylene sheeting or other appropriate containment system. Manual scrubbing with a brush will be done to decontaminate small pieces of equipment. Potentially impacted equipment will be determined “clean” by using visual inspection of all equipment.

Hazards – Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the Site as part of the project work. All personnel will review the operating procedures and PPE requirements prior to decontamination. The equipment used for decontamination and the decontamination

containment facility will be inspected daily prior to use. Personnel involved in decontamination activities must wear PPE that is one level below the level worn by personnel working in the work area. Reinstate from all decontamination activities will be collected for on-site treatment or off-site disposal/treatment.

Control – When pressure washing, steaming, or hydro-blasting, the health and safety precautions for hydro-blasting outlined below must be observed.

Pressure-washing presents a splash hazard. Protection against splash to face and skin is mandatory. The pressure-washer is not to be pointed at any person at any time.

Steam-cleaning presents a thermal burn hazard in addition to all the hazards presented by pressure. Adequate protection from the hot surfaces must be provided.

Hydro-blasting is the process of using a stream of water at high pressure to clean or prepare surfaces by removing foreign matter and PCBs. The hazards of high-pressure water cleaning are related to the high pressure of the water, which may exceed 10,000 pounds per square inch (psi) at the nozzle. Contact with the water spray may cause severe lacerations, which may then be contaminated with hazardous material. Because of the high pressure involved, the opportunity for slicing or injecting the water stream through soft tissues of the body exists. Hydro-blasters will also cut through bone at high enough pressures. A second hazard is repetitive motion, or cumulative trauma disorder. These serious disorders are related to repeatedly squeezing the trigger or constantly fighting the pressure of the spray gun with the forearm or wrist.

Only persons trained in use and maintenance of a hydro-blaster may use such equipment. All hydro-blasting operations will conducted only by qualified Contractors. The following general requirements are provided for high-pressure water cleaning activities:

- The gun, pressure piping, pressure hose ends, and couplings will have a burst pressure of at least four times the operating pressure.

- No equipment or component of such equipment will be operated beyond the manufacturer's specifications or beyond the rated working pressure.

- A hose safety shroud will be placed on hoses whenever operating pressure exceeds 2,000 psi.

- The pressure control will be a “deadman” type to safely reduce the nozzle discharge pressure when control is released.
- The pressure discharge gauge indicating pump pressure will be clearly visible for monitoring pump pressure.
- A pressure relief device set to relieve at 110% of the maximum working pressure of the unit or its components, whichever is lower, will be installed on the pump. The relief will be clearly marked and displayed on the device.
- A strainer or filter should be installed on the water supply system to prevent debris from entering the water-blasting units and clogging the gun, control, or other device.
- The maximum operating pressure will be permanently displayed on the pumping unit.

The following basic rules apply to hydro blaster use:

- Wear safety glasses and safety shoes.
- Alternate hands frequently during long periods of use.
- Rotate personnel periodically.
- Use a washer with a new style gun that supplies water to the wand in a straight line as opposed to supplying water through the grip. This eliminates the gun's twisting motion.
- Keep the equipment in good condition.
- Check to see that releasing the trigger stops the flow of water. Do not wire back the trigger in an open position, which could be disastrous if the gun were dropped.
- Pay close attention to the water line. It is under pressure, and may whip about if broken. If a water line breaks, relieve the pressure before trying to grab the line.

3.2.4 Site Restoration and Demobilization

Demobilization will take place at the conclusion of SRI/FS and the former Plainwell Impoundment TCRA. After removal of targeted materials during the TCRA, clean fill will be used to backfill each removal area as described in the *Former Plainwell Impoundment Time-Critical Removal Action Design Report* (ARCADIS BBL, 2007) and areas will be revegetated as necessary.

Demobilization involves the removal of all tools, equipment, supplies, and vehicles brought to the Site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Hazards – Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards and hot surfaces to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control – Prior to the start of restoration activities, the operation will be reviewed with all on-site personnel. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Equipment will be inspected and in proper working condition prior to use. Inspections will be conducted at the beginning of each work day and documented on the Equipment Pre-Operation Inspection Form (Appendix C). Employees will receive training to address the equipment and its operation and care. A traffic flow plan will be identified for bringing in clean fill. Truckers will be instructed on the plan and other specific site controls/rules. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Technical assistance should be provided for large lifting tasks. Hearing protection is required for use when personnel are exposed to noise levels exceeding 85 A-weighted decibels (dBA) or a level that commonly results in difficult conversation. Air monitoring (as described in Section 6) will be implemented to evaluate the airborne exposure levels and adequacy of specified PPE. Water safety procedures outlined in Section 4.22 must be implemented.

Other control procedures for the hazards listed above are discussed in Section 4, General Safety Practices.

3.2.5 Construction Oversight

Construction oversight activities will occur during the SRI/FS and the former Plainwell Impoundment TCRA and may involve a potential for exposure to physical and health hazards. Hazards may be associated with the Site, the equipment being used, and environmental conditions.

Hazards – Incidents may occur that involve personnel being struck by or struck against equipment or objects, which could result in fractures, lacerations, punctures or abrasions. Walking and working surfaces during activities may involve slip, trip or fall hazards. Slippery walking/working surfaces can increase the possibility of back injuries, overexertion injuries, and slips and falls. Material-handling operations may result in “caught between” situations when a load is being handled, and a finger or toe gets caught between two objects. Material handling also exposes employees to sprains/strains if proper lifting techniques are not used. Noise may also present a hazard. Heavy equipment operation frequently results in high noise levels.

Environmental hazards include plants such as poison ivy and poison oak; aggressive fauna such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather such as sunburn, lightning, rain, tornados, and heat-related illnesses; and pathogens such as rabies, Lyme disease, and blood-borne pathogens.

Control – Prior to the start of any field activity, the Site conditions will be discussed with all affected employees. Hazards will be identified, and protective measures will be explained and implemented. Control procedures for these hazards are discussed in Section 4, General Safety Practices, and in task-specific sections of this Multi-Area HSP. Decisions regarding PPE will be based on the potential chemical and physical hazards at the Site, and measurements and observations made prior to and during work activities. A minimum of Level D PPE must be worn by personnel conducting observation activities. See Section 5, Personal Protective Equipment, for a description of PPE requirements. Personnel conducting observation activities will do so from a safe distance.

3.2.6 Installation of Borings

This task may include the installation of floodplain soil borings at various locations along the River, the installation of borings through concrete dams (e.g., the former dams), and the

installation of sediment borings. Hazards and control measures associated with soil boring activities are discussed below in the following subsections.

3.2.6.1 Barge-Based Drilling

Some borings may require use of a barge-mounted drill rig. Such equipment poses hazards in addition to those posed by working on or adjacent to the River (see Section 4.22 for water-based hazards). Drilling will not commence in the event of a Small Craft Advisory or Warning for the effected waterway. At a minimum, the drilling contractor's HSP should discuss the following hazards and controls, if appropriate.

Hazards: The primary physical hazards for barge-based drilling are associated with the use of drilling equipment. Rig accidents can occur as a result of failing to adequately secure the rig to the barge prior to the start of operations. Tools and equipment, such as elevators, cat lines, and wire rope, have the potential for striking, pinning, or cutting personnel.

- *Wire Rope* – Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

- *Cat Lines* – Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat line operations may injure the employee doing the rigging, as well as injure the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

- *Working Surfaces* – Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls.

- *Materials Handling* – The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects.

Control – The operator is responsible for the safe operation of the drill rig and adherence to the requirements of their company-specific HSP. The driller must verify that all safety equipment is in proper condition and is properly used. The members of the drill crew must follow all instructions of the driller, wear appropriate PPE, and be aware of all hazards and control procedures. The drill crew must participate in the daily safety meetings and be aware of all emergency procedures.

- *Rig Inspection* – Each day, prior to the start of work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. Inspections will be documented. The following items must be inspected:
  - Derrick condition
  - Proper storage of equipment
  - Condition of all wire rope and hydraulic lines
  - Condition of internal and external threads on drill rods
  - Fire extinguisher
  - First-aid kit
- *Hoisting Operations* – Drillers should never engage the rotary clutch without watching the rotary table and verifying that it is clear of personnel and equipment. Safety procedures associated with hoisting operations include:
  - Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.
  - Auger strings or casing should be picked up slowly.
  - During instances of unusual loading of the derrick or mast, only the driller should be in the immediate area of the rig.
  - The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.
  - A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.
  - Hoisting control stations should be kept clean and controls labeled as to their functions.
- *Cat Line Operations* – Only experienced workers will be allowed to operate the cathead controls. Safety procedures associated with cat line operations include:
  - The kill switch must be clearly labeled and operational prior to operation of the cat line.
  - The cathead area must be kept free of obstructions and entanglements.
  - The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.
  - Personnel should not stand near, step over, or go under a cable or cat line that is under tension.
  - Personnel rigging loads on cat lines shall:

- Keep out from under the load
- Keep fingers and feet where they will not be crushed
- Be sure to signal clearly when the load is being picked up
- Use standard visual signals only and do not depend on shouting to co-workers for communication
- Make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load

- *Wire Rope* – When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope must be removed from service or resocketed. Special attention must be given to the inspection of end fittings on boom support, pendants, and guy ropes. Other safety procedures associated with using wire rope include:

  - Wire rope removed from service due to defects must be cut up or plainly marked as being unfit for further use as rigging.
  - Wire rope clips attached with U-bolts must have the U-bolts on the dead or short end of the rope; the clip nuts must be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.
  - When a wedge socket fastening is used, the dead or short end of the wire rope must have a clip attached to it or looped back and secured to it by a clip; the clip must not be attached directly to the live end.
  - Protruding ends of strands in splices on slings and bridles must be covered or blunted.
  - Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, must consist of one continuous piece without knot or splice.
  - An eye splice made in any wire rope must not have fewer than five full tucks.
  - Wire rope must not be secured by knots. Wire rope clips must not be used to splice rope.
  - Eyes in wire rope bridles, slings, or bull wires must not be formed by wire clips or knots.

- *Auger Handling* – Auger sections must be transported by cart or carried by two persons. Individuals should not carry auger sections without assistance. Other safety procedures associated with auger handling include:

  - When equipment is being hoisted, personnel should not stand where the bottom end of the auger string could whip and strike them.
  - Auger sections should be stored in a manner that keeps them secure in the event of boat wake or barge movement. Augers should be secured in racks to prevent them from rolling freely.

Additionally, airborne particulate generation shall be controlled during drilling activities, as necessary.

3.2.6.2 Land-Based Drilling

Hazards: The primary physical hazards for this activity are associated with the use of drilling equipment. Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to the start of operations. Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment. Tools and equipment, such as elevators, cat lines, and wire rope, have the potential for striking, pinning, or cutting personnel.

- *Wire Rope* – Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

- *Cat Lines* – Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat line operations may injure the employee doing the rigging, as well as injure the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

- *Working Surfaces* – Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

- *Materials Handling* – The most common type of accident that occurs in material handling operations is the “caught between” situation when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift and/or fall from a pipe rack or truck bed.

  Additionally, airborne particulate generation shall be controlled during drilling activities, as necessary.

Controls: Drill Crews – All drillers must possess required state or local licenses to perform such work. All members of the drill crew shall receive Site-specific training prior to beginning work.

The driller is responsible for the safe operation of the drill rig, as well as the crew’s adherence to the requirements of this Multi-Area HSP. The driller must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear appropriate PPE, and be aware of all hazards and control procedures. The

drill crews must participate in the daily safety meetings and be aware of all emergency procedures.

- *Rig Inspection* – Each day, prior to the start of work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. Inspections must be documented. The following items must be inspected:
  - Vehicle condition
  - Proper storage of equipment
  - Condition of all wire rope and hydraulic lines
  - Condition of internal and external threads on all drill rods
  - Fire extinguisher
  - First aid kit
- *Drill Rig Set Up* – The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels that remain on the ground must be chocked even if the rig's parking brake has been applied. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

- *Site Drilling Rules* – Before drilling activities commence, the existence and location of underground pipe, electrical equipment, and gas lines shall be determined. An underground facilities protection organization (UFPO) must be contacted at least 3 full working days, but no more than 2 weeks, prior to subsurface activities. ARCADIS BBL's SS or a Contractor representative will meet with electrical and natural gas locators at the Site prior to marking out the underground utilities. During this meeting, ARCADIS BBL's SS or a Contractor representative will provide the electric and natural gas locators with a Site figure that shows the locations where drilling activities will be completed. ARCADIS BBL's SS or a Contractor representative will conduct a Site walkover with the electrical and natural gas locators to visually identify each location where drilling activities are to be completed during Site operations. The Underground/Overhead Utility Checklist (see Appendix D) shall be used to document that nearby utilities have been marked on the ground and that the drilling areas have been cleared. The completed Underground/Overhead Utility Checklist will be in the possession of the ARCADIS BBL SS prior to commencement of any intrusive investigation.

  Combustible gas readings of the general work area will be made regularly (see Section 6, Air Monitoring).

Operations must be suspended and corrective action taken if the airborne flammable concentration reaches 10% of lower explosive limit (LEL) in the immediate area (a 1-foot [ft] radius) of the point of drilling, or near any other ignition sources.

Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the cat line be used as a personnel carrier.

- *Overhead Electrical Clearances* – If drilling activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, and marked up/guaranteed, or the equipment must be positioned such that no part, including derrick, can come within the minimum clearances listed in Table 3-1.

  When the drill rig is in transit, with the derrick lowered and no load, the equipment clearance must be at least 4 ft for voltages less than 50 kilovolts (kV), 10 ft for voltages of 50 kV to 345 kV, and 16 ft for voltages above 345 kV.

Table 3-1 – Minimum Overhead Electrical Clearances

Nominal System Voltage	Minimum Required Clearance
0-50 kV	10 ft
51-100 kV	12 ft
101-200 kV	15 ft
201-300 kV	20 ft
301-500 kV	25 ft
501-750 kV	35 ft
751-1,000 kV	45 ft

- *Rig Set Up* – All boring sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

  All rigs will be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur. Wheels remaining on the ground will be chocked and the parking brake will be applied.

When the ground surface is soft or otherwise unstable, wooden blocks at least 24 inches by 24 inches and 4 inches to 8 inches thick, shall be placed between the jack swivels and the ground. The emergency brake shall be engaged and the wheels that are on the ground shall be chocked.

- *Hoisting Operations* – Drillers should never engage the rotary clutch without watching the rotary table and ensuring it is clear of personnel and equipment. Safety procedures associated with hoisting operations include:
  - Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.
  - Auger strings or casing should be picked up slowly.
  - During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.
  - The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.
  - A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment unless it has been specifically designed for line contact.
  - Workers should never stand near the borehole whenever any wire line device is being run.
  - Hoisting control stations should be kept clean and controls labeled as to their functions.
- *Cat Line Operations* – Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the cat line. The cathead area must be kept free of obstructions and entanglements. Safety procedures associated with cat line operations include:
  - The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.
  - Personnel should not stand near, step over, or go under a cable or cat line that is under tension.
  - Employees rigging loads on cat lines shall:
    - Keep out from under the load
    - Keep fingers and feet where they will not be crushed
    - Be sure to signal clearly when the load is being picked up

- Use standard visual signals only and not depend on shouting to co-workers for communication
- Make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load

- *Wire Rope* – When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or resocketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes. Other safety procedures associated with using wire rope include:
  - Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.
  - Wire rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope; the clip nuts shall be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.
  - When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to it by a clip; the clip shall not be attached directly to the live end.
  - Protruding ends of strands in splices on slings and bridles shall be covered or blunted.
  - Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads shall consist of one continuous piece without knot or splice.
  - An eye splice made in any wire rope shall have not less than five full tucks.
  - Wire rope shall not be secured by knots. Wire rope clips shall not be used to splice rope.
  - Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.
  - *Auger Handling* – Auger sections shall be transported by cart or carried by two persons. Individuals should not carry auger sections without assistance.
  - Workers should not be permitted on top of the load during loading, unloading, or transferring of rolling stock.
  - When equipment is being hoisted, personnel should not stand where the bottom end of the equipment could whip and strike them.
  - Augers stored in racks, catwalks, or on flatbed trucks should be secured to prevent rolling.

3.2.6.3 Sediment Sampling Via Vibracoring

In the instance that sediment sampling activities are required via vibracoring, additional hazards and additional/alternative safety controls arise. A summary of the additional primary hazards and associated control measures for collecting sediment using a vibracore are presented below. Note that these hazards are in addition to the hazards presented in Section 3.2.6.1, Barge-Based Drilling, and should be considered in combination during sediment sampling via vibracoring.

Hazards – The specific physical hazards of vibracoring activities are primarily associated with the sample collection methods, procedures utilized, and the Site environment. These hazards include: impact from moving parts; pinch points; overhead hazards; electrical hazards; and noise.

Control – Prior to initiating any activities, the Site conditions will be discussed with all employees. Hazards will be identified and protective measures will be explained. Equipment will be inspected and in proper working condition. Extreme care will be taken when loading and unloading material and equipment. Proper lifting techniques must be employed and mechanical assistance shall be provided for large lifting tasks. PPE as specified in Section 5 must be utilized, to include hearing protection during generator operation and hard hats with overhead hazards.

3.2.7 Surface Water Monitoring

Turbidity and surface water monitoring will involve collecting samples using a hand-held meter operated from a boat, a shoreline location, or form a bridge (see Section 3.2.7.1 Bridge Collection of Water Column Samples). The physical hazards of surface water monitoring are primarily associated with the sample collection methods and procedures, and the environment itself. Working on or near water presents the risk of drowning, if proper procedures are not instituted. Personnel should reference the Sediment/Surface Water Sampling Checklist (Appendix E), as appropriate.

Hazards – Working from the edge of a water body is the primary hazard involved with turbidity monitoring. The flora and fauna of the launch site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces. In addition to the safety hazards specific to sample collection, hazards associated with working on, in, or near water, will be a concern.

Control – To control dermal exposure during turbidity monitoring activities, a minimum of Level D PPE and a PFD is to be worn. Each level of PPE is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices. Water safety procedures outlined in Section 4.22 must be implemented.

3.2.7.1 Bridge Collection of Water Column Samples

The primary hazards and associated control measures for collecting water column samples from a bridge are presented below. Note that these hazards are in addition to the hazards presented in Section 3.2.6.1, Barge-Based Drilling, and should be considered in combination during water column sampling from a bridge.

Hazard – Working near an active road with limited space.

Control – Road traffic avoidance.

- Schedule sampling for off-peak traffic hours, if possible (i.e., 10 AM to 11 AM and 2 PM to 3 PM).
- Personnel conducting water column sampling must utilize PPE including an orange traffic safety vest, safety cones, and signs.
- If a sidewalk is not present, sampling personnel must park the vehicle on the shoulder of the road with the emergency flashers on; the shoulder must be at least 6 ft wide and the wheels of the vehicle must not extend over the white lines on the roadway. Additionally, all sampling personnel must conduct sampling on the opposite side of the vehicle from oncoming traffic (i.e., personnel are protected by the vehicle).
- If the shoulder of the roadway is not sufficiently wide and the vehicle's wheels extend beyond the white line, then the local police department shall be contacted to close the lane and control traffic during the sampling, or flaggers should be used to direct traffic during sampling.
- Sampling will only be conducted during daylight, and will not be conducted if it is or has been snowing and snowplows could potentially be in operation.

Hazard – Boats in the River contacting sampling equipment during the sampling event.

Control – Water traffic avoidance.

- Yellow rope will be lowered over the bridge to warn boaters. The rope will be weighted with a buoy and be lowered prior to lowering any sampling equipment and will remain in place until all sampling equipment has been removed.

- Prior to lowering any sampling equipment, a visual observation will be performed to confirm the lack of boat traffic in the vicinity of the bridge.

Hazard – Water related incidents, drowning, submersion, and falls from elevation.

Control – Water safety procedures and fall protection.

- All personnel must wear a USCG-approved personal flotation device (PFD) whenever working on or near the water.

- Sampling shall be conducted so that both feet of the sampling personnel are on the base of the bridge, shoulder of the road, or sidewalk (i.e., not standing on the railing) with the center of gravity lower than the bridge railing. Additionally, a personal fall arrest system shall be used if there is no guardrail at least 42” high.

- A functioning cellular phone must be present at the Site at all times.

3.2.8 Fish Sampling

Fish sampling will be conducted in the Kalamazoo River during the SRI/FS to assess potential impacts associated with releases/erosion of sediments containing PCBs. Fish monitoring will be conducted using a variety of sampling methods, including electro-fishing (boat-mounted), seining, and gill and trap/fyke netting techniques. The physical hazards associated with sampling are associated with the sample collection methods, the equipment used to collect the samples, and the environment in which the samples are collected.

Hazards – The primary physical hazards associated with these specific procedures include muscle strains, sprains, and potential eye hazards. The conditions under which the procedures are conducted may present chemical and physical hazards. Other hazards include operation of electrical equipment and net entanglement. Potential chemical hazards include contact with water, sediment, or soil containing PCBs and potential contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection, hazards associated with working on, in, or near water or in a boat will be a concern. The primary hazard of working near or on the River is drowning. Of particular concern will be boating safety and operation of other support equipment.

The flora and fauna of the Site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Control – To control dermal exposure during sediment sampling activities, a minimum of Modified Level D PPE and a PFD will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment. Section 4.22, Water and Boating Precautions, provides general safety procedures for working on or near the River. Prior to any boat-based operations, the Sediment/Surface Water Sampling Checklist (Appendix E) must be completed. To control electrical hazards, guidelines presented in Section 4.13 Electrical Safety will be followed by all personnel.

3.3 Former Plainwell Impoundment TCRA Construction Activities, Hazards, and Controls

The following field activities, hazards, and controls are unique to the TCRA field activities.

3.3.1 Installation, Operation, and Removal of the Water Control Structure

A WCS will be constructed and then operated during TCRA activities. The primary objective of the WCS is to control water levels and minimize erosion in the targeted removal areas. WCS activities will include the installation of a series of vertical H-piles, timbers, or other suitable materials placed between the H-piles as stop logs, and sheet piling to provide seepage cutoff. A walkway platform will be installed across the top of the WCS to provide access to the former powerhouse island. Operation of the WCS will include adding or removing stop logs to control the water level elevation in the project area. After the removal action is complete, the WCS will be removed. WCS activities may involve a potential for exposure to physical and health hazards. Hazards may be associated with the Site and with environmental conditions.

Hazards – The hazards of this phase of activity are associated with manual materials handling, preparation of the area for WCS installation and operation, overhead work (sheet pile installation and lifting materials), excavation hazards, and drowning hazards.

Manual materials handling and Site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. Installation and removal of the WCS may expose personnel to electrical hazards, hot work activities, underground and overhead utilities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from scattered debris, irregular walking surfaces, or elevated work. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Working in and around the River also presents a drowning hazard. If the structural integrity of the cofferdam structures or the WCS is compromised, there is the potential for water levels within the cofferdam area, or downstream of the WCS, to rise suddenly. An event of this nature would present a drowning hazard, slip, trip, and fall hazards, and physical hazards associated with equipment that has been washed away.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating each activity, the Site conditions and JSAs will be discussed with on-site personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in Section 4, General Safety Practices, and in task-specific sections of this Multi-Area HSP. Decisions regarding PPE and air monitoring will be based on the potential chemical and physical hazards at the Site, and measurements and observations made prior to and during work activities. Equipment will be inspected and in proper working condition. Mechanical assistance will be provided for large lifting tasks. Avoidance of biological hazards, as discussed in Section 4, General Safety Practices, will be implemented. Personnel conducting observation activities will do so from a safe distance. Additionally, no hot work will be conducted on any surface covered with a protective coating whose flammability is not known. Noise may also present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 dBA, requiring the use of hearing protection. The WCS will be subject to the same rules and regulations as the Plainwell Dam, as outlined in the Plainwell Dam Emergency Action Plan (Appendix F). In the case of an emergency, personnel should follow the emergency response procedure outlined in Section 3.3.1.1, Flood Emergency Response Procedure. See Section 3.3.3, Sediment and Soil Removal Operations, and Section 4.22, Water and Boating Precautions, for additional information. Air monitoring information is provided in Section 6.

3.3.1.1 Flood Emergency Response Procedure

The failure or a situation that may cause potential failure of the cofferdam or WCS shall be immediately reported by on-site staff to the **Allegan County Emergency Preparedness Coordinator, Mr. Scott Corbin and to the SS.**

269-673-0571 (daytime) **911 (after business hours)**

Staff shall note whether failure **HAS** occurred or that a situation that may cause **POTENTIAL** for failure exists. The SS shall notify the HSS, who will, in turn, notify the HSM and DE/CQO and describe the situation.

The Emergency Preparedness Coordinator shall:

1. Mobilize appropriate emergency services personnel.

2. Announce to the media the failure or potential failure. This announcement shall include the notice of threatened contamination.

3. Directly warn and/or evacuate flood prone areas. At the time of this writing, no residential structures are known to be threatened. However, the following areas may be occupied:

   a) Land bordering the Kalamazoo River within the city limits of Otsego, including **Menasha Paper Company.**

      Telephone: 269-692-6141

   b) The state owned land along the Kalamazoo River between Otsego Dam and The city of Allegan. Recreational users may be threatened.

   c) The DNR operator of Trowbridge and Otsego Dams.

   d) The parking areas adjacent to Imperial Carving Company.

      Telephone: 269-673-3867 or 269-673-4903

   e) Jaycee Park, Corner of Monroe Street and Chestnut Street.

   f) Fairgrounds, Corner of Allegan Co. Fair Drive and Park Drive.

4. Check all bridges between Plainwell Dam #1 and Lake Allegan for flood damage. Be prepared to close bridges as necessary.

After all emergency personnel are alerted, the MDEQ's Dam Safety Unit shall be advised.

Daytime: 517-373-1170; After hours: 1-800-292-4706 (PEAS)

3.3.2 Removal of the Plainwell Dam

One element of the TCRA is complete removal of the powerhouse portion of the Plainwell Dam (i.e., the western channel), and restoration of the River channel located beneath the powerhouse portion of the dam site. These operations will include the excavation of sediment from the vicinity of the dam. Dam removal operations will include the transportation, setup, use of heavy machinery, excavation, and material transport.

Hazards – The hazards of this phase of activity are associated with manual materials handling, use of heavy machinery, excavation hazards, the Site environment, exposure to PCBs, and working on or near the River.

Ingestion and absorption (contact) of PCBs are the primary routes of entry associated with dam removal operations due to the manipulation of sample media and equipment and proximity of operations to the breathing zone. Manual materials handling and Site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. Dam removal may expose personnel to electrical hazards, hot work activities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from scattered debris, irregular walking surfaces, or elevated work. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Working in and around the River also presents a drowning hazard.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control – To control dermal exposure to PCBs during sediment excavation, a minimum of Modified Level D and PFD PPE will be worn. If necessary, based on field observations and Site conditions, air monitoring may be conducted to assess the potential for exposure to airborne

PCBs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C PPE. A description of each level of PPE is included in Section 5, Personal Protective Equipment, while a description of air monitoring requirements and action levels is included in Section 6, Air Monitoring. Prior to initiating each activity, the Site conditions will be discussed with on-site personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in Section 4, General Safety Practices, and in task-specific sections of this Multi-Area HSP. Equipment will be inspected and in proper working condition. Mechanical assistance will be provided for large lifting tasks. Personnel conducting observation activities will do so from a safe distance. Additionally, no hot work will be conducted on any surface covered with a protective coating whose flammability is not known. Noise may also present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 dBA, requiring the use of hearing protection. See Section 3.3.3, Sediment and Soil Removal Operations, and Section 4.22, Water and Boating Precautions, for additional information.

3.3.3 Sediment and Soil Removal Operations

The primary objective of the TCRA is the removal of targeted soil and sediment in the former Plainwell Impoundment. This task involves the use of heavy equipment, such as excavators, back hoes, and dump trucks to excavate targeted soil and sediment from specified locations. Turbidity curtains will also be emplaced during the construction activities to control/contain downstream migration of soils/sediments disturbed during removal, and some of the excavation areas may need to be dewatered. In the design of the removal action, it is assumed that a significant portion of the excavated materials will require the application of both active and passive measures for water removal to allow for efficient transportation and disposal. After any necessary drainage and stabilization, excavated materials will be loaded into haul trucks at the staging areas and transported to the off-site disposal facility. Water generated during the drainage process may need to be treated before it can be discharged back into the Kalamazoo River.

Hazards – The hazards of this phase of activity are associated with manual materials handling, use of heavy machinery, excavation hazards, the Site environment, exposure to PCBs, and working on or near the River.

Ingestion and absorption (contact) of PCBs are the primary routes of entry associated with excavation, dewatering, drainage, and water treatment activities due to the manipulation of sample media and equipment and proximity of operations to the breathing zone. Manual materials handling and Site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Personnel in the

vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. Excavation activities may expose personnel to electrical hazards, hot work activities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from scattered debris, irregular walking surfaces, or elevated work. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Working in and around the River presents a drowning hazard. A stabilizing agent (e.g., saw dust, fly ash, or cement) may be used to stabilize the excavated materials prior to transport and disposal.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – To control dermal exposure during sediment excavation, dewatering, drainage, and water treatment (if necessary), and a minimum of Modified Level D PPE must be worn. If necessary, based on field observations and Site conditions, air monitoring may be conducted to assess the potential for exposure to airborne PCBs or other media, especially when working with a stabilizing agent. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel may be required to upgrade to Level C PPE. A description of each level of PPE is included in Section 5, Personal Protective Equipment, while a description of air monitoring requirements and action levels is included in Section 6, Air Monitoring. Prior to initiating each activity, the Site conditions will be reviewed with on-site personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in Section 4, General Safety Practices, and in task-specific sections of this Multi-Area HSP. Equipment will be inspected and in proper working condition. Personnel conducting observation activities will do so from a safe distance. Noise may also present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 dBA, requiring the use of hearing protection. Safety information regarding working on or near the River is included in Section 4.22, Water and Boating Precautions.

3.3.3.1 Excavation Safety

Excavation activities must be conducted in accordance with this section and all applicable OSHA regulations. Excavation activities must also be conducted in accordance with 29 CFR 1926, Subpart P, including the controls outlined below and covered in more detail in the following sections.

All activities must be done remotely, without entering the excavation, to the extent feasible. Personnel should not enter excavation areas unless no remote options are available, they are required to do so and, an Excavation Competent Person from their own company has deemed it safe to enter.

- *Surface and Subsurface Encumbrances* – Locate and avoid, by using the Underground/Overhead Utility Checklist (Appendix D).

- *Access and Egress* – Provide ramp or ladder at least every 25 ft within every excavation area. Competent materials such as clay and stone will be used to provide access and egress from the excavation areas.

- *Vehicular Traffic* – All employees will wear high-visibility warning vests, all vehicles will be equipped with back-up alarms and barricades, and hand or mechanical signals will be used to direct traffic near excavations.

- *Falling Loads* – No employee will be permitted underneath loads handled by lifting or digging equipment.

- *Hazardous Atmospheres* – Hazardous atmospheres will be evaluated as described in Section 6, Air Monitoring.

- *Water Accumulation and Site Access* – The use of the WCS should permit most of the excavation activities to be done under dry conditions; however, in the event that water accumulates within an excavation area, sumps will be installed and equipment operation platforms may be built above the level of water accumulation. Weather will be monitored closely and during periods of high water, excavation operations will be suspended due to the potential risk of wall failure or overtopping.

- *Stability* – Support systems, such as shoring, bracing, or underpinning, shall be provided to maintain stability. All support structures, soil conditions, and excavation design (sloping) will be inspected daily by a competent person using the Daily/Periodic Excavation Inspection Checklist (Appendix G).

The physical hazards involved in the excavation of soils are related to the excavation itself and the operation of heavy equipment. The presence of overhead utilities such as power lines requires careful positioning of the excavating equipment to maintain a safe distance between the lines and the closest part of the equipment. The presence of underground utilities such as gas lines, power lines, water lines, and sewer pipes must be determined prior to beginning the

excavation and documented on the Underground/Overhead Utility Checklist, located in Appendix D.

If not carefully controlled, excavations pose significant hazards to employees. There exists a chance for the excavation area to collapse if it is not dug properly, sloped, benched, or shored as required by 29 CFR 1926 Subpart P. Protective systems, as required by 29 CFR 1926 Subpart P, must be used if the potential for hazardous cave-ins exist. The excavation area is also a fall hazard, and employees must pay careful attention to what they are doing or they risk a fall into the excavation. Fall protection, as required by 29 CFR 1926 Subpart M, will be required.

Noise may also present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 dBA, requiring the use of hearing protection.

At the end of each workday, open test pit excavations will be backfilled and equipment will be moved to a location away from high-voltage electrical equipment and away from routes necessary to access high-voltage electrical equipment.

Airborne concentrations of PCBs in the Site materials from the excavation pose the potential for ingestion exposure. PPE for this phase is described in Section 5, Personal Protective Equipment. Airborne particulate generation will be controlled during Site excavations. Dry, dusty soil will be wetted with a water spray from a potable water source to control the generation of dust. Soil will not be wetted to a degree that will cause runoff or erosion.

Before excavation activities commence, the existence and location of underground pipes, electrical equipment, and gas lines shall be determined. This will be done, if possible, by contacting the appropriate individual or utility representative to mark the location of the lines. An appropriate device, such as a magnetometer, must be used to locate lines. The Underground/Overhead Utility Checklist (Appendix D) must be used to document that nearby utilities have been marked on the ground, and that the excavation areas have been cleared. The completed checklist must be in the possession of the SS prior to commencement of any intrusive investigation.

All excavation activities shall be conducted in accordance with 29 CFR 1926 Subpart P. If excavation operations are located near underground installations, the exact location of the installations must be determined by safe and acceptable means. While the excavation is open, underground installations must be protected, supported, or removed as necessary to safeguard employees.

3.3.3.2 Inspections by a Competent Person

Daily inspections of excavations, the adjacent areas, and protective systems must be made by an excavation Competent Person. The purpose of these inspections is to look for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. Inspections must be conducted and documented by the Competent Person from the company that is performing the excavation at the following times:

- Prior to starting work
- At least daily
- As needed throughout each work shift when conditions change

Inspections should be conducted by the Contractor-designated Competent Person to verify that conditions around the excavation are acceptable for employees. The Contractor's Competent Person must also conduct an inspection prior to any entry. Inspections conducted by ARCADIS BBL are solely for the use of ARCADIS BBL employees. The Daily/Periodic Excavation Inspection in Appendix G or equivalent should be used to document these inspections.

Inspections must also be made after every rainstorm or other hazard-increasing occurrence. These inspections are required when conditions change and employee exposure can be reasonably anticipated. Where the Competent Person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees must be removed from the hazardous area until the necessary precautions have been taken to maintain their safety.

Walkways must be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with 1926.502(b) must be provided. Adequate barrier protection must be provided at all remotely located excavations. All wells, pits, shafts, etc., must be barricaded or covered. Upon completion of exploration and other similar operations, temporary wells, pits, shafts, etc., must be backfilled.

3.3.3.3 Soil Classification

Appendix A of 29 CFR 1926 Subpart P describes methods of classifying soil and rock deposits based on Site and environmental conditions and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable

visual and manual tests for use in classifying soils. This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with Appendix C to Subpart P of Part 1926, and when aluminum hydraulic shoring is designed in accordance with 29 CFR Subpart P Appendix D. This appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data are predicated on the use of the soil classification system set forth in Appendix A of 29 CFR 1926.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable Site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V). Short-term exposure means a period of time less than or equal to 24 hours that an excavation is open. Soil and rock deposits must be classified in accordance with Appendix A to Subpart P of Part 1926. The maximum allowable slope for a soil or rock deposit must be determined from Table 3-2 (below). The actual slope must not be steeper than the maximum allowable slope. When there are signs of distress, the actual slope must be less steep than the maximum allowable slope. If that situation occurs, the slope must be cut back to an actual slope which is at least one-half horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a Competent Person must determine the degree to which the actual slope must be reduced below the maximum allowable slope, and must assure that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with 1926.651(I). Configurations of sloping and benching systems must be in accordance with 29 CFR 1926 Subpart P Appendix B, as summarized in Table 3-2.

Table 3-2 – 29 CFR 1926 Subpart P Appendix B Maximum Allowable Slopes

Soil or Rock Type	Maximum Allowable Slopes (H:V)[1] for Excavations Less Than 20 Feet Deep[2]
Stable Rock	Vertical (90 degrees)
Type A[3]	¾:1 (53 degrees)
Type B	1:1 (45 degrees)
Type C	1½:1 (34 degrees)

Notes:
1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

2. Sloping or benching for excavations greater than 20 ft deep must be designed by a registered professional engineer.
3. A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 ft (3.67 meters [m]) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 ft (3.67 m) in depth must be 3/4H:1V (53 degrees).

3.3.3.4 Overhead Electrical Clearances

If excavation activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up/guaranteed, and grounded, or the equipment must be positioned such that no part, including excavation boom, can come within the minimum clearances presented in Table 3-1.

3.3.3.5 Excavation Entry Procedure

Persons entering an excavation must do so under controlled conditions. The excavation must be properly sloped, benched, or shored, and ladders or ramps must be available every 25 ft laterally in the excavation. Each entry must have an attendant who observes the entrant(s) and is prepared to render assistance.

Duties of Workers Entering an Excavation

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure to Site PCBs
- Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space
- Alert the attendant whenever:
  - The entrant recognizes any warning sign or symptom of exposure to a dangerous situation
  - The entrant detects a prohibited condition
- Exit from the excavation as quickly as possible whenever:
  - An order to evacuate is given by the attendant or the supervisor
  - The entrant recognizes any warning sign or symptom of exposure to a dangerous situation
  - The entrant detects a prohibited condition

Duties of Attendants

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure to Site PCBs
- Continuously maintain a count of entrants in the excavation
- Remain outside the excavation during entry operations until relieved by another attendant
- Communicate with authorized entrants as necessary to monitor entrant status to alert entrants of the need to evacuate the excavation under any of the following conditions:
  - If the attendant detects a prohibited condition
  - If the attendant detects the behavioral effects of hazard exposure in an entrant
  - If the attendant detects a situation outside the excavation that could endanger the entrants
  - If the attendant cannot effectively and safely perform his duties

The attendant will summon rescue and other emergency services if entrants need assistance to evacuate the excavation.

3.3.3.6 Backfilling and Site Restoration/Grading

The backfilling and Site restoration/grading task will involve restoring the work areas to the proper grades, establishing the required erosion controls, and removing equipment and waste generated during the removal action. After complete removal of contaminated materials, erosion control measures will be implemented to include topsoil placement, seeding, and erosion control matting as required.

Hazards – The hazards of this phase of activity are primarily associated with heavy equipment operation, vehicular traffic, materials handling and unloading, working around high-voltage lines, and hand-labor activities. Materials handling and hand-labor activities may cause blisters, sore muscles, joint and skeletal injuries, and contusion and laceration hazards. The work area itself presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. In addition, rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces. A drowning hazard is associated with working on or near the River.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating backfilling and Site restoration/grading activities, the operation will be reviewed with all on-site personnel. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Equipment will be inspected and be in proper working condition prior to use. Inspections will be conducted at the beginning of each shift and documented. Employees will receive training to address the equipment, its operations, and care. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Technical assistance should be provided for large lifting tasks. Hearing protection is required for use when exposed to noise levels exceeding 85 dBA, or a level that commonly results in difficult conversation. See Section 4 for general safety rules, including Section 4.22, Water and Boating Precautions, for safety information regarding working on or near the River.

3.3.3.7 Water Treatment Facility

Two different types of sediment/soil dewatering technologies will be employed to decrease the water content of the excavated material before it is transported in trucks from the project area to the disposal facilities. “Construction dewatering” is primarily focused on the decanting or drawdown of River water levels within the cofferdams so as to decrease the amount of water that would become entrained in sediments as they are excavated. “Sediment/soil drainage” involves removing water from excavated sediments or soils so that they can be safely and efficiently transported for disposal.

Water treatment systems will be emplaced to handle water from the construction dewatering and water from the sediment/soil drainage. These systems will include Baker tanks or other settling basins followed by multimedia filtration and carbon adsorption. The multimedia filters and carbon absorbers will be trailer-mounted and capable of relocation to the south or north of the cofferdam. Treated water will be discharged to the River.

Hazards – The hazards of this phase of activity are primarily associated with pressurized and mechanical equipment, exposure to high noise, electrical hazards, and confined space hazards. Heavy equipment may be used to relocate soil or move the water treatment systems. Operation of heavy equipment presents noise and vibration hazards and hot surfaces to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise

levels. Materials handling and hand-labor activities may cause blisters, sore muscles, joint and skeletal injuries, and contusion and laceration hazards. The work area itself presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Potential chemical hazards may include contact with media containing PCBs and potential contact with chemicals used for equipment decontamination.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating water treatment activities, the operation will be reviewed with all on-site personnel. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Equipment will be inspected and be in proper working condition prior to use. Inspections will be conducted at the beginning of each shift and documented. Employees will receive training to address the equipment, its operations, and care. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Hearing protection is required for use when exposed to noise levels exceeding 85 dBA, or a level that commonly results in difficult conversation. Lockout/tagout procedures and confined space entry procedures are to be used before repairing or cleaning any equipment. See Section 4 for general safety practices.

3.3.4 Material Transportation and Disposal

Upon completion of excavation activities in 2007, the excavated material will be staged and dewatered, if necessary, and then transported to an off-site licensed disposal facility.

Hazards – The physical hazards involved with material loading and transport relate to work performed with heavy equipment, limited clearances, and the environment itself. Incidents may occur that involve personnel being struck by or struck against powered equipment or materials, which could result in fractures, cuts, punctures, or abrasions. Walking and working surfaces during construction activities may involve slip, trip, and fall hazards. Working at elevations may also create a fall hazard.

- *Working Surfaces* - Uneven terrain and slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. All personnel should frequently inspect the area in which they are working, and keep the area as clear as possible.

- *Powered Equipment Operations* - Site workers are exposed to serious hazards during transport and disposal when using powered equipment. Workers may be struck by blades or by material thrown by powered equipment.

- *Materials Handling* - The most common type of accident that occurs in material-handling operations is the "caught between" situation when a load is being handled, and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed, and mechanical means must be used to lift objects whenever possible.

- *Traffic Hazards* – All vehicles used for transport and disposal should be labeled accordingly. Trucks should not be overloaded to the point that transport may impact roads, other vehicles, or endanger the operator of the truck. Vehicle operators will not be allowed to climb on trucks to tarp. See Section 4.23, Heavy Equipment and Materials Handling, for additional information.

Hazards – Due to the type of work involved in the removal action, the primary health hazards involve potential exposure to Site contaminants (i.e., PCBs), repetitive motion disorders, lifting, and other ergonomic stressors. Noise may also present a hazard. Operation of heavy equipment and power-actuated and pneumatic hand tools frequently results in high noise levels.

Control – Prior to the start of removal activities, the operation will be reviewed with all on-site employees. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Equipment will be inspected and in proper working condition prior to use. A clear line of sight and/or a means of communication will be maintained between personnel in the area and the equipment operator at all times. Inspections will be conducted at the beginning of each shift and documented on the Equipment Pre-Operation Inspection Form (Appendix C). Drivers will not climb on their trucks during tarping operations. All drivers will receive and sign off on a Site briefing before being allowed entry.

Employees will receive training to address the equipment and its operation and care. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Technical assistance should be provided for large lifting tasks. Hearing protection is required for use when personnel are exposed to noise levels exceeding 85 dBA or a level that commonly results in difficult conversation. Air monitoring (as described in Section 6, Air Monitoring) will be implemented to evaluate the airborne exposure levels and adequacy of specified PPE.

3.3.5 Former Plainwell Impoundment TCRA Field Sampling

The following field sampling activities will be conducted during the TCRA:

- Air sampling
- Soil and sediment confirmation sampling
- Groundwater sampling
- Turbidity and surface water monitoring

Hazards and control measures and procedures for each sampling activity are discussed in the following subsections.

3.3.5.1 Air Sampling

This task involves collecting air samples for subsequent analysis and evaluation of potential impact by PCBs. Air sampling will be conducted during the TCRA activities. The physical hazards of these operations are primarily associated with the sample collection methods and procedures used. In addition, personnel may be exposed to hazards associated with working in or near excavations and heavy equipment.

Hazards – Inhalation of PCBs is the primary route of entry associated with air sampling due to the manipulation of sample media and equipment, and proximity of operations to the breathing zone. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected, may present chemical and physical hazards. The hazards directly associated with air sampling procedures are generally limited to strains or sprains, and potential eye hazards. Exposure to air containing PCBs is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles (especially large vehicles with limited operator visibility) is a concern. Of particular concern is the backing up of trucks, excavation equipment, and other support vehicles.

The flora and fauna of the Site may present hazards of poison ivy, poison oak, ticks, ants, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil. Freezing weather hazards include frozen,

slick, and irregular walking surfaces. Working on and near the River present a potential drowning hazard.

Control – To control dermal exposure during air sampling activities, a minimum of Level D PPE is to be worn by personnel. Avoid laying tools and equipment on the ground to avoid contact with native poisonous or irritating flora and fauna. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel are to upgrade to Level C PPE. Each level of PPE is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices, namely Section 4.22, Water and Boating Precautions, which provides general safety procedures for working on or near the River.

3.3.5.2 Soil and Sediment Confirmation Sampling

Sediment and soil sampling will be conducted within the River and floodplain removal areas to determine PCB concentrations during the TCRA. Soil and sediment sampling activities consist of collecting samples for field and laboratory analysis via Lexan® tubing, driven until refusal. Sediment probing may also involve using a steel auger to discern the depth of sediment in deep water areas. In addition, any material to be used as backfill will be sampled prior to use. The physical hazards associated with sampling/probing are associated with the sample collection methods, the equipment used to collect the samples/probe the sediments, and the environment in which the samples are collected and the probing is conducted.

Hazards – The primary physical hazards associated with these specific procedures include muscle strains, sprains, and potential eye hazards. The conditions under which the procedures are conducted may present chemical and physical hazards. Potential chemical hazards include contact with sediment or soil containing PCBs and potential contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection/probing, hazards associated with working on, in, or near water or in a boat will be a concern. Samples may be collected by boat, from the shoreline or by wading into the water. The primary hazard of working near or on the River is drowning. Of particular concern will be boating safety and operation of other support equipment.

The flora and fauna of the Site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Control – To control dermal exposure during sediment sampling/probing activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment. Section 4.22, Water and Boating Precautions, provides general safety procedures for working on or near the River including proper clothing precautions such as PFDs and waders. Prior to any boat-based operations, the Sediment/Surface Water Sampling Checklist (Appendix E) must be completed.

3.3.5.3 Groundwater Sampling

Monitoring well groundwater samples will be collected to evaluate the potential presence of PCBs within the groundwater and the migration of PCBs to the River at the conclusion of the TCRA. The hazards and safety procedures for groundwater sampling are included in the following sections. The physical hazards of this operation are primarily associated with the sample collection methods and procedures and sample locations.

Hazards – The primary hazards associated with groundwater sampling are not potentially serious; however, the conditions under which samples must be collected may present physical hazards. The hazards directly associated with groundwater sampling are generally limited to strains/sprains and potential eye hazards. Potential chemical hazards may include contact with media containing PCBs and potential contact with chemicals used for equipment decontamination. In addition to the safety hazards specific to sample collection, hazards associated with working on, in, or near water, will be a concern.

The flora and fauna of the Site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Controls – To control dermal exposure during sampling activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices, namely Section 4.22, Water and Boating Precautions, which outlines safety procedures for working on or near the River. Prior to any boat-based operations, the Sediment/Surface Water Sampling Checklist (Appendix E) must be completed.

3.3.5.4 Turbidity and Surface Water Monitoring

The hazards and controls for the TCRA turbidity and surface water monitoring are the same as those described in Section 3.2.7, Surface Water Monitoring.

Environmental monitoring will be conducted to inspect the progress and condition of Site restoration at the conclusion of the former Plainwell Impoundment TCRA. During the removal action, environmental monitoring will include turbidity monitoring (also discussed above in Section 3.2.7, Surface Water Monitoring), resuspension control monitoring, dewatering discharge monitoring, and erosion control monitoring. Post-removal tasks include visual observations of restored bank stability and in-channel sediment conditions, as well as evaluation of seeded and planted vegetation.

Hazards – The primary physical hazards associated with this task include working with relatively large heavy equipment. Ergonomic strain from forceful exertion and awkward posture will pose a risk to affected employees.

There is very limited risk of exposure to hazardous materials from this task. Health hazards are primarily associated with heat stress and physical activity. In addition to the safety hazards specific to sample collection, hazards associated with working on, in, or near water, will be a concern.

Control – Prior to the start of monitoring activities, the operation will be reviewed with all on-site personnel. Hazards will be identified, and protective measures will be explained, including the appropriate level of PPE. Equipment will be inspected and in proper working condition prior to use. Inspections will be conducted at the beginning of each work day and documented on the Equipment Pre-Operation Inspection Form (Appendix C). Employees will receive training to address the equipment and its operation and care. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Technical assistance should be provided for large lifting tasks. Hearing protection is required for use when personnel are exposed to noise levels exceeding 85 dBA, or a level that commonly results in difficult conversation. Air monitoring (as described in Section 6) will be implemented to evaluate the airborne exposure levels and adequacy of specified PPE. Water safety procedures outlined in Section 4.22 must be implemented.

3.4 Chemical Hazards

The chemical hazards potentially encountered during the SRI/FS and the former Plainwell Impoundment TCRA are related to inhalation, ingestion, and skin or eye contact with materials that are impacted by PCBs.

Airborne concentrations of PCBs may be measurable during certain activities, and may require air monitoring for potentially hazardous atmospheres during such operations. Air monitoring requirements for Site activities are outlined in Section 6, Air Monitoring.

The potential for inhalation of PCBs during removal activities is low to moderate. The potential for dermal contact with environmental media containing PCBs during removal activities is moderate to high.

Levels of PPE to be used for each work activity were selected based on the chemical hazards at the Site at the time this Multi-Area HSP was written, and are discussed in Section 5, Personal Protective Equipment.

A Material Safety Data Sheet (MSDS) must accompany all materials brought to the Site. No material shall be used or installed by any personnel prior to review of the MSDS by the SS or HSS. Following review of MSDS by the SS or HSS, copies shall be made and placed in this Multi-Area HSP. The location of MSDSs for on-site chemicals shall be communicated to all on-site personnel. All provisions of 29 CFR 1910.1200 are to be followed with regard to chemicals that are to be used during on-site activities.

Table 3-3 lists the chemical, physical, and toxicological properties of PCBs. MSDSs including the MSDS for PCBs are included in Appendix H. Additional chemical hazard data is provided in Appendix I.

Table 3-3 – Chemical Hazard Information

Chemical	Hazards	TLV/PEL* 8-hr TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Aroclor® 1242 (PCB)	Irritant to skin in liquid form Potentially carcinogenic	1 mg/m^3 (skin) 1 mg/m^3 (skin) 0.001 mg/m^3	ND	irritated eyes; chloracne; acne-form dermatitis; mildly toxic by ingestion; poison by subcutaneous route – probable carcinogen	Wear gloves when handling. Avoid all contact in non-ventilated areas.
Aroclor 1254 (PCB)	Irritant to skin in liquid form Potentially carcinogenic	0.5 mg/m^3 (skin) 0.5 mg/m^3 (skin) 0.001 mg/m^3	ND	irritated eyes and skin; acne-form dermatitis; poison by intravenous route; moderately toxic by ingestion and intraperitoneal routes – probable carcinogen	Wear gloves when handling. Avoid all contact in non-ventilated areas.

Note:
*The TLV from the ACGIH is listed unless the PEL (Permissible Exposure Limit), designated by OSHA, is lower.

4. General Safety Practices

4.1 General Safety Rules

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

- Place at least one copy of this Multi-Area HSP in a location at each Site that is readily available to on-site personnel.
- All personnel must review this Multi-Area HSP prior to starting work.
- Consume or use food, beverages, chewing gum, and tobacco products only in the break area or other designated area outside the work area. Cosmetics shall not be applied in the work area.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required. Stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs and ensure closure of the suit around the neck.
- Upon skin contact with materials that may be impacted by PCBs, remove contaminated clothing and wash the affected area immediately. Change all contaminated clothing. Immediately report any skin contact with materials potentially impacted by PCBs to the SS or HSS. If needed, seek medical attention.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by PCBs, such as standing water, mud, or discolored soil. Store equipment on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the decontamination area to limit the spread of PCB-containing materials.
- At the end of each shift, or as required, place all single-use coveralls, soiled gloves, and respirator cartridges in designated receptacles designated for this purpose.
- Do not remove soil from protective clothing or equipment by using compressed air, shaking, or any other means that disperses PCBs into the air.

- Inspect all non-disposable PPE for contamination. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.
- Recognize emergency signals used for evacuation, injury, fire, etc.
- Report all injuries, illnesses, near-misses, and unsafe conditions or work practices to the SS or HSS.
- Use the “buddy system” during all operations requiring Level C PPE and, when appropriate, during Modified Level D operations.
- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so.
- Use, adjust, alter, and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer’s directions.
- Personnel are to 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.
- Do not bring or consume alcoholic beverages or illicit drugs to the Site during the work day, including breaks. Notify your supervisor if you must take prescription or over-the-counter drugs that indicate they may cause drowsiness or that you should not operate heavy equipment.
- Remain upwind during Site activities whenever possible.
- Unauthorized personnel will not be allowed in the work area. If unauthorized personnel are identified entering the work area, they will be immediately approached and requested to leave. Special attention will be directed towards the identification of unauthorized boaters entering work areas from the river.

4.2 Loss Prevention System

LPS is a behavior-based safety system meant to prevent or reduce the occurrence of injury, illness, or other incident. This program seeks the prevention or reduction of losses by:

- Emphasizing proactive activities

- Capitalizing on the on-the-job expertise of field employees
- Maximizing the use of positive reinforcement
- Integrating with daily field operations
- Solving problems from the bottom up while providing direction from the top down

ARCADIS BBL personnel that will be performing or overseeing work on this project must attend an LPS training session. This training session explains the objectives, elements, and requirements of LPS. Elements of the LPS program are briefly outlined below in Sections 4.2.1 through 4.2.4.

4.2.1 Safe Performance Self-Assessment

All on-site personnel are required to perform an SPSA prior to beginning any activity. This three-step process requires each individual to:

- *Assess* the risk of the task to be performed. Ask the following questions:
  - What could go wrong?
  - What is the worst thing that could happen if something does go wrong?
- *Analyze* the ways the risk can be reduced. Ask the following questions:
  - Do I have all the necessary training and knowledge to do this task safely?
  - Do I have all the proper tools and PPE?
- *Act* to control the risk and perform the task safely:
  - Take the necessary action to perform the job safely and to protect others.
  - Follow written procedures, and ask for assistance if necessary.

This process must be performed prior to beginning any activity, and must be performed after any near-miss or other incident in order to determine if it is safe to proceed.

4.2.2 Incident Investigation

An incident is any of the following events: first-aid cases, injuries, illnesses, near-misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions. All incidents shall be investigated within 24 hours and reported to the PC and HSO.

The purpose of an incident investigation is to prevent the recurrence of a similar hazardous event. Using the information gathered during an incident investigation, appropriate measures will be taken to protect personnel from the hazard in question. The Incident/Near-Miss Investigation Report is included in Appendix B.

4.2.3 Near-Miss Reporting

As a part of the philosophy that work-related accidents and losses are preventable, ARCADIS BBL believes that the practices and standards used to conduct work could sometimes lead to an incident and that changing these practices and standards will reduce the potential for an incident. To achieve this end, we use the practice of “near-miss” reporting. Near-misses are situations where no injury or property damage occurred; however, under slightly different circumstances, an injury or property damage could have occurred. The Incident/Near-Miss Investigation Report (Appendix B) should identify the work that was conducted, what actually happened, discuss “what could have happened” had the circumstances been slightly different, and recommend a change to procedures to prevent an incident from occurring during similar work in the future. Near-miss reporting is encouraged for all workers at any level in the work force. The worker may feel comfortable completing the report themselves or may seek assistance from their HSS or supervisor. Work should be shut down after a near-miss incident has occurred. The HSS must sign off on the Incident/Near-Miss Investigation Report prior to job restart. Near-miss reporting and job safety assessments can be particularly useful after any changes to work practices are implemented, including changes to personnel, equipment, or means and methods.

In addition to near-miss incidents, employees are encouraged to report all incidents to avoid similar incidents in the future. No punitive action will be taken against an employee who reports an incident or a near-miss incident. Punitive action for safety issues only becomes an issue when an employee repeatedly ignores safety rules.

4.2.4 Loss Prevention Observation

The SS or HSS will perform the LPO (see Appendix A for the LPO form). The purpose of the LPO is to identify and correct potential hazards and positively reinforce correct behaviors and practices. The SS or HSS must identify potential deviations from safe work practices that could possibly result in an incident and take prompt corrective action. The LPO process steps are:

- Identify tasks that have the greatest potential for hazardous incidents
- Review the standard procedure for completing the task
- Discuss with the observed employee the task and the SS/HSS role in observing the task
- Observe the employee completing the task
- Reference the LPO form for criteria and complete the form, documenting the positive, as well as areas in need of improvement
- Discuss the results of the LPO with the employee and any corrective action, if necessary
- Implement corrective action
- Communicate the results of the LPO and corrective action to the PC and HSO

4.2.5 Job Safety Analysis

A JSA is a tool used for identifying potential hazards and developing corrective or protective systems to eliminate the hazard. A JSA lists all the potential hazards associated with an activity. Hazards may be physical, such as lifting hazards or eye hazards, or environmental, such as weather or biological (stinging insects, snakes, etc.). Following identification of the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed periodically to ensure that the procedures and protective equipment specified for each activity are current and technically correct. Any changes in Site conditions and/or the scope of work may require review and modification to the JSA in question. During this review process, comments on the JSA and its procedures should be obtained from personnel associated with the activity being analyzed. Completed JSAs for some of the Site activities are provided in Appendix J.

4.2.6 Employee Intervention

Employees are encouraged to intervene with another employee when unsafe work practices are observed. Employees are also encouraged to provide positive feedback to other employees when a good safety precaution is being implemented. Reporting unsafe work practices to the HSS is encouraged. No punitive action is to be taken against the employee reporting unsafe work practices or for the employee engaged in the safety violation. Punitive action for safety issues only becomes an issue when an employee repeatedly ignores safety rules.

4.3 Buddy System

On-site personnel must use the buddy system as required by operations. Use of the "buddy system" is required during all operations requiring Level C to Level A PPE and, when appropriate, during Level D operations. Crew members must observe each other for signs of chemical exposure, and heat or cold stress. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration
- Changes in coordination
- Changes in demeanor
- Excessive salivation and pupillary response
- Changes in speech pattern

Crew members must also be aware of the potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.

Field personnel must inform their partners or fellow crew members of non-visible effects of exposure to toxic materials they may be experiencing. 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 protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member. Personnel working alone should provide the SS with information regarding the location of work being performed, the type of work being done, and the approximate timeframe to complete the task.

4.4 Heat Stress

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

4.4.1 Heat-Related Illnesses

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% sodium chloride [NaCl]), excess salt can build up in the body if the water lost

through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; headache; vertigo; weakness; thirst; and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency

Workers suffering from heat exhaustion should be removed from the hot environment, given fluid replacement, and be encouraged to get adequate rest.

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41 degrees Celsius (°C; 105.8 degrees Fahrenheit [°F]). If body temperature is too high, death can occur. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as

soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

4.4.2 Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described in Table 4-1, while examples of activities within metabolic rate categories are described Table 4-2.

Table 4-1 – Screening Criteria for Heat Stress Exposure for 8-Hour Work Day 5 Days per Week with Conventional Breaks

Work Demands	Acclimatized				Unacclimatized			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% Work	85.1ºF (29.5ºC)	81.5ºF (27.5ºC)	78.8ºF (26ºC)		81.5ºF (27.5ºC)	77ºF (25ºC)	72.5F (22.5ºC)	
75% Work; 25% Rest	86.9ºF (30.5ºC)	83.3ºF (28.5ºC)	81.5ºF (27.5ºC)		84.2ºF (29ºC)	79.7ºF (26.5ºC)	76.1ºF (24.5ºC)	
50% Work; 50% Rest	88.7ºF (31.5ºC)	85.1ºF (29.5ºC)	83.3ºF (28.5ºC)	81.5ºF (27.5ºC)	86ºF (30ºC)	82.4ºF (28ºC)	79.7ºF (26.5ºC)	77ºF (25ºC)
25% Work, 75% Rest	90.5ºF (32.5ºC)	87.8ºF (31ºC)	86ºF (30ºC)	85.1ºF (29.5ºC)	87.8ºF (31ºC)	84.2ºF (29ºC)	82.4ºF (28ºC)	79.7ºF (26.5ºC)

Source: *2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (ACGIH, 2004).

Table 4-2 – Examples of Activities within Metabolic Rate Categories

Categories	Example Activities
Resting	• Sitting quietly • Sitting with moderate arm movements
Light	• Sitting with moderate arm and leg movements • Standing with light work at machine or bench while using mostly arms • Using a table saw • Standing with light or moderate work at machine or bench and some walking about
Moderate	• Scrubbing in a standing position • Walking about with moderate lifting or pushing • Walking on a level at 6 Km/hr while carrying 3 Kg weight load
Heavy	• Carpenter sawing by hand • Shoveling dry sand • Heavy assembly work on a non-continuous basis • Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	• Shoveling wet sand

Source: *2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (ACGIH, 2004).

4.4.3 Acclimatization

Acclimatization is a set of physiological adaptations which allows the body to react to heat stress conditions. Full-heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued and a noticeable loss occurs after 4 days. With a recent history of heat-stress exposures (e.g., 5 of the last 7 days), a worker can be considered acclimatized for the purpose of using Table 4-1.

To determine if the work rest cycles are adequate for the personnel and specific Site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any Site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-site drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel just wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek®-type garments.
- All employees must be informed of the importance of adequate rest, acclimatization, and proper diet in the prevention of heat-stress disorders.

4.5 Cold Stress

Cold stress normally occurs in temperatures at or below freezing or, under certain circumstances, in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold-weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour

(mph) is equivalent in chilling effect to still air at -18°F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in Table 4-3.

Table 4-3 – Chill Temperature Chart

Estimated Wind Speed (in mph)	Actual Temperature Reading (ºF)											
	50	**40**	**30**	**20**	**10**	**0**	**-10**	**-20**	**-30**	**-40**	**-50**	**-60**
	Equivalent Chill Temperature (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	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	**LITTLE DANGER** **Maximum danger of false sense of security.**				**INCREASING DANGER** **Danger from freezing of exposed flesh within 1 minute.**			**GREAT DANGER** **Flesh may freeze within 30 seconds.**				
	Trench foot and immersion foot may occur at any point on this chart.											

Note:
This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA (Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents).

4.5.1 Cold-Related Illnesses

Frostbite is the generic terms used for local injury resulting from cold. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite - Characterized by sudden blanching or whitening of skin

- Superficial frostbite - Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient

- Deep frostbite - Tissues are cold, pale, and solid; extremely serious injury

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages:

1) Shivering

2) Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F

3) Unconsciousness, glassy stare, slow pulse, and slow respiratory rate

4) Freezing of the extremities

5) Death

Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. Safety precautions for preventing cold stress are provided below.

4.5.2 Safety Precautions for Cold Stress Prevention

To avoid cold stress, on-site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be used to prevent cold stress. More safety precautions and safe work practices in cold weather include following:

- For air temperature of 0°F or less, mittens should be used to protect the hands. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.

- At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.

- If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must ensure that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.

- For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

- Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

- Direct contact between bare skin and cold surfaces (< 20°F) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

- Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.

- Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soup is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

4.6 Biological Hazards

Biological hazards may include poison ivy, poison sumac, snakes, thorny bushes and trees, ticks, mosquitoes, and other pests.

4.6.1 Tick-Borne Diseases

Lyme Disease - This disease commonly occurs in summer and is transmitted by the bite of infected ticks.

Erlichiosis - This disease also commonly occurs in summer and is transmitted by the bite of infected ticks.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) - This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (*Rickettsia rickettsii*) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for two to three weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control - Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every three or four hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.6.2 Poisonous Plants

Poisonous plants, including poison sumac and poison ivy, may be present in the work area. Personnel should be alerted to their presence and instructed on methods to prevent exposure. Photographs of poison sumac and poison ivy are presented below to facilitate identification.

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 nonpoisonous 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 plants are occasionally present in moist or wet soils. Poison ivy is a woody shrub or vine with hairy looking aerial roots. It grows to 10 ft or more, climbing high on trees, walls, and fences or trails along the ground. All parts of poison ivy, including the roots, are poisonous at all times of the year.

Poison Sumac

Poison Ivy

Control – The main control for both poison ivy and poison sumac is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance.

Poison ivy and sumac are very easy to treat ***if*** the contact with the irritating plant is identified within a few hours of the incident. The urushiol oil present in both plants chemically bonds with the proteins in human skin about 30 minutes after contact. Seventy-five percent of the

population is affected by contact with urushiol, although immunity to urushiol today does not assure immunity tomorrow, and vice versa. 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 gets 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.

If contact occurs with poison ivy or sumac, with an animal that has been exposed to any of these, or with any tools, gear, or clothing that has exposed to any of these, wash the poison ivy or sumac off with hot water (not so hot that it burns) and strong soap as soon as possible. If the poison ivy or sumac can be washed off within 6 hours of the contract and before the first symptoms appear, there is a good chance the an outbreak can be avoided, and an even better chance that the effects will be minimized if an outbreak does occur.

4.6.3 Snakes

Encountering snakes is a potential work hazard, specifically for personnel working in wooded/vegetated areas. If a snake is encountered, an injury may occur while fleeing the area. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances by enzymatic actions. Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control – To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes and the need to avoid actions that may cause encounters, such as turning over logs, etc. If a snake is encountered, on-site personnel are encouraged to cautiously remove themselves from the area, minding their surroundings for other snakes or uneven terrain. If snakebite occurs, an attempt should be made to safely identify the snake via size and markings. The victim must be transported to the nearest hospital within 30 minutes; first aid consists of applying a constriction band and washing the area around the wound to remove any unabsorbed venom.

4.6.4 Spiders

Personnel may encounter spiders during work activities. Two spiders are of concern: the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. If a spider encountered, any injury may occur while fleeing the area. The black widow is shiny black, approximately 1-inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widow's body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the southern United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful and the bite Site ulcerates and takes many weeks to heal completely.

Control – To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel need to 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 encountered, on-site personnel are encouraged to cautiously remove themselves from the area, minding their surroundings for uneven terrain. 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.

4.6.5 Mosquitoes

Personnel may be exposed to mosquitoes during work activities. Typical exposure to mosquitoes does not present a significant hazard. However, if West Nile virus is prevalent in the area, exposure to this virus is increased. West Nile virus results in flu-like symptoms and can be serious if not treated or in immune-compromised individuals.

Control – To minimize the threat of mosquito bites, personnel working outside need to be aware of the potential for encountering mosquitoes and implement the basic precautions listed below:

- Avoid working at dawn or dusk when mosquitoes are most active.
- Prevent accumulation of standing water at the Site.
- Apply an insect repellent that contains DEET to exposed skin.

- Wear light-colored clothes, preferable with long sleeves and full-length pants.
- Do not touch any dead birds or animals that you encounter.

If dead birds are detected near the Site, report to the Kalamazoo County Health Department. If flu-like symptoms are present, contact your physician or the HSO for more information.

4.6.6 Other Stinging Insects

Thousands of other insects, both native to Michigan or invasive species, are capable of stinging and producing a negative reaction in humans. These insects include bees, wasps, hornets, fire ants, centipedes, beetles, and flies. Some insects are more likely than others to cause allergic or toxic reactions. If encountered, there is the potential for injury while fleeing the area.

- A bee leaves the stinger behind and then dies after stinging. Africanized honeybees, the so-called “killer” bees, are more aggressive than common honeybees and often attack together in great numbers.
- Wasps, including hornets and yellow jackets, can sting repeatedly. Yellow jackets cause the greatest number of allergic reactions.
- The kissing bug (Triatoma) will bite humans, often at night, to obtain blood. A typical reaction is generally an intensely itchy, red-raised area that is more severe than a typical insect bite. The kissing bug has a large body, measuring one-half to one inch in length. It has a cone-shaped head and is dark brown with yellow or red markings on the abdomen.

Bites and stings are more serious if you develop one or more of the following conditions after an insect bite or sting. These conditions include:

- Toxic reaction
- Large skin reaction
- Signs of a skin infection
- Severe allergic reaction (anaphylaxis)

Anaphylaxis is a sudden, severe allergic reaction. Anaphylaxis occurs usually within minutes of exposure to the allergen and almost always within 2 hours. The most severe cases may be fatal just 10 minutes after exposure. In anaphylactic shock, the most severe form of anaphylaxis, blood pressure drops severely; water rapidly leaves the blood stream, causing severe swelling; and bronchial tissues swell dramatically. This causes the person to choke and collapse. Anaphylactic shock is fatal if not treated immediately.

If administered in time, an injection of epinephrine (adrenaline) may reverse the condition by quickly constricting blood vessels, increasing the heart rate, stopping the swelling around the face and throat, and relaxing smooth muscles in the lungs. Because anaphylaxis can progress so quickly, the first signs of reaction should be taken seriously. Do not wait to see how serious the reaction may become: call for emergency help immediately.

It is recommended that all on-site workers with known allergies to insects, such as allergies to bees, inform coworkers of their condition and carry the appropriate medication with them into the field.

Control – To minimize the risk of insect bites, long-sleeves and full-length pants should be worn if possible. All personnel working in vegetated areas and/or around debris piles and monitor wells must be aware of the potential for encountering stinging insects. Personnel 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 encountered, on-site personnel are encouraged to cautiously remove themselves from the area, minding their surroundings for uneven terrain. First aid for all stings and bites consists of washing the area around the wound to remove any unabsorbed venom and applying ice packs to minimize swelling.

4.7 Noise

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increase with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on-site.

Control – All on-site personnel must wear hearing protection, with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA and hearing protection is necessary. All on-site personnel who may be exposed to noise must also

receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 6.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.8 Spill Control

All personnel must take every precaution to minimize the potential for spills during Site operations. All on-site personnel shall immediately report any discharge, no matter how small, to the SS.

Spill control equipment and materials will be located on the Site at locations that present the potential for discharge. All sorbent materials used for the cleanup of spills will be containerized and labeled appropriately. In the event of a spill, the SS will follow the provisions in Section 9, Emergency Procedures, to contain and control released materials and to prevent their spread to off-site areas.

4.9 Slips, Trips, and Falls

Slips, trips, and falls are leading causes of injury at job sites. Slippery or uneven surfaces and overgrown vegetation are prevalent at the Site. All personnel must take every precaution to minimize the potential for slips, trips and falls during Site operations. All on-site personnel are encouraged to report any potential hazard, no matter how small, to the SS.

On-site workers must wear proper footwear to reduce the potential for incidents. Proper site planning will minimize the potential for slippery surfaces, slopes, and footing issues. This planning involves installing guardrails, midrails, and toe boards, establishing 4-ft wide walking surfaces, and performing daily inspections. Slips, trips, and falls are a hazard throughout the Site, especially along vegetated River bank areas.

4.10 Sanitation

Site sanitation will be maintained according to OSHA requirements.

4.10.1 Break Area

Breaks must be taken away from the active work area, after on-site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the Break Area.

4.10.2 Potable Water

The following rules apply to all field operations:

- An adequate supply of potable water will be provided at the Site. Potable water must be kept away from hazardous materials or media and contaminated clothing or equipment.
- Portable containers used to dispense drinking water must be capable of being tightly closed, and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.
- Containers used for drinking water must be clearly marked and shall not be used for any other purpose.
- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

4.10.3 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.

4.10.4 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 on-site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

4.11 Emergency Equipment

Adequate emergency equipment for the activities being conducted on -site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on -site prior to the commencement of project activities. Personnel will be provided with access to emergency equipment including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926
- Industrial first aid kits of adequate size for the number of personnel at the Site
- Emergency eyewash and/or shower, if required based on Site operations

4.12 Lockout/Tagout Procedures

Only fully qualified and trained personnel will perform maintenance procedures. Before starting maintenance on equipment (electrical, moving, material-isolating, etc.), personnel must follow lockout/tagout procedures per OSHA 29 CFR 1910.147.

Lockout is the placement of a device that uses a positive means, such as a lock, to hold an energy or material-isolating device such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system shall be used. Tagout is the placement of a warning tag on an energy- or material-isolating device indicating that the equipment controls may not be operated until the tag is removed by the personnel who attached the tag. The Lockout/Tagout Procedure Form is provided in Appendix K.

4.13 Electrical Safety

Electricity may pose a particular hazard to Site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations.

- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload.
- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension cord outlets must be equipped with ground fault circuit interrupters (GFCIs).
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- Extension cords or cables must be inspected prior to each use, and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.
- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.
- Portable generators must be grounded per the manufacturer's specifications.

4.14 Traffic Safety

Exposure to vehicular traffic is likely during certain project operations. Traffic may also be encountered as vehicles enter and exit the work area. To minimize the likelihood of personnel and activities being affected by traffic, the following procedures will be implemented:

- Cones must be placed along the shoulder of the roadway starting 100 ft from the work area to alert passing motorists to the presence of personnel and equipment. A “Slow” or “Men Working” sign must be placed at the first cone. Barricades with flashing lights should be placed between the roadway and the work area.

- During activities along a roadway, equipment must be aligned parallel to the roadway to the extent feasible, facing into the oncoming traffic so as to place a barrier between the work crew and the oncoming traffic. All crewmembers must remain behind the equipment and the traffic barrier.

- All on-site personnel who are potentially exposed to vehicular traffic must wear an outer layer of orange warning garments, such as vests, jackets, or shirts. If work is performed in hours of dusk or darkness, workers will be outfitted with reflective garments, either orange, white (including silver-coated reflective coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

- The flow of traffic must be assessed, and precautions taken to warn motorists of the presence of workers and equipment. Where possible, vehicles should be aligned to provide physical protection of people and equipment.

4.15 Lifting Safety

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.

- The hands and the object should be free of dirt or grease that could prevent a firm grip.

- Gloves must be used, and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.

- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.
- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.
- The load should be kept as low as possible, close to the body with the knees bent.
- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.
- A worker should not carry a load that he or she cannot see around or over.
- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees, and the back is straight as the object is lowered.

4.16 Elevated Work Safety

During the course of this project, personnel may be exposed to the hazards of working at heights (e.g., ladders, scaffolding). The following sections of 29 CFR 1926 are applicable to the elevated work on this project:

- Subpart L, Scaffolds
- Subpart M, Fall Protection
- Subpart X, Ladders

All elevated work will be performed in a safe manner and in compliance with all regulations governing such work, and the requirements of this Multi-Area HSP. All personnel exposed to fall hazards shall be trained regarding the nature of the hazards of elevated work prior to assignment.

Hazard – Operations on elevated surfaces may expose workers to falls if not using the proper fall protection system. Work from ladders, scaffolding, and aerial lifts also exposes employees to fall hazards and injuries should the equipment be used improperly or employees are not trained in the equipment's safe use. 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.

Control – All personnel exposed to fall hazards greater than 6 ft must be protected from the hazard by a fall protection system. Fall protection systems must comply with the guidelines established in 29 CFR 1926 Subpart M, Fall Protection.

All personnel exposed to fall hazards must be trained by a competent person in the following areas:

- Nature of fall hazards in the work area
- Correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used and the employees roles and responsibilities associated with the systems
- Use and operation of the fall protection systems to be used
- Correct procedures for the handling and storage of materials and equipment and the erection of overhead protection
- Fall protection standards contained in 29 CFR 1926 Subpart M, Fall Protection

Each Contractor must maintain written certification of fall protection training for personnel exposed to fall hazards; this certification must be made available to the SS upon request. The following sections provide more specific safety precautions for working on elevated surfaces, including using ladders and aerial lifts.

4.16.1 Ladders

When portable ladders are used for access to an upper landing surface, the ladder side rails must extend at least 3 ft (0.9 m) 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 employees in mounting and dismounting the ladder. In no case should the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

Other important safety considerations when using ladders include the following:

- Ladders must be maintained in good condition, free of oil, grease, and other slipping hazards.

- Ladders must not be loaded beyond their maximum intended load or their manufacturer's rated capacity.
- Ladders must be used only for the purpose for which they were designed.
- Non-self-supporting ladders must be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).
- Wood job-made ladders with spliced side rails must be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders must be used at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder.
- Ladders must be used only on stable and level surfaces unless secured to prevent accidental displacement.
- Ladders must not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. However, slip-resistant feet must not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces. These surfaces include, but are not limited to, flat metal or concrete surfaces that are constructed so that they cannot be prevented from becoming slippery.
- Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, must be secured to prevent accidental displacement, or a barricade must be used to keep the activities or traffic away from the ladder.
- The area around the top and bottom of each ladder must be kept clear.
- The top of a non-self-supporting ladder must be placed with the two rails supported equally unless it is equipped with a single support attachment.
- Ladders must not be moved, shifted, or extended while occupied.
- Ladders must have non-conductive side rails if they are used where the employee or the ladder could contact exposed energized electrical equipment.

- Personnel using a stepladder must not stand or sit on the top, top step, or any step labeled that it or any step above it not be used as a step.
- Cross-bracing on the rear section of stepladders must not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Single-rail ladders must not be used.
- When ascending or descending a ladder, the user must face the ladder.
- Personnel must use at least one hand to grasp the ladder when progressing up and/or down the ladder.
- Personnel must not carry any object or load onto or off a ladder that could cause the employee to lose balance and fall.
- The contractor's HSS must inspect all ladders for visible defects on a daily basis and after any occurrence that could affect their safe use.
- Portable ladders with structural defects must be withdrawn from service and either be immediately marked in a manner that readily identifies them as defective, or be tagged with "**DO NOT USE**" or similar language. Defects include, but are not limited to: broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components.
- Fixed ladders with structural defects must be withdrawn from service. Defects include, but are not limited to: broken or missing rungs, cleats, or steps; broken or split rails; or corroded components,
- Before the ladder is returned to use, any repair must restore the ladder to a condition meeting its original design criteria.

4.16.2 Aerial Lifts

Certain work efforts may require using a piece of equipment with an aerial lift such as a forklift, front-end loader, crane, etc.

Hazards – Improper operation of heavy equipment with aerial lifts may result in personnel being struck by the equipment or loads being handled, resulting in contusions, fractures, or

lacerations. Personnel may be injured and equipment damaged if it is not used for the purpose intended, overloaded, or used improperly by inexperienced or unauthorized individuals.

Control – Only trained and authorized personnel shall operate aerial platforms. The operator must be trained on the same model of aerial platform as the one to be used during actual work site operations. Under the direction of a qualified person, the trainee must operate the aerial platform for a sufficient period of time to demonstrate proficiency and knowledge.

Personnel working on aerial lifts must be trained in the following subject areas at a minimum:

- Nature of fall hazards, electrical hazards, and falling object hazards in the work area
- Correct procedures for dealing with electrical hazards
- Correct procedures for erecting, dismantling, and maintaining the fall protection and overhead protection systems to be used
- Proper use of the aerial lift and the handling of material and equipment on the aerial lift
- Load capacities of the aerial lift
- Applicable sections of 29 CFR 1926 Subpart L, Scaffolds

Aerial lifts must be inspected at least daily prior to operation. The inspection should include, but not be limited to, the following:

- Operating and emergency controls
- Safety devices
- Personal protective devices, including fall protection
- Air, hydraulic, and fuel systems for leaks
- Cables and wiring harness
- Loose or missing parts
- Tires and wheels

- Placards, warnings, control markings; and operating and safety manual(s)
- Outriggers, stabilizers, extendible axles, and other structures
- Guardrail system
- Other items specified by the manufacturer

Only trained personnel can make repairs to aerial lifts.

Personnel working from boom type lifts must be protected from falling by using a safety harness and lanyard properly attached to a manufacturer's approved tie-off point.

Before the aerial lift is used, the operator must check the work area for possible hazards such as, but not limited to: holes, bumps or obstacles, debris, overhead obstructions, inadequate surface and support (soft soils), and wind and weather conditions.

Prior to each lift, the operator must ensure the following:

- Outriggers or extendible axles, if so equipped, are used as required by the manufacturer.
- Guardrails are installed and the access gate is closed.
- The load and the distribution of the load are in accordance with manufacturer's recommendations.
- There is adequate clearance from overhead obstructions.
- All personnel in the platform are wearing the required fall protection equipment and are secured to manufacture's approved tie off locations.

If aerial platform is used in the vicinity of overhead power lines, the lines must be de-energized, or the equipment must be positioned such that no part of the aerial platform or personnel on the platform can come within the minimum clearances as listed in the table below.

Table 4-4 – Minimum Required Clearances

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 ft
51kV-200kV	15 ft
201kV-300kV	20 ft
301kV-500kV	25 ft
501kV-750kV	35 ft
751-1000kV	45 ft

Personnel must maintain a firm footing on the platform floor. Personnel must not climb on the guardrails of the aerial platform to gain additional height or reach. The use of ladders, planks, buckets, and other makeshift devices to gain additional height or reach is prohibited. Aerial platforms must not be driven in an elevated position unless designed to do so.

4.17 Hot Work Activities

The purpose of the hot work safety program is to protect all personnel against hazards associated with activities producing sparks, flames, or other ignition sources, and to prevent the loss of property due to fire. To effectively comply with the provisions of the OSHA standards governing fire prevention and hot work activities, the hot work safety program establishes policy and procedures to ensure that physical and chemical fire hazards present in the workplace are isolated from hot work activities. The hot work safety program is applicable to all welding, cutting, burning, grinding, and other spark-generating work activities. Each Contractor may use their own hot work safety procedures as long as the requirements of this section are met. Appendix L contains a Site Hot Work Permit.

4.17.1 Designated Hot Work Areas

Each Contractor may establish designated hot work areas at the Site. Designated hot work areas must be delineated and all on-site personnel informed of their location.

All on-site personnel are responsible for keeping flammable and combustible materials out of designated hot work areas.

4.17.2 Conditions Prohibiting Hot Work

Hot work activities are prohibited in the following areas of the Site:

- In areas where the requirements outlined here cannot be met; in this case, hot work is prohibited in that area and alternative methods must be employed.
- In areas potentially containing explosive atmospheres due to the presence of flammable gases, vapors, liquids, or dusts.
- Within 50 ft of an area where flammable or combustible liquids or gases are stored.

All on-site personnel are responsible for preventing hot work activities within these prohibited areas.

4.17.3 Hot Work Procedures

Hot work procedures required for welding, cutting, burning, grinding, or spark-generating hot work conducted at the Site are, at a minimum, discussed in this subsection. Contractors will use their own hot work procedures; however, they must meet the requirements of this section. This procedure has been developed to ensure that basic precautions for fire prevention and employee safety are implemented prior to and during hot work activities conducted outside of designated hot work areas.

- If possible, the object or equipment on which hot work is to be conducted must be moved to a designated hot work area.
- If an object or equipment on which hot work is to be conducted cannot be moved, all moveable fire hazards must be moved at least 50 ft from the hot work operation.
- If the object or equipment on which hot work is to be conducted cannot be moved, or all fire hazards cannot be removed, then guards, barriers, or screens must be used to confine any heat, sparks, and slag, and to protect the immovable fire hazards.
- All floor, wall, and window openings or cracks within a 35-ft radius must be protected to prevent exposure of combustible material to heat, sparks, flying sparks, or slag.
- Suitable fire extinguishing equipment must be available on-hand and ready for immediate use.

- If hot work will take place in an area where flying sparks and slag may injure personnel working near, above, or below the hot work operation, additional precautions must be implemented to prevent injury to the personnel (e.g., screens, barriers, caution tape, PPE, etc.).

- A fire watch must begin before hot work is initiated and must continue during and for a minimum of 30 minutes after the hot work concludes to verify that there are no smoldering fires. A fire watch is required whenever hot work is performed outside of designated hot work areas. More specific fire watch procedures are provided below in Section 4.17.4.

- Personnel must verify that any combustible materials that are located adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and that are likely to be ignited by conduction or radiation are protected by guards, barriers, or screens, or moved 50 ft away from the metal partition, wall, ceiling, or roof.

- If hot work is to be conducted in a confined space, the requirements for confined space entry must be reviewed and followed. A Confined Space Entry Checklist and Permit are provided in Appendix M.

- Hot work must not be performed in areas where other workers may be affected unless adequate engineering controls (local exhaust ventilation) or administrative controls (removed from area during hot work) are used to prevent personnel exposure.

- Welding, cutting, and other hot work must not be undertaken unless adequate ventilation, PPE, and well-maintained welding equipment are used by trained and authorized personnel.

- After welding or cutting has been completed, the work area must be thoroughly cleaned and equipment returned to the proper location.

- All on-site personnel involved in hot work activities must use the appropriate PPE and respiratory protection.

These basic precautions for fire prevention must be implemented prior to or during hot work that is conducted outside of designated hot work areas; if these precautions cannot be implemented, then hot work activities must not be conducted in that area.

4.17.4 Fire Watch Procedures

A fire watch is required whenever hot work is performed outside of designated hot work areas. Fire watch personnel are required to meet the following requirements.

- Fire watch personnel must have fire extinguishing equipment readily available and ready for immediate use.
- Fire watch personnel must be trained in the use of the fire extinguishing equipment provided.
- Fire watch personnel must be familiar with the procedure to sound the fire alarm in the event of a fire and know the location of the nearest telephone.
- Fire watch personnel involved in hot work activities must use the appropriate PPE and respiratory protection.
- Fire watch personnel must watch for fires in exposed areas and try to extinguish a fire when safe to do so or otherwise activate the fire alarm system.
- Authorized personnel must maintain a fire watch during all hot work activities and for at least 30 minutes after the hot work activities are completed.
- Fire watch personnel must have unobstructed view of the hot work being performed. If the line of sight is obstructed then additional fire watch personnel must be assigned.

If any of the above requirements cannot be met, hot work shall not be conducted.

4.18 Clearing and Grubbing

Personnel must wear the proper PPE when clearing and grubbing bushes and felling trees. The proper PPE includes a hard hat, hearing protection, long sleeves, safety shield, and safety shoes. Employees using chainsaws will require chaps and gloves. Entering and exiting the work area presents slip, trip, and fall hazards along with the potential to be punctured by protruding branches. Individuals should remain clear of workers operating cutting equipment such as weed whackers or chainsaws. The equipment itself as well as flying debris can lead to sprain, strains, eye hazards, and lacerations. Equipment should be properly inspected before work begins to ensure that all parts are attached and no fluids are leaking. Leaking fluids such as gasoline are flammable and can lead to fires, burns, or spills. An area should be cleared for

use as a “landing zone” for downed trees. Personnel should remain more than 20-ft outside of this area. Before performing any operations, vegetation should be inspected to ensure that it is not in contact with any electrical lines. A JSA will be prepared and reviewed with all participants prior to the start of clearing/grubbing activities.

4.19 Lightning Safety

Lightning is the second greatest cause of storm-related deaths (after floods) in the United States. Although absolute personal protection from lightning cannot reasonably be achieved, the vast majority of lightning casualties can be avoided with awareness, and application of safety guidelines.

Lightning can strike many miles from the parent thunderstorm, well outside the rain area and even beyond the visible thundercloud, and can strike from debris clouds many minutes after the parent thunder storm has decayed.

4.19.1 Lightning Safety Guidelines

Obtain weather forecasts beforehand and schedule activities around the weather to avoid exposure to lightning. Know your local weather patterns.

If you must engage in outdoor activities when lightning exposure is possible, identify and stay within traveling range of a proper shelter. Use the “30-30” rule to decide when to seek shelter. The “30-30” rule states that when you see lightning, count the time until you hear thunder. If this time is 30 seconds or less (you are within 6 miles of the last flash), go immediately to a safer place, and wait at least 30 minutes following dissipation of the storm (last audible thunder) before leaving the shelter.

When lightning threatens, do not hesitate to go to a safer location. Even a few extra minutes lead time can be life saving (don’t be the guy that “almost made it”). The safest location for lightning protection is a large, fully enclosed, substantially constructed building. Do not touch any conductor exposed to the outside – stay away from corded telephones, electrical appliances, lighting fixtures, electrical sockets, and plumbing. Inner rooms are safest, and avoid watching lightning from an open window or doorway. If you can’t reach a substantial building, an enclosed vehicle with a solid metal room and metal sides is a reasonable second choice. Again, keep windows closed and avoid contact with conducting paths going outside (steering wheel, door handles, radio, etc).

If you cannot reach a safer location, take action to minimize the threat of being struck. Move from higher to lower elevation. Avoid wide-open areas (fields, beaches, etc). Avoid water-related activities. Avoid tall isolated objects like trees. Do not remain in open vehicles like tractors or cab-less construction machinery. Avoid unprotected open structures, metal fences and other long metal structures.

If you are caught far from a safer place and lightning is about to strike, it will sometimes provide a very few seconds of warning. Sometimes your hair may stand on end, you skin will tingle, light metal objects will vibrate, or you will hear a crackling sound. If this happens, use the "lightning crouch" – put your feet together, squat down, tuck your head and cover your ears. If you are in a group, spread out to provide several body lengths between individuals before crouching. When the immediate threat has passed, proceed to the safest place possible.

No lightning safety guidelines will provide 100% guaranteed safety; however, these will greatly minimize the lightning hazard.

4.19.2 Lightning Safety Action Plan

When conducting activities where lightning exposure is possible, a site-specific Lightning Safety Action Plan must prepared. Among other items, this plan must identify the following:

- A designated responsible individual (or individuals) to monitor the weather and to initiate the evacuation process when appropriate
- Safer sites, along with a means to route the people to those locations
- "Warning" signal
- "All Clear" signal

4.20 High Winds

Hazards – High winds have the potential to cause serious injury; branches, trees, and structural objects can become mobile during high winds that can occur unexpectedly.

Control – Should high wind conditions become hazardous (e.g., objects become mobile, walking becomes difficult), seek shelter in a rigid structure, preferably concrete or brick, and stay away from windows.

Table 4-5, developed by the National Oceanic and Atmospheric Administration (NOAA) should be used to monitor wind conditions and change location/activities as appropriate.

Table 4-5 - Estimating Winds and Wind Conditions

Estimating Wind Speeds with Visual Clues			
Beaufort number	Description	Speed	Visual Clues and Damage Effects
0	Calm	Calm	Calm wind. Smoke rises vertically with little if any drift.
1	Light Air	1 to 3 mph	Direction of wind shown by smoke drift, not by wind vanes. Little if any movement with flags. Wind barely moves tree leaves.
2	Light Breeze	4 to 7 mph	Wind felt on face. Leaves rustle and small twigs move. Ordinary wind vanes move.
3	Gentle Breeze	8 to 12 mph	Leaves and small twigs in constant motion. Wind blows up dry leaves from the ground. Flags are extended out.
4	Moderate Breeze	13 to 18 mph	Wind moves small branches. Wind raises dust and loose paper from the ground and drives them along.
5	Fresh Breeze	19 to 24 mph	Large branches and small trees in leaf begin to sway. Crested wavelets form on inland lakes and large rivers.
6	Strong Breeze	25 to 31 mph	Large brances in continous motion. Whistling sounds heard in overhead or nearby power and telephone lines. Umbrellas used with difficulty.
7	Near Gale	32 to 38 mph	Whole trees in motion. Inconvenience felt when walking against the wind.
8	Gale	39 to 46 mph	Wind breaks twigs and small branches. Wind generally impedes walking.
9	Strong Gale	47 to 54 mph	Structural damage occurs, such as chimney covers, roofing tiles blown off, and television antennas damaged. Ground is littered with many small twigs and broken branches.
10	Whole Gale	55 to 63 mph	Considerable structural damage occurs, especially on roofs. Small trees may be blown over and uprooted.
11	Storm Force	64 to 75 mph	Widespread damage occurs. Larger trees blown over and uprooted.
12	Hurricane Force	over 75 mph	Severe and extensive damage. Roofs can be peeled off. Windows broken. Trees uprooted. RVs and small mobile homes overturned. Moving automobiles can be pushed off the roadways.

Source: National Weather Service Portland, http://weather.gov/portland. Table accessed at: http://www.wrh.noaa.gov/pqr/info/pdf/wind.pdf.

4.21 Tornados

According to the Michigan Committee for Severe Weather, Allegan County experienced 24 tornados between 1950 and 2005. A tornado warning system is in place at the City of Plainwell Fire Station approximately ½-mile from the former Plainwell Impoundment. Should the warning be heard, seek shelter in the lowest floor of a permanent structure. If no basement is available, seek the lowest level; a good rule of thumb is to put as many walls between you and the tornado as possible. Stay away from windows, doors, and outside walls. Broken glass and wind blown projectiles cause more injuries and death than collapsed buildings. The general rule for tornado safety is to "go low and get low". If you are not in a building or cannot get to one, lie flat in a low area with your hands covering the back of your head and neck.

When severe thunderstorms threaten, people should watch the sky and pay close attention to weather advisories. Environmental clues that may indicate an approaching tornado include a dark, often greenish sky, large hail and a loud roar similar to a freight train. To alert the public of tornadoes, the National Weather Service issues tornado watches and warnings.

A tornado **watch** means that weather conditions are favorable for the development of tornadoes. If a tornado **watch** is broadcast, stay tuned for further advisories and be prepared to take cover.

If a tornado **warning** is issued, it means a tornado has actually been sighted. **Warnings** are issued for individual counties and include the tornado's location and its direction and speed. If you are in or near its path, seek shelter immediately. Do not attempt to look for the tornado. Many tornadoes are obscured by rain and are not visible at all or are not visible until it is too late.

4.22 Water and Boating Precautions

Hazards – Working from a boat presents the obvious hazard of drowning, but several other hazards exist. Powered craft carry a fuel supply, with the potential for fire or explosion if vapors accumulate and reach an ignition source. Weather, currents, and other watercraft may also pose significant hazards to the crew.

Control – For water-based field operations, proper training and equipment are essential to completing a project efficiently and safely. ARCADIS BBL is strongly committed to familiarizing all on-site personnel who operate boats or conduct work adjacent to bodies of water with the hazards of water operations and the proper protective measures that must be taken to prevent injury. The type of boats used may include "Jon" boats or other small powerboats (less than 20

ft). This section outlines the precautions that must be taken to maintain worker safety while working on, over, adjacent to, or near the River.

Personnel working on, over, adjacent to, or near water, where the danger of drowning exists, must wear USCG-approved PFDs. Prior to and after each use, the PFDs must be inspected for defects that would alter their strength and buoyancy. Defective units must be removed from service. Ring buoys with at least 90 ft of line must be provided and readily available for emergency rescue operations. Distance from ring buoys must not exceed 200 ft. At least one boat must be immediately available at locations where employees are working over or adjacent to water.

4.22.1 Boating Safety Training

At a minimum, each employee working from a boat is required to participate in a boating safety training session conducted during the daily safety meeting. The training session must provide instruction on the following topics:

- Proper boat and safety equipment inspections
- Content and frequency of equipment safety inspections
- Proper use of on-board safety equipment, including fire extinguisher, radio or cellular phone, flares, horn, etc.
- Proper procedures for completing and filing a float plan (see Appendix N for Float Plan)
- Appropriate boating “rules-of-the-road”
- Emergency procedures in the event of capsizing or being thrown overboard
- Different types of PFDs, and their proper inspection and use

4.22.2 Boat and Equipment Inspections

Prior to each day of operation, a boat inspection must be conducted by the boat operator/SS. Appendix O provides the Daily Boat Inspection List. The daily boat inspection must be conducted in accordance with accepted USCG and any applicable state boating safety inspection procedures. The inspection must verify that necessary safety equipment is aboard, functioning properly, and that all crew members are aware of proper procedures that are to be

followed on the water. In addition, this information must be reviewed during the daily tailgate safety meeting to confirm that the procedures have been followed and all crew members are satisfied as to its completion.

The SS will be responsible for confirming that daily boat and equipment inspections are completed and documented, and daily tailgate safety meetings are conducted. Appendix N provides an example of a Float Plan that can be used for documenting daily boating activities. The following safety procedures must be observed at all times:

- Boat(s) must not be overloaded with equipment or personnel.
- Loads must be distributed evenly throughout the boat.
- PFD Types I, II, or III must be worn at all times when working on or adjacent to the water.
- All PFDs must be properly inspected to confirm that appropriate USCG approvals and ratings information is available.
- At least one Type IV PFD (seat cushion, ring buoy) must be available on board.
- An audible signal or alarm (capable of being heard up to ½-mile away) must be maintained in each boat.
- Each boat must be equipped with a ship-to-shore radio, cellular phone, and/or “walkie-talkie” capable of contacting the USCG, Marine police, or other onshore station to call for help in an emergency.
- Each boat must be equipped with some type of visual display signal or device (e.g., flares or appropriate distress flag).
- All powerboats must have a valid state registration. This registration must be maintained on the boat and, as necessary, be made available for USCG or Marine police inspection.
- At a minimum, each powerboat must be equipped with a Type 4-A, 10-B, C-rated fire extinguisher.
- Boats must not be operated at night without proper lighting and the capability for making visual distress signals.

- The “buddy system” must be strictly adhered to during any water-related activities. At no time will anyone enter the water without another individual readily available to contact emergency services.

4.22.3 Proper Clothing for Water-Based Operations

PFDs – Personnel working on, over, adjacent to, or near water, where the danger of drowning exists, must wear USCG-approved PFDs. Prior to and after each use, the PFDs must be inspected for defects that would alter their strength and buoyancy. If the PFD is torn, or has any damage to the straps, the PFD will be removed from service.

Thermal-Protective Clothing and Equipment – In addition to PFDs, personnel who are working in boats over water when water temperatures are below 50°F must be equipped with thermal-protective clothing and equipment (wet suits, dry suits, etc.). The thermal-protective clothing must be adequate to protect personnel from hypothermic effects of immersion in water at the temperatures encountered.

Waders – Sampling activities may be done using hip waders and the required level of PPE. Waders must be inspected prior to donning for holes, punctures, tears, or any other defect (i.e., missing straps) that would allow water to enter. Personnel must wear a USCG-approved PFD during all activities conducted in water. Prior to each use, the PFD must be inspected for defects that may alter its strength or buoyancy. Defective units must be tagged “**DO NOT USE**” and removed from service. The “buddy system” will be strictly adhered to during any water-related activities. At no time will anyone enter the water without another individual readily available to contact emergency services.

In addition to the drowning hazards associated with working on or near the water, there exists the possibility for slips, trips, or falls caused by slippery, unstable, and irregular walking surfaces. Waders used for sampling activities must be properly sized and provide the wearer with adequate traction.

4.23 Heavy Equipment and Materials Handling

To protect on-site personnel against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized operators shall be allowed to operate heavy equipment. Materials handling equipment must be maintained in safe operating condition and inspected daily prior to use. Heavy equipment operation must be conducted in accordance with this section and all OSHA regulations.

Hazards – The physical hazards involved with heavy equipment materials handling activities relate to the work done with heavy equipment and the Site environment itself. Incidents may occur that involve personnel being struck by or struck against heavy equipment or materials, resulting in fractures, cuts, punctures, or abrasions. Heavy equipment operation may present noise hazards, vibration hazards, and a potential for contact with moving parts or hot surfaces to equipment operators. Walking and working surfaces may involve slip, trip, and fall hazards. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. Noise may also present a hazard. Heavy equipment operation frequently results in high noise levels exceeding 85 dBA; during which the use of hearing protection will be required.

Control measures for these hazards are discussed in the following sections.

4.23.1 Haulage Roadways/Traffic Safety

Single-lane private roads with two-way traffic must be provided with turnouts. Where turnouts are not practical, a control system must be provided to prevent vehicles from meeting on such single-lane roads. On private roads used for two-way traffic, arrangements must be made so vehicles travel on the right side as much as possible. Signs shall be posted to clearly indicate variations from this system.

Where practicable, separate haulage roads must be provided between loaded and empty units. Haulage roads must be wide enough to allow for safe passage. Safe distances between moving units must be maintained. Private roads must be maintained free from holes and ruts that affect the safe control of the vehicle. Every emergency access ramp and berm used by project personnel must be constructed to restrain and control runaway vehicles. Where a hazard exists to on-site personnel because of traffic or haulage conditions, a system of traffic controls must be required so as to abate the hazard.

On-site personnel, such as grade-checkers, surveyors, and others exposed to vehicular traffic, must wear flagging garments, or equivalent, as required for flaggers.

Equipment must kept be under control and in gear when descending grades. No vehicle must be driven at a speed greater than is reasonable and proper, with due regard for weather, traffic, intersections, width and character of the roadway, type of motor vehicle, and any other existing conditions.

4.23.2 Equipment Construction/Safety Features

Arrangements must be made to direct exhaust gases away from the operator's breathing zone. When push-tractors are working in tandem, heat shields or equivalent protection must be provided for operators.

Windshields complying with the applicable provisions of the Vehicle Code must be provided and maintained on haulage vehicles and scrapers. Equipment and accessories installed on haulage vehicles must be arranged so as to avoid impairing the driver's operational vision to the front or sides.

Service brake systems for self-propelled, rubber-tired, off-highway equipment manufactured before January 1, 1972 (for scrapers January 1, 1971) must meet minimum performance criteria for service brake systems as set forth in the Society of Automotive Engineers Recommended Practices listed below. Service, emergency, and parking brake systems for self-propelled, rubber-tired, off-highway equipment manufactured after January 1, 1972 (for scrapers January 1, 1971) must meet the applicable minimum performance criteria for each system as set forth in the same Society of Automotive Engineers Recommended Practices.

Self-Propelled Graders	SAE J236-1971
Trucks and Wagons	SAE J166-1971
Front-End Loaders and Dozers	SAE J237-1971
Self-Propelled Scrapers	SAE J319b-1971

Haulage vehicles whose pay load is loaded by means of cranes, power shovels, loaders, or similar equipment must have a cab shield and/or canopy adequate to protect the operator from shifting or falling materials. Whenever visibility conditions warrant additional light, vehicles or combinations of vehicles in use must be equipped with at least two headlights and two taillights in operable condition.

Crawler tractors, bulldozers, carryalls, and similar equipment manufactured and used prior to April 1, 1971 (except for scrapers, front-end loaders and new equipment) must have canopy protection and seat belts for the operator when used where there is exposure to falling or rolling objects.

Operating levers controlling hoisting or dumping devices on haulage bodies must be equipped with a latch or other device that prevents accidental starting or tripping of the mechanism. Trip handles for tailgates of dump trucks must be so arranged that in dumping, the operator is not exposed to the hazard of being struck by falling material or to any part of the truck. Haulage vehicles equipped with dump bodies that tilt to release their load by gravity through an opening at the rear or side must be provided with a device that gives the operator a clearly audible alarm or visible warning when sufficient force is applied by the elevating mechanism to cause or sustain dump body elevation.

Tractor-scrapers (self-propelled) pushed by other equipment during loading operations must be provided with a clearly audible or visible warning device that can be activated by the operator of the tractor-scraper to communicate an "**ALL STOP**" warning to the pushing equipment in event of an emergency. Roll-over protective structures (ROPS) and seat belts must be installed and used on equipment in accordance with 29 CFR 1926 Subpart W.

Vehicles with cabs must have windshields and powered windshield wipers. Cracked or broken windshields must be replaced promptly. Where fogging or frosting of windshields is prevalent, defogging or defrosting equipment must be used. Tools and material must be secured to prevent movement when transported in the same compartment with on-site personnel.

Vehicles used to transport on-site personnel must have seats firmly secured and adequate for the number of on-site personnel to be carried.

Where vehicles are operated, temporary covers for conduits, trenches, and manholes and their supports, when located in roadways and vehicular aisles, must be designed to carry at least two times the maximum intended vehicular live load and must be designed and installed as to prevent accidental displacement.

4.23.3 Audible Alarms

Every vehicle used to haul dirt, rock, concrete, or other construction material must be equipped with a warning device that sounds automatically and immediately while the vehicle is backing up. The warning sound must be loud enough so it will be audible from a distance of 200 ft. In congested areas or areas with high ambient noise that obscures the audible alarm, a signaler, in clear view of the operator, must direct the backing operation. Other vehicles, if operating in areas where their backward movement would constitute a hazard to employees working in the area on foot, and where the operator's vision is obstructed to the rear of the vehicle, must be equipped with an effective device or method to safeguard employees such as:

- An automatic backup audible alarm, which would sound immediately on backing
- An automatic braking device at the rear of the vehicle that will apply the service brake immediately on contact with any obstruction to the rear
- In lieu of the above requirements, administrative controls must be established such as:
  - Providing a spotter or flagger who can direct the backing operation, in clear view of the operator
  - Establishing procedures that require the operator to dismount and circle the vehicle immediately prior to starting a backup operation
  - Prohibiting all foot traffic in the work area
  - Providing other means that will furnish safety equivalent to the foregoing for personnel in the work area

The vehicle operator must not leave the controls of the vehicle while it is moving under its own engine power. Hauling or earth-moving operations must be controlled in such a manner as to verify that the equipment or vehicle operators know of the presence of other personnel in the areas of their operations.

4.23.4 Equipment Inspection and Maintenance

All vehicles must be checked at the beginning of each shift to verify that the following parts, equipment and accessories are in safe operating condition and free of apparent damage that could cause failure while in use: service brakes, including trailer brake connections; parking system (hand brake); emergency stopping system (brake); tires; horn; steering mechanism; coupling devices; seat belts; operating controls; and safety devices. As an example, the Equipment Pre-Operation Inspection Form (Appendix C) or a model-specific checklist must be used and maintained as a record of inspection. All defects affecting safe operation must be corrected before the vehicle is placed in service. These requirements also apply to equipment such as lights, reflectors, windshield wipers, defrosters, fire extinguishers, etc., where such equipment is necessary.

Vehicle engines are not allowed to run in closed garages or other enclosed places unless vents are provided which effectively remove the exhaust gases from the building.

Except for emergency field repairs, a safety tire rack, cage, or equivalent protection must be used when inflating truck or equipment tires after mounting on a rim, if such tires depend on a locking ring or similar device to hold them on the rim.

No repairs should be attempted on power equipment until arrangements are made to eliminate the possibility of injury caused by sudden movements or operation of the equipment or its parts. When the equipment being repaired is a bulldozer, carryall, ripper, or other machine having sharp or heavy moving parts such as blades, beds, or gates, such parts must be lowered to the ground or securely and positively blocked in an inoperative position.

All controls must be in a neutral position, with the engine(s) stopped and brakes set, unless work being performed requires otherwise. Trucks with dump bodies must be equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done. In all cases where the body is raised for any work, the locking device must be used.

When wire rope is being wound on a power-driven drum, a mechanical threading device must be used, where practicable, to guide the cable. When this operation is done manually, feet shall not be used and hands shall be kept at least 3 ft from the drum.

4.23.5 Equipment Parking and Loading

Whenever equipment is parked, the operator must set the parking brake. Equipment parked on inclines must have the wheels chocked and the parking brake set, or be otherwise prevented from moving by effective mechanical means.

Scissor points on all front-end loaders, which constitute a hazard to the operator, must be adequately guarded. A loader shall not travel without adequate visibility for the driver and stability of the equipment. No loading device should be left unattended until the load or bucket is lowered to the ground, unless proper precautions such as blocking are taken to prevent accidental lowering.

4.23.6 Equipment Fueling

No internal combustion engine fuel tank can be refilled with a flammable liquid while the engine is running. Fueling must be done in such a manner that the likelihood of spillage is minimal. If a spill occurs, it must be contained and cleaned, or equivalent action taken to control vapors before restarting the engine. Fuel tank caps must be replaced before starting the engine.

A good metal-to-metal contact must be kept between fuel supply tank or nozzle of supply hose and the fuel tank. No open lights, welding, or sparking equipment should be used near internal combustion equipment being fueled or near storage tanks. No smoking is permitted at or near

the gasoline storage area or on equipment being fueled. A conspicuous sign must be posted in each fuel storage and fueling area stating: "**NO SMOKING WITHIN 50 FEET**."

Class I liquids should not be dispensed by pressure from drums, barrels, and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets must be used. No repairs should be made to equipment while it is being fueled.

Each fuel storage tank or drum must have the word "**FLAMMABLE**" conspicuously marked on it and should also have a similarly sized word indicating the contents of the container. A fire extinguisher rated 20:BC or larger must be placed in a location easily and quickly accessible to the fueling area. All fuel storage tanks, drums, or safety cans must be properly marked and of the proper type.

4.23.7 Flaggers

Flaggers must be used at locations where barricades and warning signs cannot control the moving traffic. When flaggers are required, they shall be placed in relation to the equipment or operation so as to give effective warning. Placement of warning signs shall be according to the Michigan Department of Transportation (MDOT) requirements.

Flaggers must wear orange warning garments such as vests, jackets, or shirts. When worn, rainwear must be orange, or other color provided an orange outer warning garment is worn. During the hours of darkness, flaggers must be wear reflective garments and flaggers' stations must be illuminated so the flagger is clearly visible to approaching traffic. The reflective garments must be orange, white (including silver-coated reflecting coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

Flaggers must be trained in the proper fundamentals of flagging moving traffic before being assigned as flaggers. Signaling directions used by flaggers must conform to MDOT standards.

4.23.8 Additional Safety Requirements

To protect on-site personnel against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized personnel will be allowed to operate heavy equipment. All materials handling equipment must be maintained in a safe operating condition and inspected daily prior to use.

Additional heavy equipment safety requirements include, but are not limited to:

- Prior to operating any heavy equipment, the authorized operator must conduct a pre-operation inspection to determine if the heavy equipment is in safe operating condition prior to each work shift.
- All mobile equipment must be equipped with an audible back-up alarm.
- Personnel are not allowed to stand or pass under the elevated portion of any heavy equipment, whether loaded or empty.
- Personnel must not place arms and legs between pinch or scissor points of the equipment or outside the operator enclosure.
- Operators must maintain a safe distance from the edge of excavations, ditches, ramps, or platforms.
- Operators must maintain sufficient clearance under overhead utilities, installations, lights, pipes, etc.
- Heavy equipment must never be used for lifting or transporting personnel.
- Operators must look in the direction of, and maintain a clear view of the path of travel.
- Heavy equipment must have an overhead guard and ROPS to protect the operator against falling objects and equipment roll-over.
- Heavy equipment must not be driven up to anyone standing in front of any object.
- Stunt driving and horseplay are strictly prohibited.
- Operators must yield the right-of-way to other Site vehicles.
- Other heavy equipment traveling in the same direction, at intersections, blind spots, or other dangerous locations must not be passed.

- A safe distance must be maintained from other heavy equipment and the equipment must be kept under control at all times.
- Operators must slow down for wet and slippery conditions. Under all travel conditions, operators must operate the equipment at a speed that will permit it to be brought to a stop in a safe manner.
- Operators must avoid running over loose objects on operating surfaces.
- Grades and ramps must be ascended and descended slowly.
- On all grades, the load will be tilted back and raised only as far as necessary to clear the operating surface.
- Operators must slow down and sound the horn at intersections, when entering buildings, and other locations where vision may be obstructed.
- If the load being carried obstructs forward view, the operator must travel with the load trailing.
- While negotiating turns, operators must reduce speed to a safe rate, and turn the equipment in a smooth, sweeping motion to avoid abrupt turns and potential equipment or load upset.
- Operators will only handle stable or safely arranged loads that are within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.
- When a piece of heavy equipment is left unattended, hydraulics will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheels will be blocked or chocked if the heavy equipment is parked on an incline. Operators will only handle stable or safely arranged loads that are within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.
- In the event an accident causes a material spill while in route from the work areas to the off-site licensed disposal facility, the SS should immediately be notified. The SS will follow the provisions in Section 9, Emergency Procedures, to contain and control released materials and to prevent their spread to off-site areas. Terra Contracting, LLC, a local response contractor, has been retained to respond to any such emergency. Employees of

Terra Contracting, LLC are OSHA HAZWOPER certified and trained in emergency response techniques. Their contact information is included below.

Terra Contracting, LLC
2612 Miller Road
Kalamazoo, Michigan 49001
269.342.0231

5. Personal Protective Equipment

5.1 Levels of Protection

PPE is required to safeguard on-site personnel from various hazards. Varying levels of protection may be required depending on the levels of potential contamination and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. The PPE levels are summarized in Table 5-1 – PPE Selection Matrix, presented later in this section.

5.1.1 Level D Protection

The minimum level of PPE required for ARCADIS BBL and Contractor personnel at the Site will be Level D, which must be worn when Site conditions or air monitoring indicates that no inhalation hazard exists. The following equipment will be used for Level D:

- Work clothing as prescribed by weather conditions
- American National Standards Institute (ANSI) Z41-approved protective footwear (must be at least 6 inches high)
- Safety glasses (as necessary) with side shields or goggles, meeting ANSI Z87
- Hard hat, meeting ANSI Z89, when falling object hazards are potentially present
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)
- PFD if working on or near the water

5.1.2 Modified Level D Protection

Modified Level D PPE must be used when airborne PCBs are not present at levels of concern, but Site activities present an increased potential for skin contact with contaminated materials. Modified Level D consists of Level D plus any of the following:

- Latex/polyvinyl chloride (PVC) overboots when contact with PCB-impacted media is anticipated

- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist
- Nitrile outer gloves worn over nitrile surgical gloves
- Tyvek® coveralls (polyethylene-coated Tyvek® suits for handling liquids) when body contact with PCB-impacted media is anticipated
- PFD if working on or near the water

5.1.3 Level C Protection

Level C PPE must be worn when the airborne concentration of PCBs or the PCBs detected during air monitoring reaches one-half of the OSHA Permissible Exposure Limit (PEL) or ACGIH TLV. The following equipment will be used for Level C:

- Full-face, air-purifying respirator with organic vapor cartridges for PCBs
- Polyethylene-coated Tyvek® suit, with ankles and cuffs taped to boots and gloves
- Nitrile outer gloves worn over nitrile surgical gloves
- ANSI Z41-approved protective footwear (must be at least 6 inches high)
- Chemical-resistant boots with steel toes or latex/PVC overboots over work boots
- Hard hat, meeting ANSI Z89
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)
- PFD if working on or near the water

5.2 Selection of Personal Protective Equipment

PPE will be selected based on the potential for contact with PCBs, Site conditions, ambient air quality, and the judgment of supervising Site personnel and health and safety professionals. The PPE selected will be effective against PCBs present on the Site.

5.3 Site Respiratory Protection Program

Respiratory protection is integral to employee health and safety at the Site due to potentially hazardous concentrations of airborne PCBs. The Site Respiratory Protection Program will consist of the following (at a minimum):

- All on-site personnel who may use respiratory protection will have an assigned respirator.
- All on-site personnel who may use respiratory protection will have been fit-tested and trained in the use of a full-face air-purifying respirator within the past 12 months.
- All on-site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the HSS prior to commencement of Site work.
- Only cleaned, maintained, NIOSH-approved respirators will be used.
- If respirators are used, the respirator cartridge must be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- Contact lenses must not be worn when a respirator is worn.
- All on-site personnel who use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.
- Before each use, respirators must be inspected and a negative pressure test performed.
- After each use, the respirator must be wiped with a disinfectant, cleansing wipe. At the end of the work shift, the respirator must be thoroughly cleaned and stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

5.4 Using Personal Protective Equipment

Depending on the level of PPE selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Modified Level D or Level C PPE is used. All personnel entering the EZ must put on the required PPE in accordance with the requirements of this Multi-Area HSP. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of PCBs.

5.4.1 Donning Procedures

These procedures are mandatory only if Modified Level D or Level C PPE is used on the Site:

- Remove bulky outerwear; remove street clothes and store in clean location.
- Put on work clothes or coveralls.
- Put on the required chemical protective coveralls.
- Put on the required chemical protective boots or boot covers.
- Tape the legs of the coveralls to the boots with duct tape.
- Put on the required chemical protective gloves.
- Tape the wrists of the protective coveralls to the gloves.
- Don the required respirator and perform appropriate fit test (Level C).
- Put hood or head covering over head and respirator straps and tape hood to facepiece (Level C).
- Don remaining PPE, such as safety glasses or goggles and hard hat.

When these procedures are instituted, one person must remain outside the work area to verify that each person entering has the proper PPE.

5.4.2 Doffing Procedures

The following procedures are only mandatory if Modified Level D or Level C PPE is required for the Site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers.
- Clean reusable PPE.
- Remove protective garments, equipment, and respirator (Level C); all disposable clothing should be placed in plastic bags, which are labeled with contaminated waste labels.
- Wash hands, face, and neck (or shower if necessary).
- Proceed to clean area and dress in clean clothing.
- Clean and disinfect respirator for next use.

All disposable equipment garments and PPE must be bagged in plastic bags, labeled for off-site disposal/treatment. See Section 3.2.3, Decontamination, for detailed information on decontamination stations.

5.5 Selection Matrix

The level of PPE selected will be based on air monitoring of the work environment and an assessment by the SS and HSS of the potential for skin contact with PCBs. The PPE Selection Matrix is presented in Table 5-1. This matrix is based on information available at the time this plan was written. The Airborne Contaminant Action Levels in Table 6-1 should be used to verify that the PPE prescribed in these matrices is appropriate.

Table 5-1 – PPE Selection Matrix

Task	Anticipated Level of Protection
SRI/FS and TCRA Activities	
Mobilization	Level D
Construction Oversight	Level D
Decontamination	Modified Level D
Demobilization	Level D
SRI/FS Activities	
Installation of Borings	Modified Level D
Surface Water Monitoring	Level D/Modified Level D
Fish Monitoring	Level D/Modified Level D
Former Plainwell Impoundment TCRA Activities	
Water Control Structure Activities	Level D/Modified Level D
Dam Removal Operations	Level D/Modified Level D
Sediment and Soil Removal Activities	Modified Level D
Material Transportation and Disposal	Modified Level D
Confirmation Sampling	Modified Level D
Environmental Monitoring	Level D/Modified Level D

6. Air Monitoring

6.1 Air Monitoring

Air monitoring will be conducted to determine employee exposure to airborne constituents. Monitoring will be performed at the discretion of the SRI/FS or former Plainwell Impoundment TCRA HSS based on a qualitative assessment of the particular field activity and previously measured air monitoring results for similar activities conducted at the Site. When performed, air results will dictate work procedures and the selection of PPE. The monitoring devices to be used are an MIE PDR 1000 particulate monitor (or equivalent) and a Rae Systems Multi RAE detector (PID with a 10.6 eV lamp/oxygen/LEL/Hydrogen Sulfide Sensors) (or equivalent).

If ARCADIS BBL and one or more Contractors are working in an area, one Contractor may conduct direct-reading air monitoring and share the results with the other Contractors working in the area. In this situation, Contractors should coordinate air monitoring through a mutually agreed-upon air monitor. The ARCADIS BBL HSS will be responsible for using the air monitoring results to specify the appropriate health and safety precautions for ARCADIS BBL personnel only.

Monitoring for organic vapors for the purpose of estimating worker exposure level should be conducted in the breathing zone with the PID during intrusive field activities where potentially impacted materials are being handled. At a minimum, readings should be measured and recorded on an hourly basis on an Air Monitoring Log (Appendix P) or in a field notebook.

Air monitoring should be conducted continuously during work activities in areas where flammable vapors or gases are suspected. Work activity must stop where tests indicate the concentration of flammable vapors exceeds 10% of the LEL at any location. During operations that may cause airborne particulates (e.g., grading, drilling), a particulate monitor should be used to measure airborne concentrations of total particulate material. At a minimum, readings should be measured and recorded on an hourly basis on an Air Monitoring Log (Appendix P) or in a field notebook.

6.2 Noise Monitoring

Noise monitoring may be conducted as required with a calibrated sound level meter capable of accurately measuring noise levels. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

6.3 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in a field notebook. All completed health and safety documentation/forms must be reviewed by the SRI/FS or the former Plainwell Impoundment TCRA HSS and maintained by the respective SS.

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 personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the HSS must be 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 HSS will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

6.4 Action Levels

Table 6-1 presents airborne contaminant action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the Site.

Table 6-1 – Airborne Contaminant Action Levels – Work Zone

Parameter	Reading	Action
Total Particulates (measured with PDR 1000)[1]	0 to 0.100 milligrams per cubic meter (mg/m^3) above background >0.100 mg/m^3 above background	Normal operations. Initiate wetting of work area to control dust, upgrade to Level C if dust control measures do not control dust within 15 minutes. Monitor downwind impacts.
	>0.150 mg/m^3 in breathing zone or at downwind perimeter of work area	Stop work, investigate cause of reading, and ventilate area.
Oxygen (O_2)	$\leq$ 19.5% > 19.5% to < 23.5% $\geq$ 23.5%	Stop work, evacuate work area, investigate cause of reading, and ventilate area. Normal operations. Stop work, evacuate work area, investigate cause of reading, and ventilate area.
Carbon monoxide (CO)	0 ppm to $\leq$ 20 ppm > 20 ppm	Normal operations. Stop work, evacuate work area, investigate cause of reading, and ventilate area.
Hydrogen Sulfide (H_2S)	0 ppm to $\leq$ 5 ppm > 5 ppm	Normal operations. Stop work, evacuate work area, investigate cause of reading, and ventilate area.
Flammable Vapors (LEL)	< 10% LEL $\geq$ 10% LEL	Normal operations. Stop work, ventilate area, investigate source of vapors.

Notes:

1. Readings for particulates are for 15 consecutive minutes at breathing zone height, measured with a calibrated PDR (personal data RAM). Dust sampling instruments provide "total dust" levels and do not differentiate between contaminated and non-contaminated dust particulates. Dust action levels are based on total dust and not respirable dust levels. Dust action levels are in excess of background levels, as measured either prior to on-site or off-site activities. The 0.150 mg/m^3 level is based on the National Ambient Air Quality Standard.

7. Work Zones and Decontamination

7.1 Work Zones

7.1.1 Authorization to Enter

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the Site. The SRI/FS or the former Plainwell Impoundment TCRA SS will maintain a list of authorized persons; only personnel on the authorized persons list will be allowed to enter the work areas.

7.1.2 Site Orientation and Hazard Briefing

No person will be allowed in a work area during Site operations without first being given a Site orientation and hazard briefing. This orientation will be presented by the SS or HSS, and will consist of a review of this Multi-Area HSP. This review must cover the following:

- Chemical, physical, and biological hazards
- PPE
- Safe work procedures
- Emergency procedures for the project

Following this initial meeting, safety meetings will be held each day before work begins.

All people entering the work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings on the forms included with this plan.

7.1.3 Certification Documents

A training and medical file may be established for the project and kept at the Site during all Site operations. Specialty training, such as first aid/cardiopulmonary resuscitation (CPR) certificates, as well as current medical clearances for all field personnel required to wear respirators, will be maintained within that file. If required, on-site personnel must provide their training and medical documentation to the HSS before starting work.

7.1.4 Entry Log

A log-in/log-out sheet will be maintained at the Site by the SS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the SS may document entry and exit in the field notebook.

7.1.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any ARCADIS BBL work area unless they are wearing the minimum PPE as described in Section 5, Personal Protective Equipment.

7.1.6 Emergency Entry and Exit

People who must enter the work area on an emergency basis will be briefed of the hazards by the SS. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a safe area for a head count. The SS is responsible for ensuring that all people who entered the work area have exited in the event of an emergency.

7.1.7 Contamination Control Zone

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

7.1.7.1 Exclusion Zone

An EZ may consist of a specific work area, or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or a Site diagram will identify the location of each EZ.

7.1.7.2 Contamination Reduction Zone

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ must pass through this area to prevent any cross-contamination. Tools, equipment, and machinery must be decontaminated in a specific location. The decontamination of all personnel must be performed on-site adjacent to the EZ. Personal protective outer garments and respiratory protection will

be removed in the CRZ and prepared for cleaning or off-site disposal/treatment. This zone is the only appropriate corridor between the EZ and the SZ.

7.1.7.3 Support Zone

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the SZ only after proper decontamination. Smoking may be permitted in the SZ, subject to Site requirements.

7.1.8 Posting

Work areas will be prominently marked and delineated using cones, caution tape, or a Site diagram.

7.1.9 Site Inspections

The SS must conduct a daily inspection of Site activities, equipment, and procedures to verify that the required elements are in place. The Health and Safety Inspection form in Appendix Q may be used as a guide for daily inspections. LPOs will be completed per the project schedule and input to the ARCADIS BBL LPS database for follow up and review.

7.2 Decontamination

7.2.1 Personnel Decontamination

All personnel wearing Modified Level D or Level C PPE in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations at a minimum:

- *Station 1*: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.

- *Station 2*: Personnel will remove their outer garment and gloves and dispose in properly labeled containers. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.

- *Station 3*: Personnel will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and then placed in a clean plastic bag.

7.2.2 Equipment and Vehicle 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 of tires and wheel wells with water. If the vehicle is significantly contaminated, steam-cleaning or pressure-washing of vehicles and equipment may be required.

7.2.3 Personal Protective Equipment 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 labeled containers. Reusable protective clothing will be rinsed at the Site with detergent and water. The rinsate will be collected for on-site treatment or off-site disposal/treatment.

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 be ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water, or by using a spray disinfectant.

8. Training and Medical Surveillance

8.1 Training

All SRI/FS and former Plainwell Impoundment TCRA on-site personnel who perform intrusive work, or work in areas where they may be exposed to PCBs, must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees also must receive a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor.

Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. The SS must have completed an additional 8 hours of supervisory training, and must have a current first aid/CPR certificate.

8.1.1 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures
- Physical hazards (fall protection, noise, heat stress, cold stress)
- Names and job descriptions of key personnel responsible for Site health and safety
- Safety, health, and other hazards typically present at hazardous waste sites
- Use, application, and limitations of PPE
- Work practices by which employees can minimize risks from hazards
- Safe use of engineering controls and equipment on-site
- Medical surveillance requirements
- Recognition of symptoms and signs that might indicate overexposure to hazards
- Worker right-to-know (Hazard Communication OSHA 1910.1200)

- Routes of exposure to contaminants such as PCBs
- Engineering controls and safe work practices
- Components of a health and safety program and a site-specific HSP
- Decontamination practices for personnel and equipment
- Confined-space entry procedures
- General emergency response procedures

8.1.2 Supervisor Course

Management and supervisors must receive an additional eight hours of training, which typically includes:

- General Site safety and health procedures
- PPE programs
- Air monitoring techniques

8.1.3 Site-Specific Training

Site-specific training will be accomplished by on-site personnel reading this Multi-Area HSP, or by a thorough Site briefing by the PC, SS, or HSS on the contents of this Multi-Area HSP before work begins. The review must include a discussion of the chemical, physical, and biological hazards, PPE, safety procedures, and emergency procedures.

8.1.4 Daily Safety Meetings

Safety meetings will be held twice a day to cover the work to be accomplished, hazards anticipated, PPE and procedures required to minimize Site hazards, and emergency procedures. These meetings should be held prior to beginning the day's field work and again in the early afternoon. No work will be performed in an EZ before a safety meeting has been held. A safety meeting must also be held prior to new tasks, and repeated if new hazards are encountered. The Safety Meeting Log is included in Appendix R.

8.1.5 First Aid and Cardiopulmonary Resuscitation

At least one employee current in first aid/CPR will be assigned to the work crew and will be on-site during operations. Refresher training in first aid (triennially) and CPR (annually) are required to keep the certificate current. These individuals must also receive training regarding the precautions and PPE necessary to protect against exposure to blood-borne pathogens.

8.1.6 Boat Operators

The operator/skipper of each boat must complete a USCG boating safety training course (or equivalent) prior to conducting work on the River and verify that vessels are equipped with proper safety equipment. Each operator/skipper must demonstrate proficiency in the following subject areas:

- Proper operation of a boat
- Boat and safety equipment inspections
- Content and frequency of equipment safety inspections
- Proper use of on-board safety equipment, including fire extinguisher, radio or cellular phone, flares, horn, etc.
- Proper procedures on the completion and filing of a float plan (see Appendix N for Float Plan)
- Appropriate boating “rules-of-the-road”
- Emergency procedures in the event of capsizing or being thrown overboard
- Different types of PFDs and their proper inspection and use

8.2 Medical Surveillance

8.2.1 Medical Examination

All personnel who are potentially exposed to PCBs must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120 (f).

8.2.2 Pre-Placement Medical Examination

All on-site personnel must have completed a comprehensive medical examination prior to assignment, and periodically thereafter as defined by applicable regulations. The pre-placement and periodic medical examinations 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
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director

The examining physician provides the employee with a letter summarizing his/her findings and recommendations, confirming the worker's fitness for work, and ability to wear a respirator. Documentation of medical clearance must be available for each employee during performance of Site work.

Contractors performing intrusive work must certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Contractors must supply copies of the medical examination certificate for each on-site employee.

8.2.3 Other Medical Examinations

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials
- At the discretion of the HSS, HSO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials

8.2.4 Periodic Exam

Following the placement examination, all ARCADIS BBL employees must undergo a periodic examination, similar in scope to the placement examination. For employees potentially exposed for more than 30 days a year, the frequency of periodic examinations will be annual. For employees potentially exposed for fewer than 30 days a year, the frequency for periodic examinations will be 24 months.

8.2.5 Medical Restriction

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the HSS. The terms of the restriction will be discussed with the employee and the supervisor.

9. Emergency Procedures

9.1 General

Prior to the start of operations, the work area must be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions must be reported to the SS/HSS immediately.

The SS/HSS must establish evacuation routes and assembly areas for the Site. All personnel entering the Site must be informed of this route and the assembly area.

9.2 Emergency Response

If an incident occurs, the following steps must be taken:

- The SS/HSS will evaluate the incident and assess the need for assistance and/or evacuation.
- The SS/HSS will call for outside assistance as needed.
- The SS/HSS will ensure the KRSG, HSM, HSO, PIC/Project Officer, and PC are notified promptly of the incident.
- The SS/HSS will take appropriate measures to stabilize the incident scene.

9.2.1 Fire

In the case of a fire at the Site, the SS/HSS will assess the situation and direct fire-fighting activities. The SS/HSS will ensure that the PC is immediately notified of any fires. On-site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that on-site personnel are unable to safely extinguish with one fire extinguisher, the local fire department must be summoned.

9.2.2 Contaminant Release

In the event of a contaminant release, the following steps must be taken:

- Notify the SS/HSS immediately.

- Evacuate immediate area of release.
- Conduct air monitoring to determine the necessary level of PPE.
- Don required level of PPE and prepare to implement control procedures.

The SS/HSS has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-site areas.

9.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- Confirm that the injured employee receives prompt first aid and medical attention
- In emergency situations, make sure the worker is transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room)
- If the injured person is an ARCADIS BBL employee, notify Pat Bullock, ARCADIS Workers Compensation Administrator, 720-344-3844, as soon as possible after the employee has been safely evacuated from the Site.

9.3.1 Emergency Care Steps

Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim. The following emergency care steps can help when aiding a victim:

- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.
- Phone Emergency Medical Services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.
- Maintain airway and perform rescue breathing as necessary.
- Perform CPR as necessary.

- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

Treat other conditions as necessary. If the victim can be moved, take him/her to a location away from the work area where EMS can gain access.

9.4 First Aid – General

All persons must report any injury or illness to their immediate supervisor or the SS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The SS and HSS must conduct an incident investigation as soon as emergency conditions no longer exist and first aid and/or medical treatment has been ensured. Incident investigations must be completed and submitted to the PC within 24 hours after the incident.

If first aid treatment is required, first aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory, or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

9.4.1 First Aid – Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Safety Practices, will be removed from the work area and transported to the designated medical facility for examination and treatment.

9.4.2 First Aid – Ingestion

Should ingestion of contaminants occur, call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

9.4.3 First Aid – Skin Contact

Project personnel who have had skin contact with contaminants must, unless the contact is severe, proceed through the CRZ, to the wash area. Personnel must remove any contaminated clothing and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he/she shows any sign of skin reddening, irritation, or if he/she requests a medical examination.

9.4.4 First Aid – Eye Contact

Project personnel who have had contaminants splashed in their eyes or who have experienced eye irritation while in the EZ must immediately proceed to the eyewash station in the CRZ. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

9.5 Reporting Injuries, Illnesses, and Near-Miss Incidents

Injuries and illnesses, however minor, must be reported to the SS immediately. The SS must complete an injury report and submit it to the Client, HSO, HSM, PIC/Project Officer, and PC within 24 hours.

Near-miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near-misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. An SPSA must be done immediately after an injury, illness, near-miss, or other incident to determine if it is safe to proceed with the work.

Employees who sustain a non-emergency, non-life-threatening, **work-related** injury or illness should contact WorkCare™ at 1-800-455-6155 prior to proceeding to an emergency room or clinic.

9.6 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 9-1.

Table 9-1 – Emergency Contacts

Agency	Telephone No.
Emergency Services	
Fire	911
Police	911
Ambulance	911

Agency	Telephone No.
Health Departments	
Kalamazoo County Health and Community Services Department 3299 Gull Road Kalamazoo, MI 49048	Phone: 269.373.5300 Emergency Hotline
Allegan County Health Department 3255 122nd Avenue, Suite 200 Allegan, MI 49010	Phone: 269.673.5411
Hospitals	
Borgess Emergency & Trauma Center 1521 Gull Road Kalamazoo, MI	Phone: 269.226.4815
Holland Hospital 602 Michigan Avenue Holland, MI 49423	Phone: 616.392.5141
Allegan General Hospital 555 Linn Street Allegan, MI	Phone: 269.673.8424
Borgess-Pipp Hospital 411 Naomi Street Plainwell, MI	Phone: 269.685.0700
ARCADIS BBL Staff	
ARCADIS BBL SRI/FS PC: Michael Erickson, P.E.	Phone: 810.225.1924 Cell: 734.604.7044
ARCADIS BBL TCRA PC: Stephen Garbaciak Jr., P.E.	Phone: 312.332.4937 ext. 12 Cell: 708.203.0566
ARCADIS BBL HSM: Charles P. Webster, CSP	Phone: 315.671.9297 Cell: 315.247.5971
Client Contacts*	
Georgia-Pacific Corporation Mark P. Brown, PhD	Phone: 774.553.5342 Cell: 774.766.0021
Georgia-Pacific Corporation Chase L. Fortenberry, P.G.	Phone: 404.652.6166 Cell: 404.539.3509
Millennium Holdings, LLC Mark E. Tapp	Phone: 713.309.7164 Cell: 281.467.0657

* Client contacts will be notified as soon as possible, without interrupting emergency response, in case of any emergency.

9.6.1 Directions to Hospital

The closest hospital from the TCRA activities is the Borgess-Pipp Hospital located at 411 Naomi Street, Plainwell, MI. Figure 9-1 presents the locations, directions and the route to the Borgess-Pipp Hospital from the TCRA staging areas.

The closest hospital for the SRI/FS activities will vary depending upon the specific work area. Figures 9-2 through 9-7 present the locations, directions and routes to the various hospitals depending on the SRI/FS Area. Table 9-2 presented SRI/FS work areas to the corresponding closest hospital.

Table 9-2 – Nearest Hospital for SRI/FS Work Areas

SRI/FS Work Area	Reference Location	Closest Hospital/ Emergency Room	Distance to Hospital (miles)	Figure Reference
Kalamazoo Area	Corner of Upjohn Drive and I-94 Business Route	Borgess Emergency & Trauma 1521 Gull Road, Kalamazoo, MI	2.1	9-2
Plainwell and Otsego Area	Farmer Street Bridge	Borgess-Pipp Hospital 411 Naomi Street, Plainwell, MI	2.7	9-3
	Main Street Bridge	Borgess-Pipp Hospital 411 Naomi Street, Plainwell, MI	0.2	9-3
Former Otsego Impoundment Area	Corner of 106th Avenue and M-89	Borgess-Pipp Hospital 411 Naomi Street, Plainwell, MI	5.0	9-4
Allegan and Trowbridge Area	Corner of 24th Street and M-89	Allegan General Hospital 555 Linn Street, Allegan, MI	5.1	9-5
Lake Allegan and Fennville Area	Corner of 46th Street and M-89	Allegan General Hospital 555 Linn Street, Allegan, MI	10.3	9-5
Saugatuck Area	Corner of Riverside Drive and Holland Street/Washington Road	Holland Hospital 602 Michigan Avenue, Holland, MI	9.6	9-7

SRI/FS work areas and starting points for each route are presented as reference points only during the completion of SRI/FS activities. On-site personnel should be aware of the closest hospital and direction to that hospital prior to the commencement of field activities each day. The location of the nearest hospital will be reviewed during each daily safety meeting.

10. References

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Tables

Kalamazoo River Study Group
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Multi-Area Health and Safety Plan

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.2.1	Mobilization	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		High Noise	Hearing protection for noises that exceed 85 dBA
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
3.2.2	Surveying Activities	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Contact with media containing PCBs	Wear proper PPE
		Contact with decontamination equipment	Wear proper PPE
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		River Work	Boating safety and personal flotation devices

Section Reference	Activity	Hazards	Controls
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
3.2.3	Decontamination	Skin contact with decontamination materials	Wear proper PPE
		Rinsate from decontamination activities could contain PCBs	Collect all rinsate for off-site treatment/disposal
		Pressure-washing presents a splash hazard and hazards associated with high pressure water.	Only persons trained in use and maintenance of a hydro-blaster may use such equipment. Inspect equipment before use
		Steam-cleaning presents a thermal burn hazard in addition to all the hazards presented by pressure	Adequate protection from the hot surfaces must be provided, do not point pressure washer at a person.
3.2.4	Site Restoration and Demobilization	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		High Noise	Hearing protection for noises that exceed 85 dBA
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Potentially hazardous atmospheres	Perform air monitoring as outlined in Section 6
3.2.5	Construction Oversight	Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions. Wear proper PPE
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals. Observe from a safe distance.

Section Reference	Activity	Hazards	Controls
		High Noise	Hearing protection for noises that exceed 85 dBA
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
3.2.6.1	Barge Based Drilling	Use of drilling equipment Hoisting operations, catline operations, wire rope, and auger handling.	The operator is responsible for the safe operation of the drill rig and adherence to the requirements of their company-specific HSP. The driller must verify that all safety equipment is in proper condition and is properly used. The members of the drill crew must follow all instructions of the driller, wear appropriate PPE, and be aware of all hazards and control procedures. The drill crew must participate in the daily safety meetings and be aware of all emergency procedures. Drill crew must be properly training and rig must be inspected daily before starting work.
3.2.6.2	Land Based Drilling	Use of drilling equipment: Wire rope, catlines, materials handling, and working surfaces.	The operator is responsible for the safe operation of the drill rig and adherence to the requirements of their company-specific HSP. The driller must verify that all safety equipment is in proper condition and is properly used. The members of the drill crew must follow all instructions of the driller, wear appropriate PPE, and be aware of all hazards and control procedures. The drill crew must participate in the daily safety meetings and be aware of all emergency procedures. Drill crew must be properly training and rig must be inspected daily before starting work. Know the site drilling rules and set up the rig properly.
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
3.2.6.3	Sediment Sampling Via Vibracoring	Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Impact from moving parts and pinch points	Equipment will be inspected and in proper working condition. Extreme care will be taken when loading and unloading material and equipment.
		Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions. Wear proper PPE
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		The hazards outlined in Section 3.2.6.1 are also applicable here.	See above

Section Reference	Activity	Hazards	Controls
3.2.7	Surface Water Monitoring	River Work	Boating safety and personal flotation devices
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Contact with media containing PCBs	Wear proper PPE
		Contact with decontamination equipment	Wear proper PPE
3.2.7.1	Bridge Collection of Water Samples	Working near an active road with limited space.	Schedule sampling for off-peak traffic hours, if possible (i.e., 10 AM to 11 AM and 2 PM to 3 PM); utilize PPE including an orange traffic safety vest, safety cones, and signs; park vehicles on sidewalk or shoulder if possible; close roads if necessary. Sampling will only be conducted during daylight, and will not be conducted if it is or has been snowing and snowplows could potentially be in operation.
		Boats in the River contacting sampling equipment during the sampling event.	Yellow rope will be lowered over the bridge to warn boaters. The rope will be weighted with a buoy and be lowered prior to lowering any sampling equipment and will remain in place until all sampling equipment has been removed. Prior to lowering any sampling equipment, a visual observation will be performed to confirm the lack of boat traffic in the vicinity of the bridge.
		Water related incidents, drowning, submersion, and falls from elevation	All personnel must wear a USCG-approved personal flotation device (PFD) whenever working on or near the water. Sampling shall be conducted so that both feet of the sampling personnel are on the base of the bridge, shoulder of the road, or sidewalk (i.e., not standing on the railing) with the center of gravity lower than the bridge railing. Additionally, a personal fall arrest system shall be used if there is no guardrail at least 42” high.
3.2.8	Fish Sampling	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions. Wear proper PPE
		River Work	Boating safety and personal flotation devices

Section Reference	Activity	Hazards	Controls
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Net entanglement	Do not enter the river near net layout.
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Contact with media containing PCBs	Wear proper PPE
		Contact with decontamination equipment	Wear proper PPE
Former Plainwell Impoundment TCRA Activities, Hazards, and Controls			
3.3.1	Installation, Operation, and Removal of Water Control Structure	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Excavation Hazards (access and egress, surface stability, vehicular traffic, falling loads, hazardous atmospheres, water accumulation)	Maintain ladders at regular intervals, brace sidewalls, follow traffic safety, do not stand under falling loads, air monitoring, use of sumps and water control structure). Have a competent person inspect daily.
		High Noise	Hearing protection for noises that exceed 85 dBA
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		Hot work activities	Use lockout/tagout
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Overhead work (sheet pile installation and lifting materials)	Use ladder and aerial lift safety. Do not stand under elevated loads.
		Flooding resulting from structural malfunction of water control structure or cofferdam	Follow emergency response outlined in the Plainwell Dam Emergency Action Plan
		Observation safety	Observe from a safe distance

Section Reference	Activity	Hazards	Controls
3.3.2	Removal of the Plainwell Dam	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Excavation Hazards (access and egress, surface stability, vehicular traffic, falling loads, hazardous atmospheres, water accumulation)	Maintain ladders at regular intervals, brace sidewalls, follow traffic safety, do not stand under falling loads, air monitoring, use of sumps and water control structure). Have a competent person inspect daily.
		High Noise	Hearing protection for noises that exceed 85 dBA
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		Hot work activities	Use lockout/tagout
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices
		Contact with media containing PCBs	Wear proper PPE
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
3.3.3	Sediment and Soil Removal Operations	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Excavation Hazards (access and egress, surface stability, vehicular traffic, falling loads, hazardous atmospheres, water accumulation)	Maintain ladders at regular intervals, brace sidewalls, follow traffic safety, do not stand under falling loads, air monitoring, use of sumps and water control structure). Have a competent person inspect daily.
		High Noise	Hearing protection for noises that exceed 85 dBA
		Potentially hazardous atmospheres	Perform air monitoring as outlined in Section 6

Section Reference	Activity	Hazards	Controls
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		Hot work activities	Use lockout/tagout
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices
		Contact with media containing PCBs	Wear proper PPE
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
3.3.6	Backfilling and Site Restoration/ Grading	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		River Work	Boating safety and personal flotation devices
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
3.3.3.7	Water Treatment Facility	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		High Noise	Hearing protection for noises that exceed 85 dBA
		Confined Space Entry	Follow OSHA confined space guidelines
		Pressurized and Mechanical Equipment	Inspect equipment before use, use logout/tagout

Section Reference	Activity	Hazards	Controls
		Contact with media containing PCBs	Wear proper PPE
		Contact with decontamination equipment	Wear proper PPE
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
3.3.4	Material Transportation and Disposal	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Electrical (overhead and underground utilities)	Maintain property distance from utility lines; Use lockout/tagout
		High Noise	Hearing protection for noises that exceed 85 dBA
		Elevated work	Use ladder and aerial lift safety. Do not stand under elevated loads.
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		Potentially hazardous atmospheres	Perform air monitoring as outlined in Section 6
		Contact with media containing PCBs	Wear proper PPE
		Contact with decontamination equipment	Wear proper PPE
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
3.3.5.1	Air Sampling	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Potentially hazardous atmospheres	Perform air monitoring as outlined in Section 6
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices

Section Reference	Activity	Hazards	Controls
3.3.5.2	Soil and Sediment Confirmation Sampling	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Contact with media containing PCBs	Wear proper PPE
		Contact with decontamination equipment	Wear proper PPE
		River Work	Boating safety and personal flotation devices
3.3.5.3	Groundwater Sampling	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Contact with media containing PCBs	Wear proper PPE
		Contact with decontamination equipment	Wear proper PPE
		River Work	Boating safety and personal flotation devices
3.3.5.4	Turbidity and Surface Water Monitoring	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Slip, trip, and fall/unstable soil	Proper foot protection and avoid dangerous terrain
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Contact with media containing PCBs	Wear proper PPE

Section Reference	Activity	Hazards	Controls
		Contact with decontamination equipment	Wear proper PPE
		River Work	Boating safety and personal flotation devices

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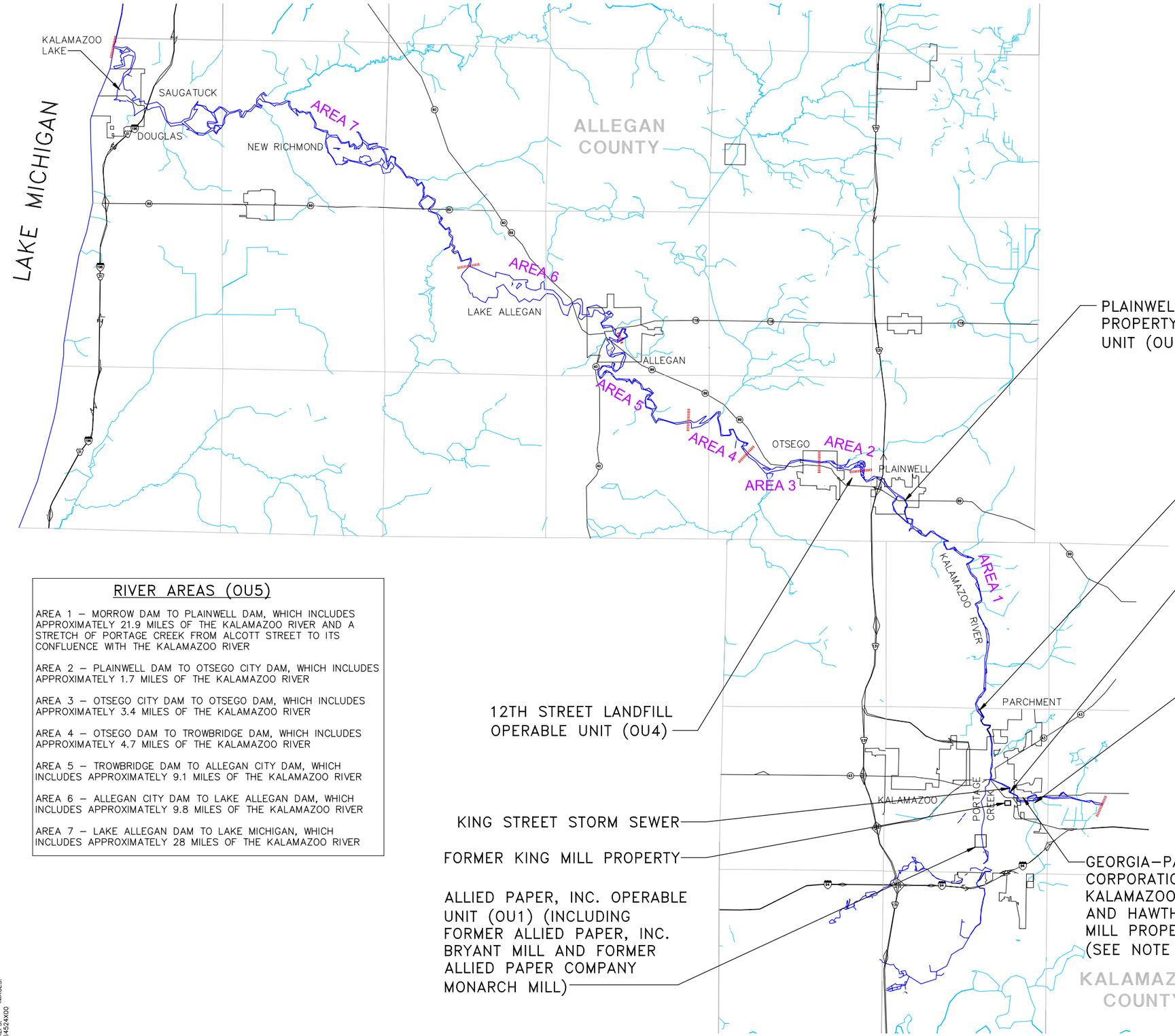
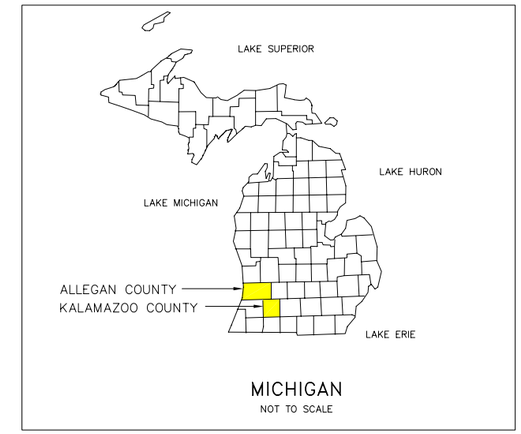
Figures





NOTES:

1. ALLEGAN AND KALAMAZOO COUNTY MAPPING OBTAINED FROM MICHIGAN RESOURCE INFORMATION SYSTEM.
2. OU6 IS CURRENTLY A RELATIVELY SMALL PART OF THE PARCEL COMPRISING BOTH MILLS.

LEGEND:

LIMITS OF RIVER AREAS WITHIN OU5

RIVER AREAS (OU5)

AREA 1 – MORROW DAM TO PLAINWELL DAM, WHICH INCLUDES APPROXIMATELY 21.9 MILES OF THE KALAMAZOO RIVER AND A STRETCH OF PORTAGE CREEK FROM ALCOTT STREET TO ITS CONFLUENCE WITH THE KALAMAZOO RIVER

AREA 2 – PLAINWELL DAM TO OTSEGO CITY DAM, WHICH INCLUDES APPROXIMATELY 1.7 MILES OF THE KALAMAZOO RIVER

AREA 3 – OTSEGO CITY DAM TO OTSEGO DAM, WHICH INCLUDES APPROXIMATELY 3.4 MILES OF THE KALAMAZOO RIVER

AREA 4 – OTSEGO DAM TO TROWBRIDGE DAM, WHICH INCLUDES APPROXIMATELY 4.7 MILES OF THE KALAMAZOO RIVER

AREA 5 – TROWBRIDGE DAM TO ALLEGAN CITY DAM, WHICH INCLUDES APPROXIMATELY 9.1 MILES OF THE KALAMAZOO RIVER

AREA 6 – ALLEGAN CITY DAM TO LAKE ALLEGAN DAM, WHICH INCLUDES APPROXIMATELY 9.8 MILES OF THE KALAMAZOO RIVER

AREA 7 – LAKE ALLEGAN DAM TO LAKE MICHIGAN, WHICH INCLUDES APPROXIMATELY 28 MILES OF THE KALAMAZOO RIVER

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
MULTI-AREA HEALTH AND SAFETY PLAN

AREAS OF THE SITE

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
1-1

SYR-85-GMS LJP KEW LAYER: ON=*, OFF=REF
G:\CAD\ACTIVE\-DWG\ACT\64524500\HASP\64530B01.DWG SAVED:5/1/2007 12:41 PM LAYOUT:1-1 PAGESETUP:---- PENTABLE:PLTFULL.CTB PRINTED:5/1/2007 12:41 PM BY:ASAMIOS
PROJECTNAME:----
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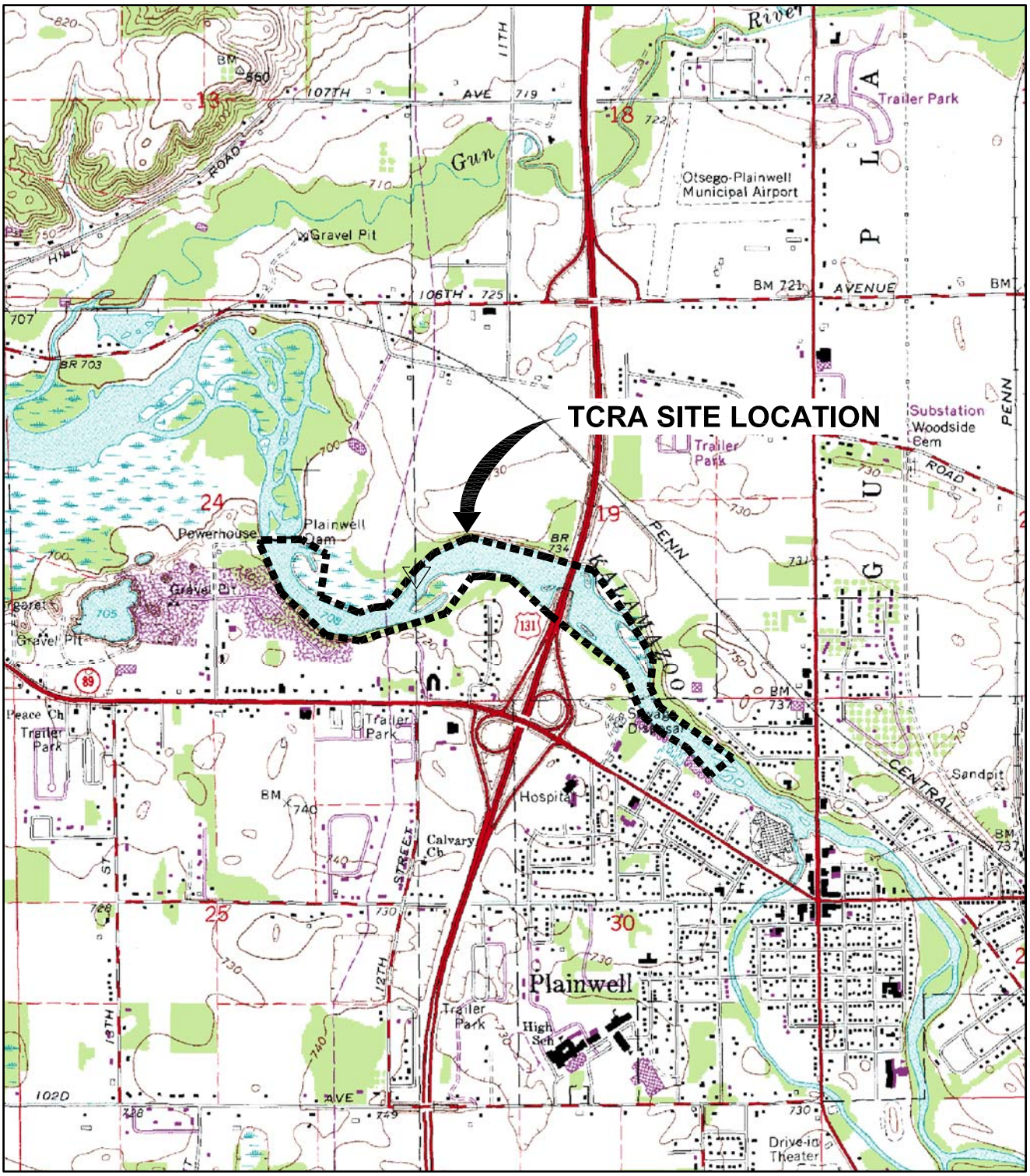
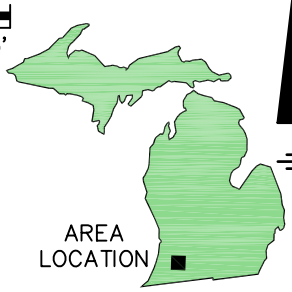
64524X00



REFERENCE: USGS QUADS., 7.5 MIN. SERIES, DRG TOPOGRAPHIC MAP - ALLEGAN COUNTY, KALAMAZOO MICHIGAN.

0 2000' 4000'

Approximate Scale: 1" = 2000'



KALAMAZOO RIVER STUDY GROUP
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KALAMAZOO RIVER SUPERFUND SITE

MULTI-AREA HEALTH AND SAFETY PLAN

TCRA SITE LOCATION

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infrastructure, environment, facilities

FIGURE
1-2

[SYR-85-KLS] SYR-85-KLS KEW AGS LAYER: ON=*, OFF=*REF*
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PROJECTNAME: ----
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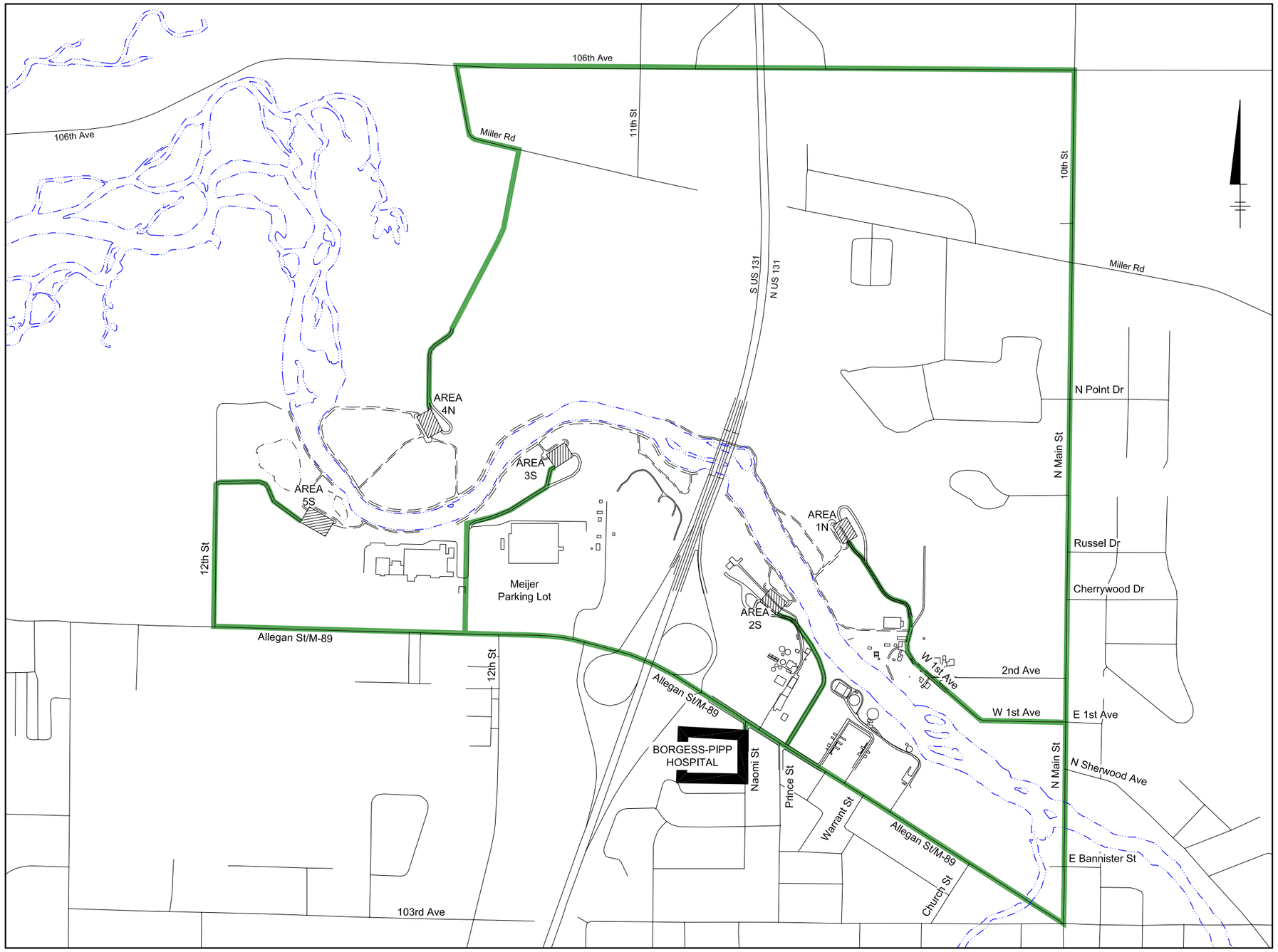
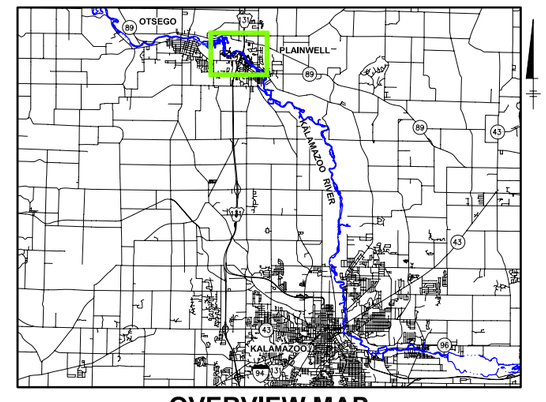


TCRA AREAS TO BORGESS-PIPP HOSPITAL

0 500' 1000'
SCALE: 1"=500'

DIRECTIONS TO BORGESS-PIPP HOSPITAL FROM TCRA AREAS	
ROUTE FROM AREA 1N	
Start on W 1st Ave.	0.2 miles
Turn right on North Main St./CR-A45	0.3 miles
Turn right on Allegan St./M-89	0.7 miles
Turn left on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	
ROUTE FROM AREA 2S	
Turn right on Allegan St./M-89	<0.1 miles
Turn left on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	
ROUTE FROM AREA 3S	
Exit Meijer parking lot through main exit	<0.1 miles
Turn left on Allegan St./M-89	0.6 miles
Turn right on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	
ROUTE FROM AREA 4N	
Turn left on Miller Rd.	<0.1 miles
Turn right on 106th Ave.	1.0 miles
Turn right on 10th St./CR-A45	1.4 miles
Turn right on Allegan St./M-89	0.7 miles
Turn right on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	
ROUTE FROM AREA 5S	
Turn left on 12th St.	0.3 miles
Turn left on Allegan St./M-89	1.0 miles
Turn right on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	



OVERVIEW MAP

0 3 6
SCALE: 1"=3 MILES

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MULTI-AREA HEALTH AND SAFETY PLAN

TCRA AREAS - ROUTES TO THE HOSPITAL

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Infrastructure, environment, facilities

FIGURE
9-1

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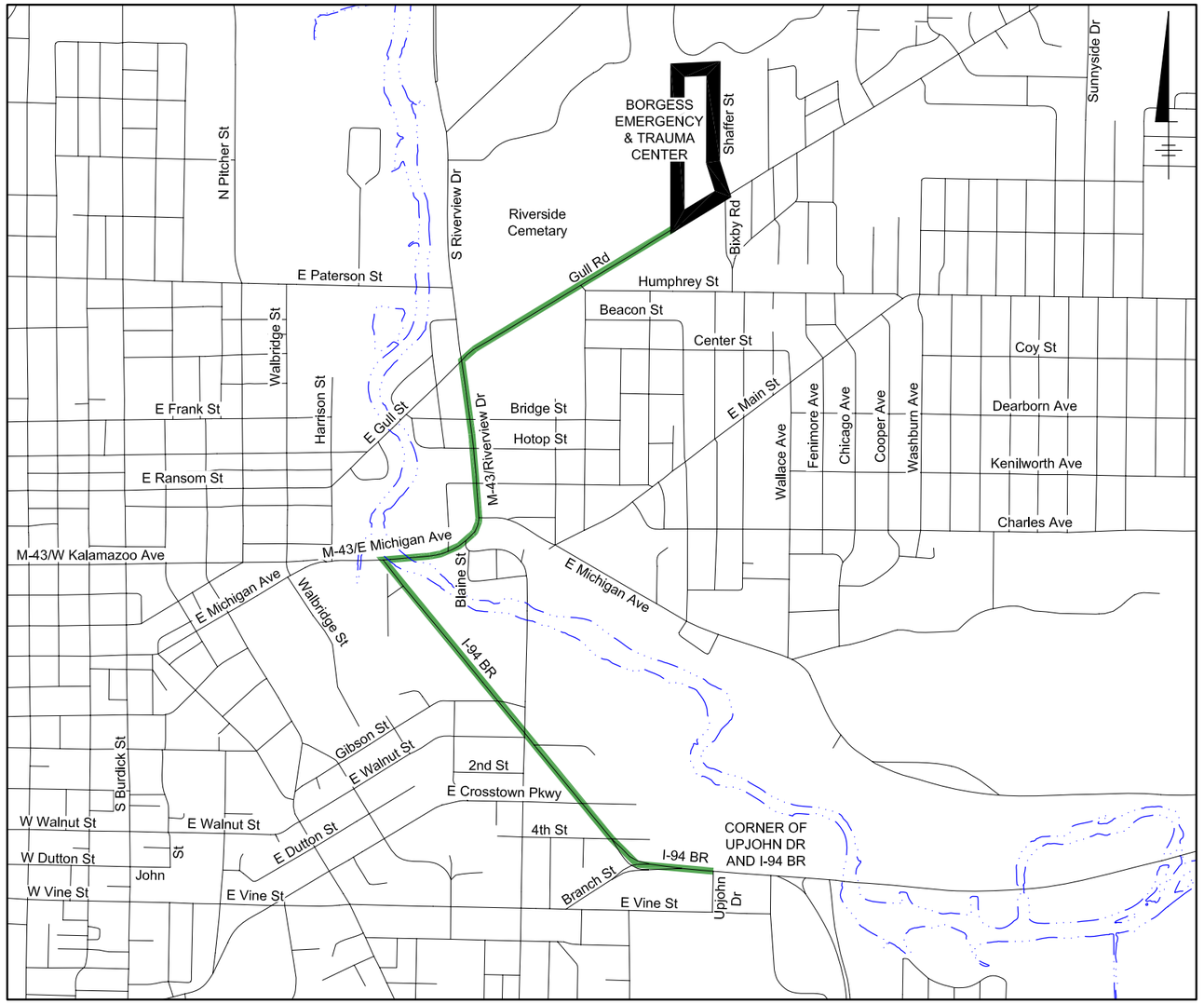
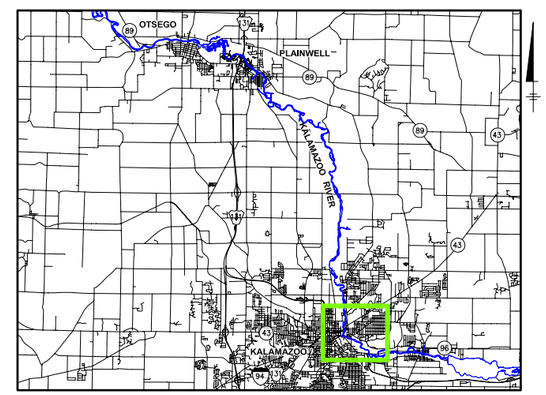


CORNER OF UPJOHN DR AND I-94 BR TO BORGESS EMERGENCY & TRAUMA CENTER

0 800' 1600'

SCALE: 1"=800'

DIRECTIONS TO BORGESS EMERGENCY & TRAUMA CENTER FROM UPJOHN DR AND I-94 BR	
Turn right (west) on I-94 BR	1.0 miles
Turn right at M-43/E. Michigan Ave.	0.2 miles
Stay on M-43/Riverview Drive as it turns to the left	0.4 miles
Turn right on M-43/Gull Rd.	0.5 miles
Arrive at 1521 Gull Road, Kalamazoo, MI	



OVERVIEW MAP

0 3 6

SCALE: 1"=3 MILES

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

MULTI-AREA HEALTH AND SAFETY PLAN

KALAMAZOO AREA - ROUTE TO THE HOSPITAL

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
9-2

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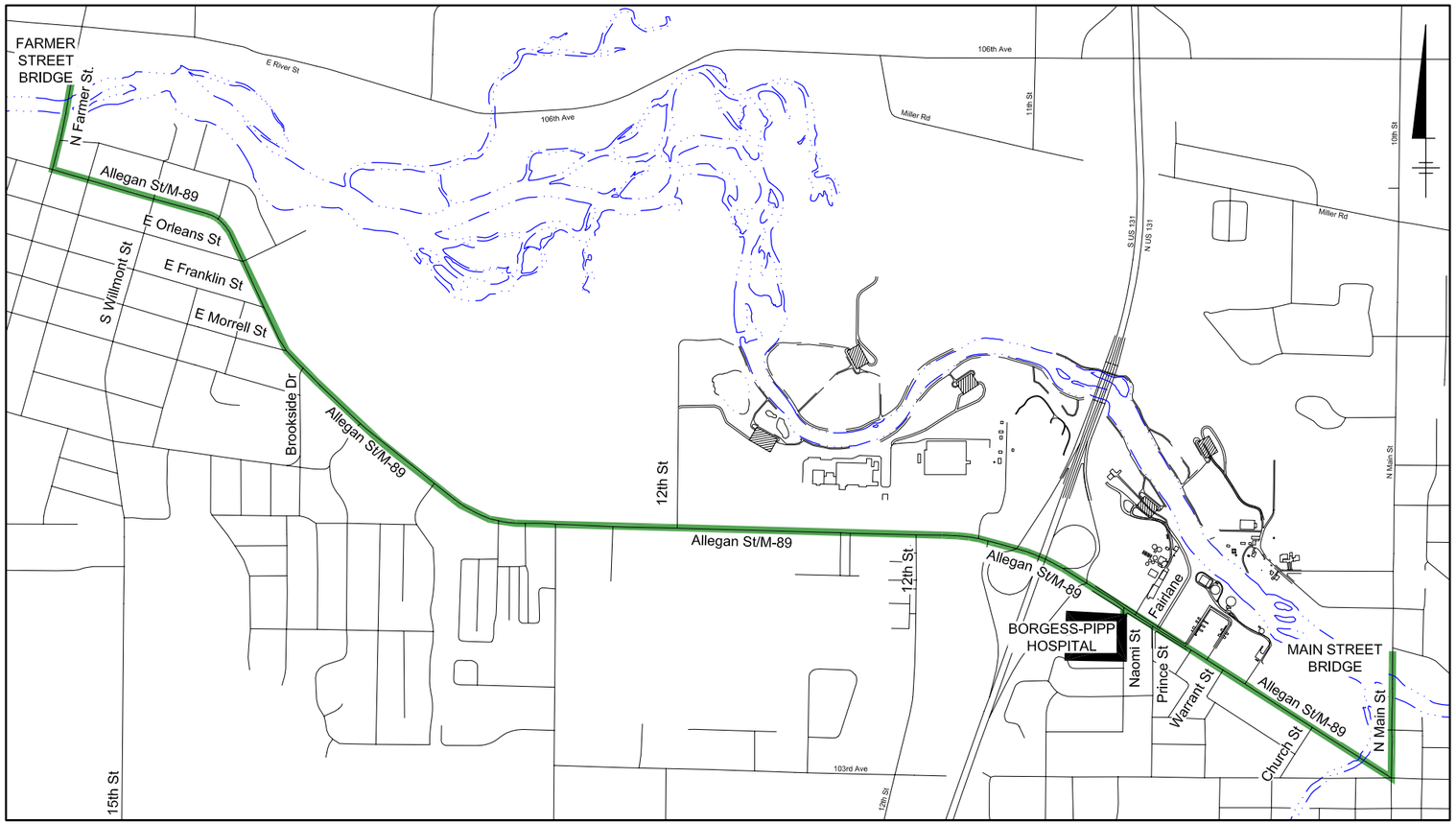
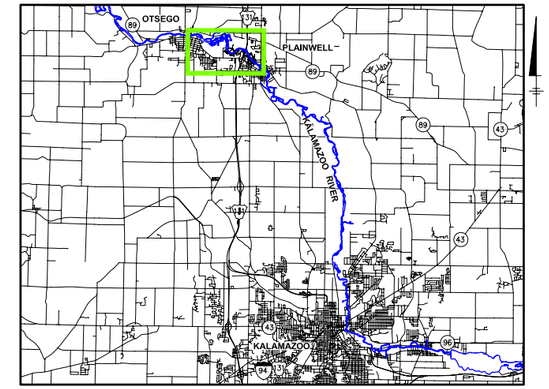


FARMER STREET BRIDGE AND MAIN STREET BRIDGE TO BORGESS-PIPP HOSPITAL

0 800' 1600'
SCALE: 1"=800'



OVERVIEW MAP

0 3 6
SCALE: 1"=3 MILES

DIRECTIONS TO BORGESS-PIPP HOSPITAL FROM FARMER STREET BRIDGE	
Start south on N. Farmer St.	0.1 miles
Turn left on Allegan St./M-89	2.6 miles
Turn right on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	

DIRECTIONS TO BORGESS-PIPP HOSPITAL FROM MAIN STREET BRIDGE	
Start south on Main St./CR-A45	0.2 miles
Turn right on Allegan St./M-89	<0.1 miles
Turn left on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
MULTI-AREA HEALTH AND SAFETY PLAN

PLAINWELL AND OTSEGO AREA - ROUTES TO THE HOSPITAL

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
9-3

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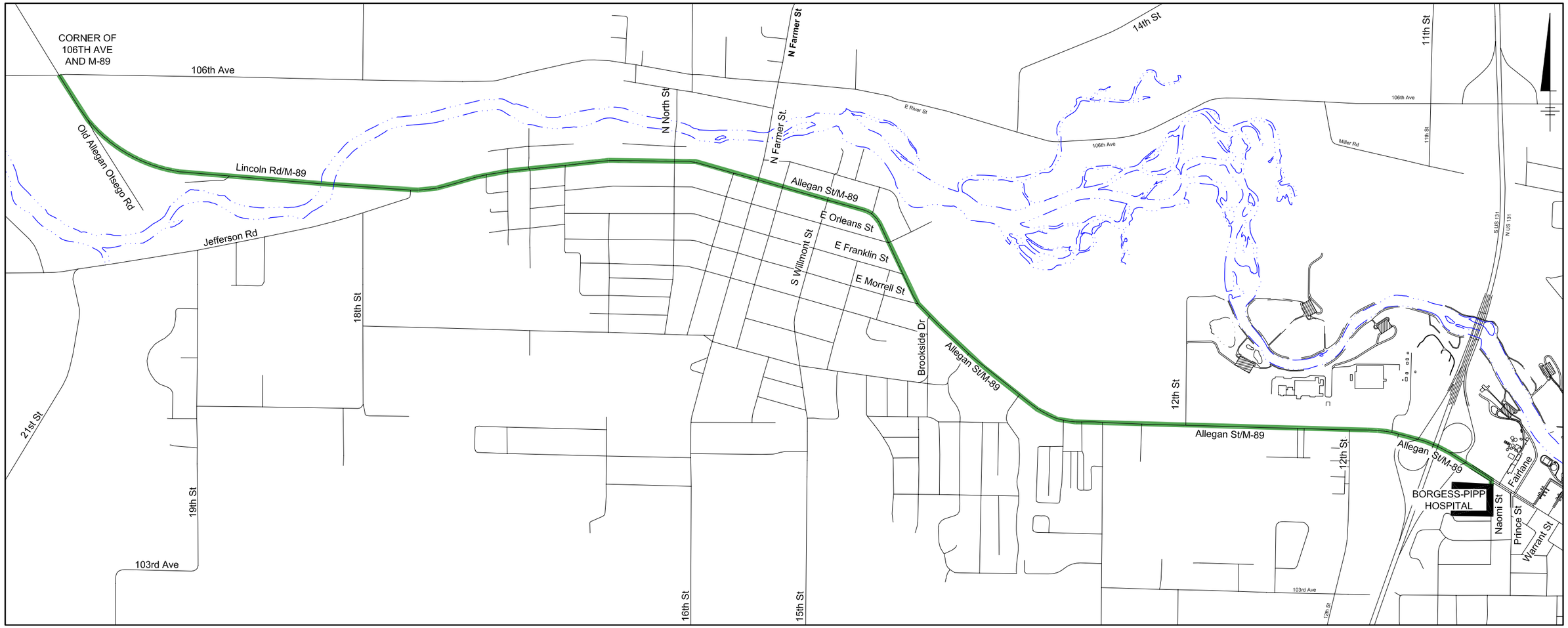
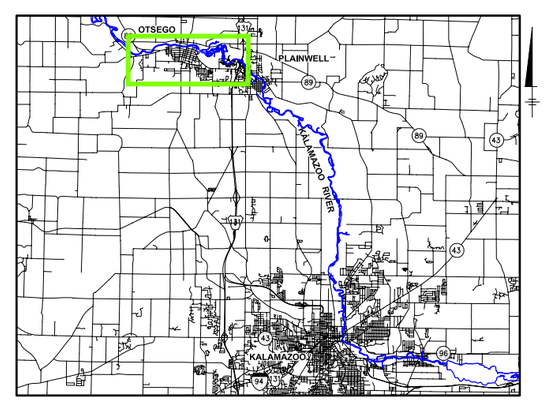


DIRECTIONS TO BORGESS-PIPP HOSPITAL FROM 106th Ave and M-89	
Start Southeast on M-89	5 miles
Turn right on Naomi St.	<0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	

CORNER OF 106TH AVE AND M-89 TO BORGESS-PIPP HOSPITAL

0 800' 1600'
SCALE: 1"=800'



OVERVIEW MAP

0 3 6
SCALE: 1"=3 MILES

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
MULTI-AREA HEALTH AND SAFETY PLAN

FORMER OTSEGO IMPOUNDMENT AREA - ROUTE TO THE HOSPITAL

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
9-4

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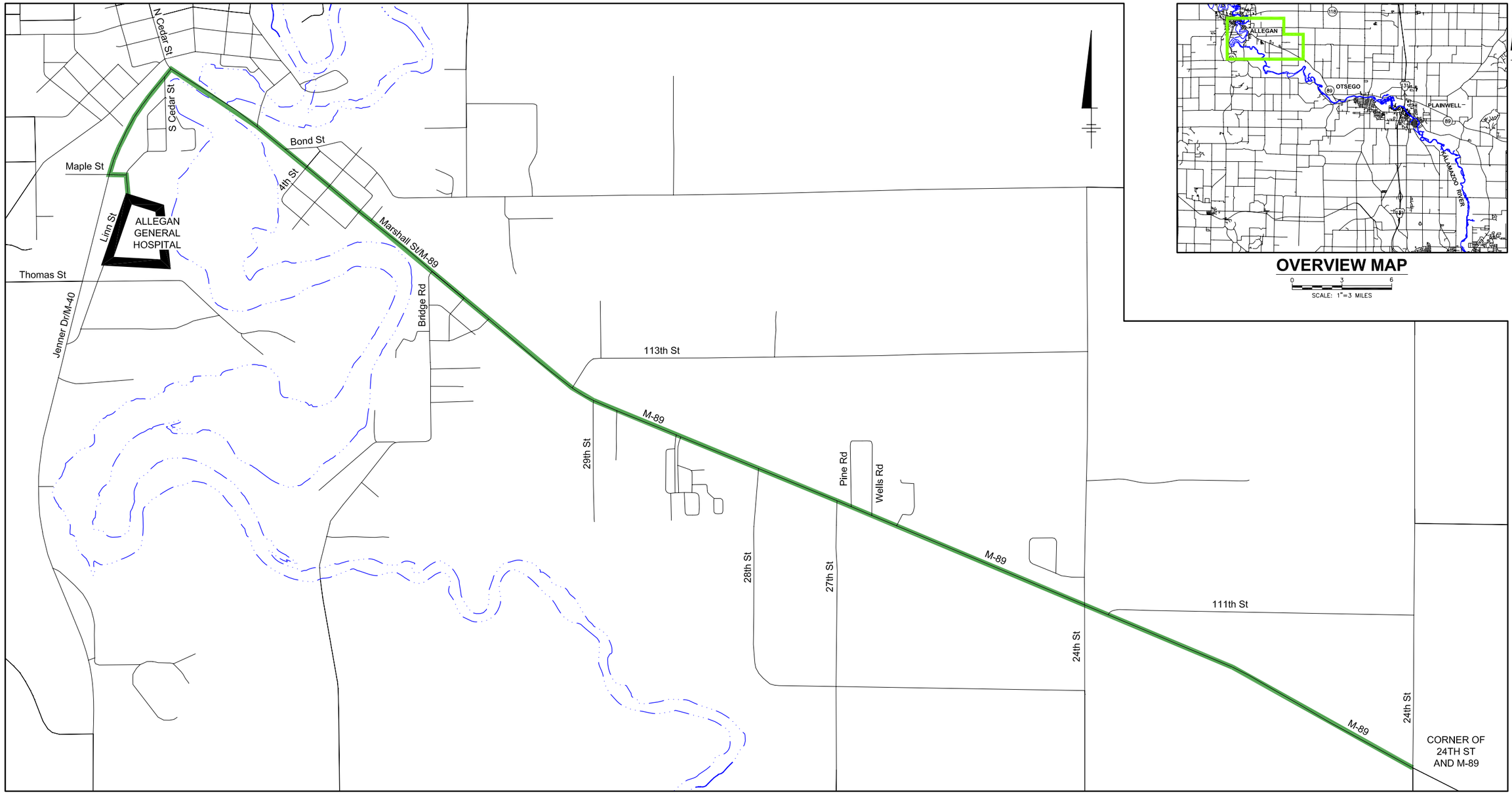

DIRECTIONS TO ALLEGAN GENERAL HOSPITAL FROM 24th St and M-89	
Start Northwest on M-89	4.4 miles
Turn left on Jenner Dr./M-40	0.5 miles
Turn left on Maple St.	<0.1 miles
Turn right on Linn St.	<0.1 miles
Arrive at 555 Linn Street, Allegan, MI	

CORNER OF 24TH ST AND M-89 TO ALLEGAN GENERAL HOSPITAL

0 800' 1600'
SCALE: 1"=800'

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

MULTI-AREA HEALTH AND SAFETY PLAN

ALLEGAN AND TROWBRIDGE AREA - ROUTE TO THE HOSPITAL

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
9-5

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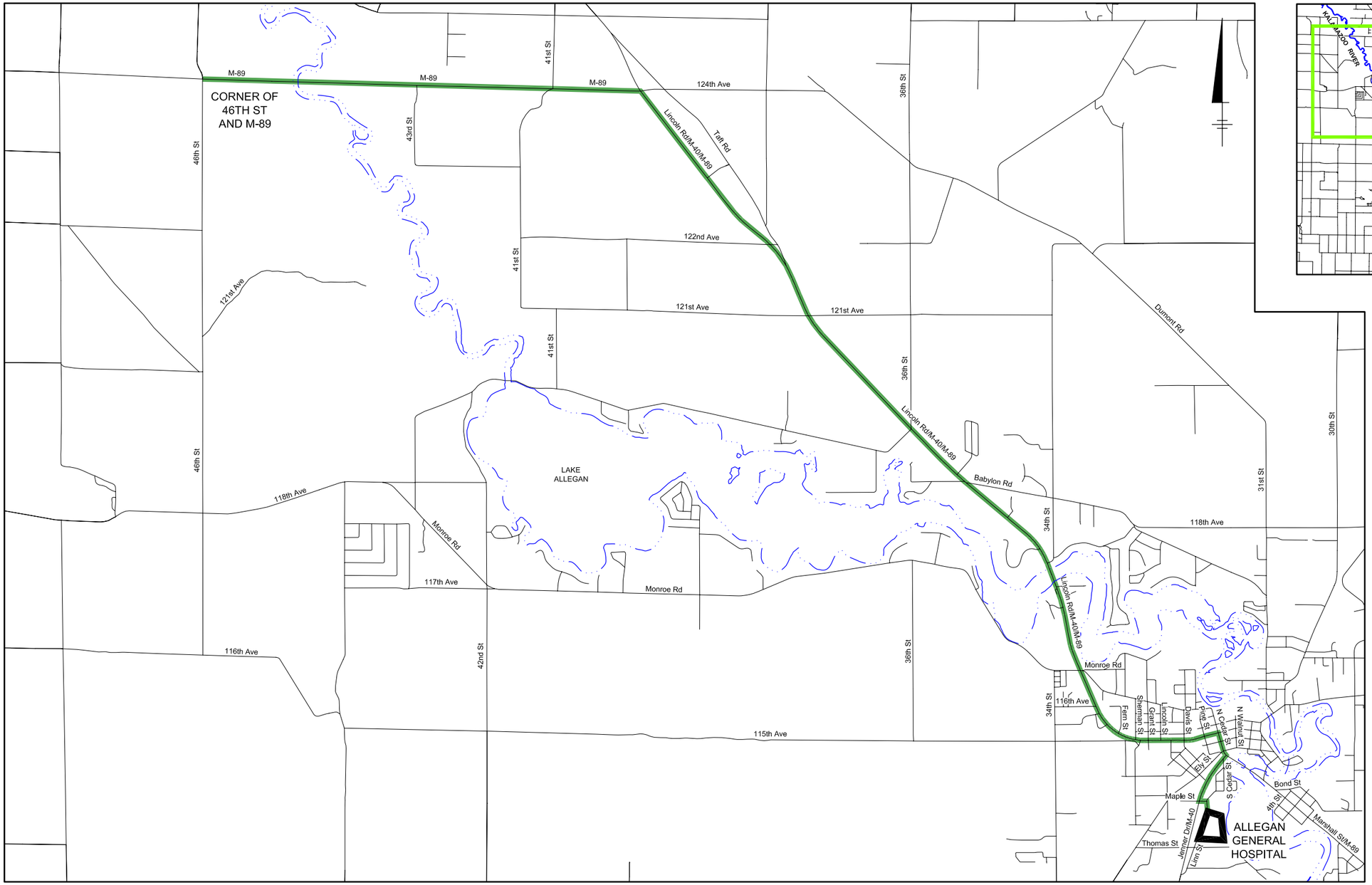

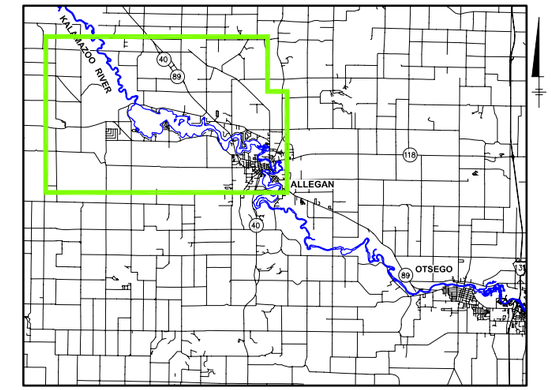

OVERVIEW MAP

0 3 6

SCALE: 1"=3 MILES

DIRECTIONS TO ALLEGAN GENERAL HOSPITAL FROM 46th St and M-89	
Start South on M-89	3.1 miles
Turn left on Lincoln Rd./M-40	7.1 miles
Turn left on Maple St.	<0.1 miles
Turn right on Linn St.	<0.1 miles
Arrive at 555 Linn Street, Allegan, MI	

CORNER OF 46TH ST AND M-89 TO ALLEGAN GENERAL HOSPITAL

0 2000' 4000'

SCALE: 1"=2000'

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

MULTI-AREA HEALTH AND SAFETY PLAN

LAKE ALLEGAN AND FENNVILLE AREA - ROUTE TO THE HOSPITAL

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
9-6

SYR-85-BGP LAYER: ON=*, OFF=*REF*
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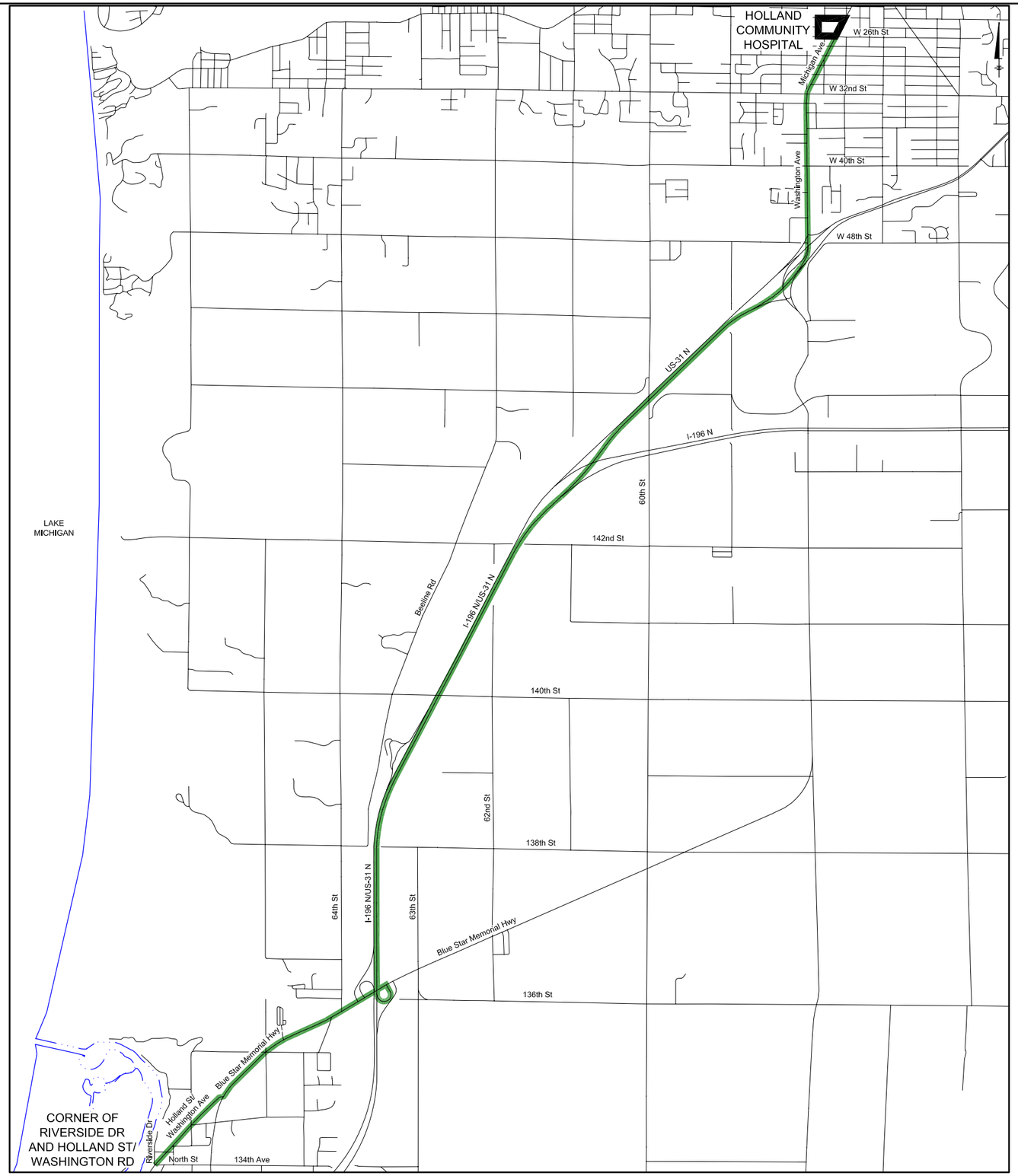

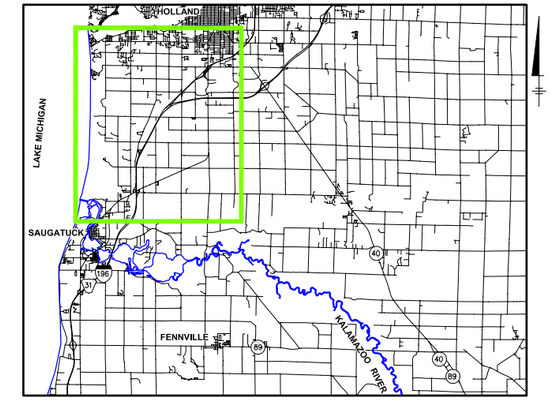

OVERVIEW MAP

0 3 6
SCALE: 1"=3 MILES

DIRECTIONS TO HOLLAND COMMUNITY HOSPITAL FROM RIVERSIDE Dr and HOLLAND St/WASHINGTON Rd	
Start North on Holland St./Washington Rd.	0.4 miles
Continue on Washington Ave.	0.3 miles
Turn left at Blue Star Memorial Hwy.	1.3 miles
Turn right to merge onto I-196 N/US-31 N	3.8 miles
Take exit 44 on the left for US-31 toward Lake Michigan/Holland/Muskegon	0.4 miles
Merge onto US-31 N	1.7 miles
Take exit 47B on the left for I-196-BR/US-31-BR toward Holland	0.2 miles
Merge onto US-31-BR	1.0 miles
Continue on Michigan Ave.	0.5 miles
Arrive at 602 Michigan Avenue, Holland, MI	

CORNER OF RIVERSIDE DR AND HOLLAND ST/WASHINGTON RD TO HOLLAND COMMUNITY HOSPITAL

0 2000' 4000'
SCALE: 1"=2000'

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
MULTI-AREA HEALTH AND SAFETY PLAN

SUAGATUCK AREA - ROUTE TO THE HOSPITAL

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
9-7

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Appendices

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Appendix A

Loss Prevention Observation Form

Loss Prevention Observation (LPO) Form

(page 1 – LPO Information)

Observer Name:	**Observer Title:**	**Project / Project Number:**
Date / Time:	**Project Type / Task Observed:**	

Background Information

List Critical Work Procedures

List Issue / Items Requiring Corrective Action

Explanation of Root Cause(s) Analysis Numbers (RCA No):

1. Lack of SKILL or KNOWLEDGE (XOM#1)	2. Lack of or inadequate operational PROCEDURES or work standards (XOM#5)
3. Inadequate COMMUNICATION OF EXPECTATIONS regarding procedures or acceptable practices (XOM#6)	4. Inadequate TOOLS or EQUIPMENT (XOM#7)
5. Doing the job according to procedures or acceptable practices takes more TIME or EFFORT (XOM#2)	6. Short-cutting procedures or acceptable practices is POSITIVELY REINFORCED or TOLERATED, rewarded or appreciated (XOM#3)
7. IN THE PAST, did not follow procedures or acceptable practices and NO INCIDENT occurred (XOM#4)	8. EXTERNAL factors (XOM#8)

Criterion #	RCA #	Corrective Action Identified	Responsible Individual	Due Date	Closure Date

Results of Corrective Action

Reviewed by:	Date:	Reviewed by:	Date:

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Infrastructure, environment, facilities

Loss Prevention Observation (LPO) Form

(page 2 - Environmental Operations)

Pre-Task Preparation		Correct	Questionable	Comments
1.	Health and Safety Plan / MSDSs on site	☐	☐	
2.	Employee familiar / trained on task	☐	☐	
3.	OSHA-required training/medical surveillance	☐	☐	
4.	Utility mark out / check performed	☐	☐	
5.	Traffic hazard addressed / work area marked	☐	☐	
6.	Walking / working surfaces free of hazards	☐	☐	
7.	Tailgate safety meeting performed	☐	☐	
8.	Impact on nearby residence / business evaluated	☐	☐	
9.	Communicates intentions to other personnel	☐	☐	
10.	Knowledge of emergency procedures	☐	☐	
11.	Distance between equipment and power lines	☐	☐	
12.	Personal protective equipment	☐	☐	
13.	Air monitoring equipment on site, calibrated	☐	☐	
14.	First aid kit / fire extinguisher on site	☐	☐	
15.	One person trained in first aid / CPR	☐	☐	
16.	Work zones established and marked	☐	☐	
Performing Task		**Correct**	**Questionable**	**Comments**
17.	Employee trained in task to be performed	☐	☐	
18.	Correct body positioning	☐	☐	
19.	Proper lifting / pushing / pulling techniques	☐	☐	
20.	Keep hands / body away from pinch points	☐	☐	
21.	Walking / working surfaces kept clear of debris	☐	☐	
22.	Faces traffic as appropriate	☐	☐	
23.	Vehicles / barricades to protect against traffic	☐	☐	
24.	Drill rig located properly, blocked / chocked	☐	☐	
25.	Drill rig moved only with derrick lowered	☐	☐	
26.	Excavator located on stable ground	☐	☐	
27.	Eye contact made with equipment operator	☐	☐	
28.	Spoil at least 2 feet back from edge of excavation	☐	☐	
29.	Excavation shored / sloped / benched	☐	☐	
30.	Excavation entry controlled	☐	☐	
31.	Equipment / tools used properly	☐	☐	
32.	Electrical equipment connected through GFCI	☐	☐	
33.	Power tools handled properly	☐	☐	
34.	Electrical cords inspected / in good condition	☐	☐	
35.	Follows lockout / tagout procedures	☐	☐	
36.	Air monitoring conducted / action levels understood	☐	☐	
37.	Equipment decontaminated properly	☐	☐	
38.	Personnel decon prior to eating / drinking / smoking	☐	☐	
39.	Decontamination effective	☐	☐	
Post-Task		**Correct**	**Questionable**	**Comments**
40.	Procedures / JSA adequate	☐	☐	
41.	Equipment / tools stored properly	☐	☐	
42.	Proper storage of soil / water / waste material	☐	☐	
43.	Work area secured	☐	☐	
44.	Other	☐	☐	

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Appendix B

Incident/Near-Miss Investigation Report

ARCADIS BBL
Infrastructure, environment, facilities

Incident/Near-Miss Investigation Report

☐ OSHA Recordable	☐ First Aid Injury	☐ Fire	Date of Incident:
☐ Lost Workday Injury	☐ Vehicle Accident	☐ Spill / Leak	
☐ Restricted Duty Injury	☐ Equipment Damage	☐ Near Miss	Incident Number:

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name:	Project #:
Location of Incident:	

Employee

Name:	Employee Number:
Employment Status: ☐ Regular ☐ Part Time	How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic):	Phone No.:
If hospitalized, name and address of hospital:	Phone No.:
Date of injury or onset of illness: / /	Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift's work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY) / /

Has employee returned to work? ☐ Regular Work ☐ Restricted Work ☐ No
☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported:	Other workers injured / made ill in this event? ☐ Yes ☐ No

Description of Incident / Near Miss: (Describe what happened and how it happened.)

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Incident/Near-Miss Investigation Report

Motor Vehicle Accident (MVA)		Company Vehicle?	☐ Yes ☐ No		
Accident Location (street, city, state)					
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:	# of Injuries:

Spill		
Material Spilled:	Quantity:	Source:
Agency Notifications:		
Cost of Incident $		

Third-Party Incidents		
Name of Owner:	Address:	Telephone:
Description of Damage:		
Witness Name:	Address:	Telephone:
Witness Name:	Address:	Telephone:

#	Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)
1	
2	
3	
4	
5	

Explanation of Root Cause(s) Analysis Numbers (RCA No):	
1. Lack of SKILL or KNOWLEDGE (XOM#1)	2. Lack of or inadequate operational PROCEDURES or work standards (XOM#5)
3. Inadequate COMMUNICATION OF EXPECTATIONS regarding procedures or acceptable practices (XOM#6)	4. Inadequate TOOLS or EQUIPMENT (XOM#7)
5. Doing the job according to procedures or acceptable practices takes more TIME or EFFORT (XOM#2)	6. Short-cutting procedures or acceptable practices is POSITIVELY REINFORCED or TOLERATED, rewarded or appreciated (XOM#3)
7. IN THE PAST, did not follow procedures or acceptable practices and NO INCIDENT occurred (XOM#4)	8. EXTERNAL factors (XOM#8)

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date

Investigation Team Members		
Name:	Job Title:	Date:

Incident/Near-Miss Investigation Report

Results of Solution Verification and Validation		
Reviewed By		
Name:	Job Title:	Date:
	Project Manager	
	Health and Safety Reviewer	

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Appendix C

Equipment Pre-Operation Inspection Form

Equipment Pre-Operation Inspection Form

Date: _____ Hours Start: _____

Unit: _____ Hours End: _____

Operator: _____ Shift: _____

CHECK BEFORE OPERATING	OK	NR	COMMENTS
Seat Belts			
Back-up Alarm			
Brakes (service/retarder, secondary, park)			
Low Air Pressure			
Steering Components			
Speedometer			
Tires (flats/lug nuts loose)			
Pins (hoist cylinders/body wiretainers)			
Auto Lube System (is truck lubricated?)			
Fluid Leaks			
Fluid Levels			
Lights (head, tail, brake, retarder, clearance, hazard, panel)			
Fire Extinguisher (portable)			
Glass/Mirrors			
Horn			
Wheel Chocks			
Windshield Wipers			
Heater/Air conditioner (circle)			
Grab Irons/Steps/Ladders (circle)			
Frame Cracks/Bed Cracks/Nose Cone Assembly (circle)			
Clean Working Place			
Drain Air Tanks (main, secondary, governor)			
Operator's Seat/Passenger's Seat (circle)			
Suspensions			
Doors			
Safety Chains & Cables			
Exhaust System			
Air Cleaners			
Hoist Cylinders (hard to dumo)			
Canopy & Rock Guards			
Radio			
Automatic Electronic Traction Aid System			
Ducktail on Bed Intact?			
Does Automatic Retarder Work Correctly			
Gauges and All Other Warning Devices			
Starter			
Switches			

NR = Needs Repaired

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Appendix D

Underground/Overhead Utility Checklist

Underground / Overhead Utility Checklist

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**

This checklist must be completed for any intrusive subsurface work such as excavation or drilling. It documents that overhead and underground utilities in the work area are identified and located. The Project Manager shall request utility markouts before the start of field operations to allow the client and utility companies sufficient time to provide them. If complete information is not available, a magnetometer or other survey shall be performed to locate obstacles prior to intrusive subsurface activities.

Procedure: A diagram of the work area depicting the proposed location of intrusive subsurface work sites (i.e., boring locations, excavation locations) must be attached to this form. The diagram must clearly indicate the areas checked for underground structures / utilities, and overhead power lines. This form and the diagram must be signed by the ARCADIS BBL Project Manager (if present), the ARCADIS BBL Site Supervisor, and the client representative.

Type of Structure	Present	Not Present	Method of Markout
Electric Power Line			
Natural Gas Line			
Telephone Line			
Water Line			
Product Line			
Sewer Line			
Steam Line			
Drain Line			
Underground Tank			
Underground Cable			
Overhead Power Line			
Overhead Product Line			
Other (Specify)			

Reviewed By		
Name:	Job Title:	Date:
	Client Representative	
	ARCADIS BBL Project Manager	
	ARCADIS BBL Site Supervisor	

ARCADIS BBL

Appendix E

Sediment/Surface Water Sampling Checklist

Sediment / Surface Water Sampling Checklist

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**

This checklist must be completed for any sediment or surface water sampling. It documents that the required permits, notifications, procedures, and equipment are in place prior to commencing sampling activities. The Project Manager shall identify the need for and arrange to obtain sampling permits, clearance or right-of-way access from the appropriate entity during project planning.

Procedure: Prior to any work on a navigable waterway or any activity that requires access, the following items will be completed:

Activity	Required for Project	Completed	Comments
Access rights to property	Yes ☐ No ☐	Yes ☐ No ☐	
Activity planned that impedes traffic on navigable waterway	Yes ☐ No ☐	Yes ☐ No ☐	
Notification and approval obtained from U.S. Coast Guard and/or other regulating authority (e.g., County, U.S. Parks Service, U.S. Environmental Protection Agency)	Yes ☐ No ☐	Yes ☐ No ☐	
Buoys, signs, markings, or other forms of notification present	Yes ☐ No ☐	Yes ☐ No ☐	
Other (specify)	Yes ☐ No ☐	Yes ☐ No ☐	

Boating / Water Safety Checklist:

Activity	Required for Project	Completed	Comments
Working on, over, or near water (within 6 feet)	Yes ☐ No ☐	Yes ☐ No ☐	
Boat has current registration, has been inspected, and loaded safely	Yes ☐ No ☐	Yes ☐ No ☐	
Boat operator has appropriate training (USCG Boating Safety Course or equivalent)	Yes ☐ No ☐	Yes ☐ No ☐	
Sampling on, over, or near water below 50 degrees Fahrenheit	Yes ☐ No ☐	Yes ☐ No ☐	
Method of communication available	Yes ☐ No ☐	Yes ☐ No ☐	

Reviewed By

Name:	Job Title:	Date:
	Client Representative	
	ARCADIS BBL Project Manager	
	ARCADIS BBL Site Supervisor	

ARCADIS BBL

Appendix F

Plainwell Dam EAP

Plainwell Dam #1

Emergency Action Plan Background Information

Dam Operator:
John Lerg
Wildlife Biologist
Dept. of Natural Resources
621 North 10th Street
Plainwell, Michigan 49080
269-685-6851

Alternate:
Sara Schaefer
District Wildlife Biologist
Dept. of Natural Resources
621 North 10th Street
Plainwell, Michigan 49080
269-685-6851

Hazard Potential Classification: High
Watercourse: Kalamazoo River
Location: SE 1/4 Sec. 24, T1N,R12W, Allegan County 3/4 mile downstream of US-131 bridge

History:
This dam was built to produce hydroelectric power. When it was decommissioned, the impoundment water level was lowered to the sill (fixed crest) elevation of the gated spillways. Due to dam design, the impoundment could not be lowered further. Subsequently, portions of the dam's power house and embankments were removed. The normal difference between headwater and tailwater (hydraulic head) is now approximately 7.5 ft. The remaining impoundment surface area is about 56 acres.

At some time after the Department of Natural Resources (DNR) acquired ownership, serious contamination (PCBs) was found in the sediments which have accumulated in the impoundment. These contaminants are found both in the sediments still covered by impoundment and in the sediments which were exposed after the dam was drawn down. Many of these contaminated sediments would be released into the floodwaters by a failure of this dam.

Types of Emergencies:

1) Failure during severe flooding.
   This failure mode will generally cause very high downstream flood stages as released impoundment waters are added to the already high flood stages. At any time when significant flooding may threaten the dam, it must be checked periodically for indications of potential failure. The checks should be coordinated by DNR staff and emergency personnel.

2) Failure during normal flow conditions.
   This failure mode usually results in less severe downstream flood stages than an overtopping failure, but is often more dangerous because it generally occurs without warning.

3) Potential failure in progress.
   In this situation, quick action may prevent a failure. It also provides the most lead time to announce the potential danger.

Plainwell Dam #1
Emergency Action Plan

DNR staff have made arrangements with local contractors who are available for immediate response in the event of an emergency. A listing of these contractors is found in Attachment 3.

The failure or potential failure of the dam shall be immediately reported by DNR staff to the **Allegan County Emergency Preparedness Coordinator, Mr. Scott Corbin**

269-673-0571 (daytime) 911 (after business hours)

Staff shall note whether failure **HAS** occurred or that **POTENTIAL** for failure exists. Staff shall also note whether failure is **CONFIRMED**. If failure is unconfirmed, staff shall then travel to the site to assess the situation and advise coordinator of findings. DNR staff shall then mobilize local contractor(s) if appropriate.

Emergency Preparedness Coordinator shall:

1. Mobilize appropriate emergency services personnel.

2. Announce to the media the dam's failure or potential failure. This announcement shall include the notice of threatened contamination (attachment 1).

3. Directly warn and/or evacuate flood prone areas. At the time of this writing, no residential structures are known to be threatened. However, the following areas may be occupied:

   a) Land bordering the Kalamazoo River within the city limits of Otsego.

   b) The state owned land along the Kalamazoo River between Otsego Dam and The city of Allegan. Recreational users may be threatened.

   c) The DNR operator of Trowbridge and Otsego Dams (if the report came from some other source than DNR).
   (Telephone numbers on page 1)

   d) The parking areas adjacent to Imperial Carving Company.
   Telephone: 269-673-3867 or 269-673-4903

   e) Jaycee Park, Corner of Monroe Street and Chestnut Street.

   f) Fairgrounds, Corner of Allegan Co. Fair Drive and Park Drive.

4. Check all bridges between Plainwell Dam #1 and Lake Allegan for flood damage. Be prepared to close bridges as necessary.

The above areas are highlighted on the map found in Attachment 2.

After all emergency personnel are alerted, the Department of Environmental Quality's Dam Safety Unit shall be advised.
Daytime: 517-373-1170; After hours: 1-800-292-4706 (PEAS)

Attachment 1

Notice of Threatened Contamination

Failure of the Plainwell Dam #1 may result in the mobilization of contaminated sediments from within the dam's impoundment and/or the floodplain downstream from the dam. These contaminants include polychlorinated biphenyls (PCBs). PCBs are considered hazardous substances and are a probable human carcinogen. Contact with flood waters and sediment deposits should be avoided.

Background Information

On August 30, 1990, the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site (site) was officially included on the National Priorities List (NPL) pursuant to the Comprehensive Environmental Response, Compensation and Liability Act, 1980 PA 96-510. The site was placed on the NPL because the sediments, soils, water column, groundwater and biota within this site are heavily contaminated with PCBs, a hazardous substance and probable human carcinogen. This contamination is a result of area paper mills discharging the waste from their recycling of carbonless copy paper.

The site boundaries includes a 3-mile stretch of Portage Creek, from Cork Street just above the Bryant Mill Pond, in the City of Kalamazoo, Michigan, to its confluence with the Kalamazoo River, and along a 77-mile stretch of the Kalamazoo River from the Morrow Dam to the furthest downstream point of the contaminant migration, which may be the mouth of the river at Lake Michigan. Included within this site are the former Bryant Mill Pond, Plainwell Impoundment, Otsego Impoundment, Trowbridge Impoundment and hundreds of acres of PCB contaminated wetlands and floodplains located behind these dams.

The data clearly indicated that PCBs are continuing to migrate further downstream and that upstream sources owned by the responsible parties are causing the ongoing contamination. As a direct result, the soil, sediments, surface water, groundwater, and fish at the site are contaminated with PCBs. Direct contact with, inhalation of, or ingestion of soils, sediments, surface water, groundwater, or fish poses a threat to both wildlife and human health. Annually, since 1977, the Michigan Department of Public Health has issued an advisory warning people not to eat the fish from the Kalamazoo River because of PCB contamination. The MDEQ estimates that the sediments contain well over 300,000 pounds of PCBs. The PCBs continue to migrate into the environment from these areas due to erosion, surface water runoff and groundwater infiltration. This migration of PCBs is contributing to the ongoing contamination to the soils, sediments, water column and biota both in and adjacent to the Kalamazoo River/Portage Creek and Lake Michigan.

Failure of any of the dams on this river would severely exacerbate the existing problems resulting from the PCB contamination noted above. The data indicate that dam failure would significantly increase the bioavailability of the PCBs to the wildlife resulting in greater injury to the natural resources and increased the health threat to humans.

For further information contact:

Paul Bucholtz
Remediation and Redevelopment Division
Department of Environmental Quality
517-373-8174

Plainwell Dam #1

Emergency Action Plan

Attachment #3

Excavating Contractors

Leonard Roe
6 Weeks Street, Allegan Mi. 49010 269-673-4736

Pat Knapp Excavating
5698 109th Avenue, Pullman, Mi. 49450 269-236-5606

Broe's X-cavating
1817 64th Street, Fennville, Mi. 49408 269-543-4275

Remington Excavating
40360-CR388, Bloomingdale, Mi. 49026 269-521-3350

Al's Excavating
4515 134th Street, Hamilton, Mi. 49419 269-751-5158

Van Dragt Land Improvement
11 130th Avenue, Fennville, Mi. 49408 269-857-2066

D. J. Bentley
3036 110th Avenue, Allegan, Mi. 49010 269-673-2828

Milbocker and Sons, Inc.
1256 29th Street, Allegan, Mi. 49010 269-673-2195

ARCADIS BBL

Appendix G

Daily/Periodic Excavation Inspection Checklist

ARCADIS BBL
Infrastructure, environment, facilities

Daily / Periodic Excavation Inspection Checklist

Project Name:	**Date / Time:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**

This checklist must be completed for all excavations. It documents that daily and post-event / periodic inspections are conducted.

Soil Classified As: Stable Rock Type A Type B Type C

Soil Classified On: By:

Type of Protective System in Use: Sloping Shoring Other _____

Description:

Inspection Item	Yes	No	Comments
Is the underground / overhead utilities checklist completed?	☐	☐	
Are underground installations protected from damage?	☐	☐	
Are adequate means of entry / exit available in the excavation?	☐	☐	
If exposed to traffic, are personnel wearing reflective vests?	☐	☐	
Do barriers exist to prevent equipment from rolling into the excavation?	☐	☐	
Was air monitoring conducted prior to and during excavation entry?	☐	☐	
Was the stability of adjacent structures reviewed by a registered P.E.?	☐	☐	
Are spoil piles at least 2 feet from the excavation edge?	☐	☐	
Is fall protection in use near excavations deeper than 6 feet?	☐	☐	
Are work tasks completed remotely if feasible?	☐	☐	
Is a protective system in place and in good repair?	☐	☐	
Is emergency rescue (lifeline / body harness) equipment used due to potential atmospheric hazard?	☐	☐	
Is excavation exposed to vibration?	☐	☐	
Are employees protected from falling / elevated material?	☐	☐	
Is soil classification adequate for current environmental / weather conditions?	☐	☐	
Do portable ladders extend at least 4 feet above the excavation?	☐	☐	
Are portable ladders or ramps secured in place?	☐	☐	
Have all personnel attended safety meeting on excavation hazards?	☐	☐	
Are support systems for adjacent structures in place?	☐	☐	
Is the excavation free from standing water?	☐	☐	
Is water control and diversion of surface runoff adequate?	☐	☐	
Are employees wearing required protective equipment?	☐	☐	
ARCADIS BBL Excavation Competent Person:			**Date/Time:**

ARCADIS BBL

Appendix H

Material Safety Data Sheets

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Polychlorinated Biphenyls (PCBs)
POL2140

Issue Date: 2002-02

Section 1 - Chemical Product and Company Identification 54

Material Name: Polychlorinated Biphenyls (PCBs) **CAS Number:** 1336-36-3
Chemical Formula: Unspecified or Variable
Structural Chemical Formula: $(C_{12}H_{10-x})Cl_x$
Synonyms: AROCLOR; AROCLOR 1221; AROCLOR 1232; AROCLOR 1242; AROCLOR 1248; AROCLOR 1254; AROCLOR 1260; AROCLOR 1262; AROCLOR 1268; AROCLOR 2565; AROCLOR 4465; AROCLOR 5442; 1,1'-BIPHENYL,CHLORO DERIVS; BIPHENYL,POLYCHLORO-; CHLOPHEN; CHLOREXTOL; CHLORINATED BIPHENYL; CHLORINATED DIPHENYL; CHLORINATED DIPHENYLENE; CHLORO 1,1-BIPHENYL; CHLORO 1,1-BIPHENYL-; CHLORO BIPHENYL; CLOPHEN; CLOPHEN A 60; DYKANOL; EPA PESTICIDE CHEMICAL CODE 017801; FENCLOR; FENCLOR 42; INERTEEN; KANECHLOR; KANECHLOR 300; KANECHLOR 400; MONTAR; MONTER; NOFLAMOL; PCB; PCBS; PHENOCHLOR; PHENOCLOR; POLYCHLORINATED BIPHENYL; POLYCHLORINATED BIPHENYLS; POLYCHLORINATED BIPHENYLS (PCB'S); POLYCHLOROBIPHENYL; PYRALENE; PYRANOL; SANTOTHERM; SANTOTHERM FR; SOVOL; THERMINOL; THERMINOL FR-1
General Use: Used as dielectric fluids in transformers and capacitors. Prior to 1972, were used as hydraulic and other industrial fluids (e.g., in vacuum pumps, as lubricants and cutting oils), in paints, inks and fire retardants.
Also used in heat transfer systems; gas-transmission turbines; carbonless reproducing paper; adhesives; as plasticizer in epoxy paints; fluorescent light ballasts; wax extenders; coolants; dedusting agents; pesticide extenders; surface treatment and coatings; sealants; caulking material.
This is one of a group of once widely used industrial chemicals whose high stability contributed both to their commercial usefulness and the long term deleterious environmental health effects. Consequently their use has been phased out. Their manufacture in the U.S.A. was discontinued in 1977.

Section 2 - Composition / Information on Ingredients

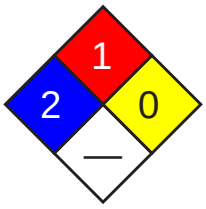
Name	CAS	%
polychlorinated biphenyls (PCB's)	1336-36-3	100

OSHA PEL
No data found.

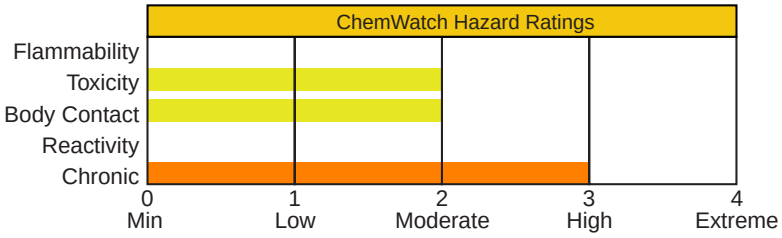
NIOSH REL
No data found.

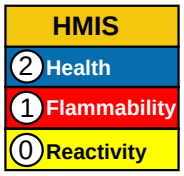
ACGIH TLV
No data found.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Oily liquid, white crystalline solid, or hard resin. Severely irritating. Suspect cancer hazard. Chronic: chloracne, GI disturbances, neurological symptoms, liver enlargement, menstrual changes, bronchitis. Possible reproductive and teratogenic effects.

Potential Health Effects

Target Organs: skin, liver, eyes, mucous membranes, respiratory system
Primary Entry Routes: inhalation, skin contact, ingestion

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Acute Effects

Inhalation: Not normally a hazard due to nonvolatile nature of product. Inhalation of vapor is more likely at higher than normal temperatures.

The vapor/mist is discomforting and may be extremely toxic if inhaled.

Eye: The vapor/liquid is moderately discomforting and may be harmful to the eyes.

Skin: The liquid is harmful to the skin, it is rapidly absorbed and is capable of causing skin reactions.

Exposure to material may result in a dermatitis, described as chloracne, a persistent acneiform characterized by comedones (white-, and black- heads), keratin cysts, and inflammed papules with hyperpigmentation and an anatomical distribution frequently involving the skin under the eyes and behind the ears. It occurs after acute or chronic exposure to a variety of chlorinated aromatic compounds by skin contact, ingestion or inhalation and may appear within days and months following the first exposure. Other dermatological alterations including hypertrichosis (the growth of excess hair), an increased incidence of actinic or solar elastosis (the degeneration of elastic tissue within muscles or loss of dermal elasticity produced by the effects of sunlight), and Peyrone's disease (a rare progressive scarring of the penile membrane).

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Digestion may lead to nausea, vomiting, abdominal pain, anorexia, jaundice and liver damage, coma and death.

Headache, dizziness, lethargy, depression, nervousness, loss of libido, muscle, joint pains may be found.

Symptoms appear after a latent period of 5 to 6 months.

PCB's may appear in breast milk of exposed mothers and in newborn infants.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: People occupationally exposed to PCB's have relatively high PCB residue levels in blood plasma. Symptoms include chloracne dermatitis and degreasing the skin, pigmentation of skin and nails, excessive eye discharge, swelling of eyelids, transient visual disturbances, distinctive hair follicles, edema of the face and hands.

In common with other polyhalogenated aromatic hydrocarbons, the chlorinated biphenyls exhibit dioxin-like behavior. Polyhalogenated aromatic hydrocarbons (PHAHs) comprise two major groups.

The first group represented by the halogenated derivatives of dibenzodioxins (the chlorinated form is PCDD), dibenzofurans (PCDF) and biphenyls (PCB) exert their toxic effect (as hepatoxicants, reproductive toxicants, immunotoxicants and procarcinogens) by interaction with a cytostolic protein known as the Ah receptor. In guinea pigs the Ah receptor is active in a mechanism which "pumps" PHAH into the cell whilst in humans the reverse appears to true. This, in part, may account for species differences often cited in the literature. This receptor exhibits an affinity for the planar members of this group and carries these to the cellular nucleus where they bind, reversibly, to specific genomes on DNA.

This results in the regulation of the production of certain proteins which elicit the toxic response. The potency of the effect is dependent on the strength of the original interaction with the Ah receptor and is influenced by the degree of substitution by the halogen and the position of such substitutions on the parent compound.

The most potent molecule is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) while the coplanar PCBs (including mono-ortho coplanars) possess approximately 1% of this potency. Nevertheless, all are said to exhibit "dioxin-like" behavior and in environmental and health assessments it has been the practice to assign each a TCDD-equivalence value.

The most subtle and important biological effects of the PHAHs are the effects on endocrine hormones and vitamin homeostasis. TCDD mimics the effect of thyroxin (a key metamorphosis signal during maturation) and may disrupt patterns of embryonic development at critical stages. Individuals from exposed wildlife populations have been observed to have altered sexual development, sexual dysfunction as adults and immune system suppression.

Immunotoxic effects of the PHAHs (including the brominated congener, PBB) have been the subject of several studies. No clear pattern emerges in human studies however with T-cell numbers and function (a blood marker for immunological response) increasing in some and decreasing in others.

Three incidences have occurred which have introduced abnormally high levels of dioxin or dioxin-like congeners to humans. The explosion at a trichlorophenol-manufacturing plant in Seveso, Italy distributed TCDD across a large area of the country-side, whilst rice-oil contaminated with heat-transfer PCBs (and dioxin-like contaminants) has been consumed by two groups, on separate occasions (one in Yusho, Japan and another in Yu-cheng, Taiwan). The only symptom which can unequivocally be related to all these exposures is the development of chloracne, a disfiguring skin condition, following each incident. Contaminated oil poisonings also produced eye-discharge, swelling of eyelids and visual disturbances. The Babies born up to 3 years after maternal exposure (so-called "Yusho-babies") were characteristically brown skinned, colored gums and nails and (frequently) produced eye-discharges. Delays in intellectual development have been noted. It has been estimated that Yu-cheng patients consumed an average level of 0.06 mg/kg body weight/day total PCB and 0.0002 mg/kg/day of PCDF before the onset of symptoms after 3 months. When the oil was withdrawn after 6 months they had consumed 1 gm total PCB containing 3.8 mg PCDF.

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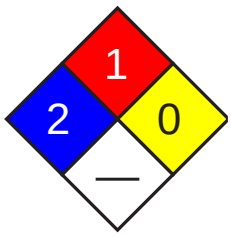
Preliminary data from the Yusho cohort suggests a six-fold excess of liver cancer mortality in males and a three-fold excess in women.
Recent findings from Seveso indicate that the biological effects of low level exposure (BELLEs), experienced by a cohort located at a great distance from the plant, may be hormetic, i.e. may be protective AGAINST the development of cancer.
TCDD induces carcinogenic effects in the laboratory in all species, strains and sexes tested. These effects are dose-related and occur in many organs.
Exposures as low as 0.001 ug/kg body weight/day produce carcinoma.
Several studies implicate PCBs in the development of liver cancer in workers as well as multi-site cancers in animals.
The second major group of PHAH consists of the non-planar PCB congeners which possess two or more ortho-substituted halogens. These have been shown to produce neurotoxic effects which are thought to reduce the concentration of the brain neurotransmitter, dopamine, by inhibiting certain enzyme-mediated processes.
The specific effect elicited by both classes of PHAH seems to depend on the as much on the developmental status of the organism at the time of the exposure as on the level of exposure over a lifetime.

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: Contact a Poison Control Center. DO NOT induce vomiting. Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink. Transport to hospital or doctor without delay.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Treat symptomatically. If large amounts are ingested, gastric lavage is suggested. For splash in the eyes, a petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.
If electrical equipment arcs over, PCB dielectric fluids may decompose to produce hydrogen chloride (HCl), a respiratory irritant. [Monsanto] Preplacement and annual medical examinations of workers, with emphasis on liver function, skin condition, reproductive history, is recommended.

Section 5 - Fire-Fighting Measures

Flash Point: > 141 °C
Autoignition Temperature: 240 °C
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Foam.Alcohol stable foam.
Dry chemical powder.
General Fire Hazards/Hazardous Combustion Products: Noncombustible liquid.
POLLUTANT -contain spillage.
Decomposes on heating and produces acrid black soot and toxic fumes of aldehydes, hydrogen chloride (HCl), chlorides and extremely toxic polychlorinated dibenzofuran (PCDF), polychlorinated dibenzodioxin (PCDD).



Fire Diamond

Fire Incompatibility: Reacts vigorously with chlorine (Cl_2).
Fire-Fighting Instructions: POLLUTANT -contain spillage. Noncombustible.
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.
Use fire fighting procedures suitable for surrounding area.
Cool fire-exposed containers with water spray from a protected location.
Avoid spraying water onto liquid pools.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

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Section 6 - Accidental Release Measures

Small Spills: POLLUTANT -contain spillage. Clean up all spills immediately.
Environmental hazard - contain spillage.
Avoid breathing vapors and contact with skin and eyes.
Wear protective clothing, impervious gloves and safety glasses.
Contain spill with sand, earth or vermiculite.
Wipe up and absorb small quantities with vermiculite or other absorbent material.
Place spilled material in clean, dry, sealable, labeled container.
Large Spills: POLLUTANT -contain spillage. Clear area of personnel.
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.
Stop leak if safe to do so.
Contain spill with sand, earth or vermiculite.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect residues and seal in labeled drums for disposal.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
If equipment is grossly contaminated, decontaminate and destroy.
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: Do not allow clothing wet with material to stay in contact with skin 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.
Avoid all personal contact, including inhalation.
Wear protective clothing and gloves when handling containers.
Avoid physical damage to containers.
Use in a well-ventilated area and Use only in completely enclosed system.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Wash hands with soap and water after handling.
Work clothes should be laundered separately: NOT at home.
Recommended Storage Methods: Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Metal can or metal drum or Steel drum with plastic liner.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Provide adequate ventilation in warehouse or closed storage areas.
If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
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: Impervious gloves or Viton gloves or Polyethylene gloves or PVC gloves.
Protective footwear.

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Other: Impervious protective clothing. Overalls. Impervious apron.
Eyewash unit.
Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to yellow-green, mobile oily to viscous liquid, or sticky to hard resin, or white crystalline solid, depending on degree of chlorination. Slightly soluble in glycerol and glycols. Soluble in organic solvents and lipids. Viscosity range: 71 - 2500 Saybolt unit sec. at 38 °C. PCBs are resistant to chemical and biological degradation and because of their solubility in fats and oils they tend to be concentrated in living organisms. The highly chlorinated PCBs are retained in animal's bodies longer and seems to delay the excretion of the lower chlorinated PCB's. They have become widely dispersed in the world-wide environment and in the food-chain since their introduction in 1929. They are now recognized internationally to be a major environmental pollutant, their persistence causing ecological damage via water pollution. Consequently loss of PCBs to the environment is to be avoided at all costs.

Physical State: Liquid
Vapor Pressure (kPa): Negligible
Formula Weight: 188.66 - 395
Specific Gravity (H_2O=1, at 4 °C): 1.18 - 1.8
Water Solubility: Solubility in water extremely low
Evaporation Rate: Non Vol. at 38 °C

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 340 °C (644 °F) to 375 °C (707 °F)
Decomposition Temperature (°C): 375-550

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. Segregate from chlorine.
Avoid contamination of water, foodstuffs, feed or seed.

Section 11 - Toxicological Information

TOXICITY
Oral (human) LD_{Lo}: 500 mg/kg
Oral (rat) LD_{50}: 3980 mg/kg

IRRITATION
Nil reported

See NIOSH, *RTECS* TQ1350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: PCBs are mixtures of different congeners of chlorobiphenyl and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination. In general, the persistence of PCBs increases with an increase in the degree of chlorination. Mono-, di- and trichlorinated biphenyls (Aroclor 1221 and 1232) biodegrade relatively rapidly, tetrachlorinated biphenyls (Aroclors 1016 and 1242) biodegrade slowly, and higher chlorinated biphenyls (Aroclors 1248, 1254, and 1260) are resistant to biodegradation. Although biodegradation of higher chlorinated congeners may occur very slowly on an environmental basis, no other degradation mechanisms have been shown to be important in natural water and soil systems; therefore, biodegradation may be the ultimate degradation process in water and soil.

If released to soil, PCBs experience tight adsorption with adsorption generally increasing with the degree of chlorination. PCBs will generally not leach significantly in aqueous soil systems; the higher chlorinated congeners will have a lower tendency to leach than the lower chlorinated congeners. In the presence of organic solvents PCBs may leach quite rapidly through soil. Vapor loss from soil surfaces appears to be an important fate mechanism with the rate of volatilization decreasing with increasing chlorination. Although the volatilization rate may be low, the total loss by volatilization over time may be significant because of persistence and stability. Enrichment of the low Cl PCBs occurs in the vapor phase relative to the original Aroclor; the residue will be enriched in the PCBs containing high Cl content.

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If released to water, adsorption to sediment and suspended matter will be an important fate process; PCB concentrations in sediment and suspended matter have been shown to be greater than in the associated water column. Although adsorption can immobilize PCBs (especially the higher chlorinated congeners) for relatively long periods of time, eventual resolution into the water column has been shown to occur. The PCB composition in the water will be enriched in the lower chlorinated PCBs because of their greater water solubility, and the least water soluble PCBs (highest Cl content) will remain adsorbed. In the absence of adsorption, PCBs volatilize relatively rapidly from water. However, strong PCB adsorption to sediment significantly competes with volatilization, with the higher chlorinated PCBs having longer half-lives than the lower chlorinated PCBs. Although the resulting volatilization rate may be low, the total loss by volatilization over time may be significant because of persistence and stability. PCBs have been shown to bioconcentrate significantly in aquatic organisms. If released to the atmosphere, PCBs will primarily exist in the vapor-phase; the tendency to become associated with the particulate-phase will increase as the degree of chlorination of the PCB increases. The dominant atmospheric transformation process is probably the vapor-phase reaction with hydroxyl radicals which has estimated half-lives ranging from 12.9 days for monochlorobiphenyl to 1.31 years for heptachlorobiphenyl. Physical removal from the atmosphere, which is very important environmentally, is accomplished by wet and dry deposition.

Ecotoxicity: Aquatic toxicity: 0.278 ppm/96 hr/bluegill/TLm/fresh water 0.005 ppm/336-1080 hr/pinfish/TLm/salt water; Waterfowl toxicity: LD_{50} 2000 ppm (mallard duck); Food chain concentration potential: High

Henry's Law Constant: 5×10^{-5}

BCF: bioconcentrate in tissue

Biochemical Oxygen Demand (BOD): very low

Soil Sorption Partition Coefficient: K_{oc} = 510 to 1.33×10^{4}

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Due to their environmental persistence and potential health hazards, PCBs cannot be disposed of in landfills or dumped at sea. The only environmentally acceptable method for the disposal of PCBs is by high temperature incineration.

All wastes and residues containing PCB's (e.g., wiping cloths, absorbent material, used disposable protective gloves, contaminated clothing, etc.) should be collected, placed in proper containers, labelled and disposed of in accordance with applicable regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: POLYCHLORINATED BIPHENYLS

Additional Shipping Information: PCB'S

Hazard Class: 9

ID No.: 2315

Packing Group: II

Label: Miscellaneous Dangerous Goods[9]

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1 lb (0.454 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Unleaded Petrol **CAS Number:** 8006-61-9
Chemical Formula: Mixture of hydrocarbons
EINECS Number: 232-349-1
ACX Number: X1003056-5
Synonyms: AUTOMOTIVE GASOLINE, LEAD-FREE; GASOLINE; MOTOR FUEL; MOTOR SPIRITS; NATURAL GASOLINE; PETROL; UNLEADED PETROL
General Use: Lead free motor fuel for internal combustion engines, 2-stroke and 4-stroke.

Section 2 - Composition / Information on Ingredients

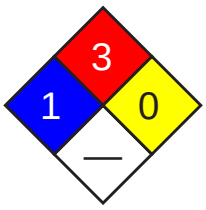
Name	CAS	%
gasoline	8006-61-9	>90
benzene	71-43-2	5 max.

OSHA PEL **NIOSH REL**

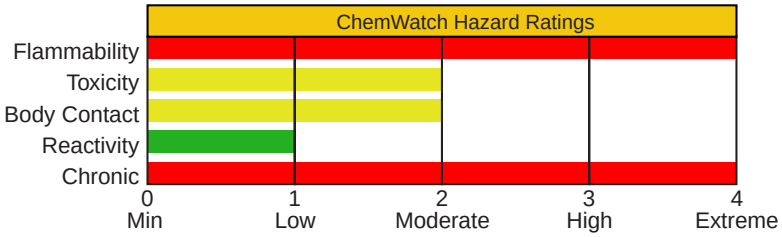
OSHA PEL Vacated 1989 Limits
TWA: 300 ppm; 900 mg/m^3;
STEL: 500 ppm; 1500 mg/m^3.

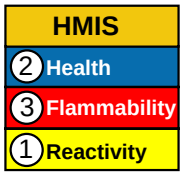
ACGIH TLV
TWA: 300 ppm, 890 mg/m^3;
STEL: 500 ppm, 1480 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear liquid; distinctive odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, drunkenness, unconsciousness. Chronic Effects: dermatitis. Possible cancer hazard. Flammable.

Potential Health Effects

Target Organs: skin, eye, respiratory system, central nervous system (CNS)
Primary Entry Routes: inhalation, ingestion, skin contact

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Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if exposure is prolonged. Inhalation hazard is increased at higher temperatures. Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. WARNING: Intentional misuse by concentrating/inhaling contents may be lethal. High inhaled concentrations of mixed hydrocarbons may produce narcosis characterized by nausea, vomiting and lightheadedness. Inhalation of aerosols may produce severe pulmonary edema, pneumonitis and pulmonary hemorrhage. Inhalation of petroleum hydrocarbons consisting substantially of low molecular weight species may produce irritation of mucous membranes, incoordination, giddiness, nausea, vertigo, confusion, headache, appetite loss, drowziness, tremors and anesthetic stupor. Massive exposures may produce central nervous system depression with sudden collapse and deep coma; fatalities have been recorded. Irritation of the brain and/or apneic anoxia may produce convulsions. Although recovery following overexposure is generally complete, cerebral micro- hemorrhage of focal post-inflammatory scarring may produce eleptiform seizures some months after the exposure. Pulmonary episodes may include chemical pneumonitis with edema and hemorrhage. The lighter hydrocarbons may produce kidney and neurotoxic effects. Liquid paraffins may produce anesthesia and depressant actions leading to weakness, dizziness, slow and shallow respiration, unconsciousness, convulsions and death. C_{5-7} paraffins may also produce polyneuropathy. Aromatic hydrocarbons accumulate in lipid-rich tissues (typically the brain, spinal cord and peripheral nerves) and may produce functional impairment manifested by nonspecific symptoms such as nausea, weakness, fatigue, vertigo; severe exposures may produce inebriation or unconsciousness. Many of the petroleum hydrocarbons are cardiac sensitizers and may cause ventricular fibrillations.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The vapor is discomforting to the eyes. Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient, disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The material is moderately discomforting to the skin if exposure is prolonged. The material contains a component that may be absorbed through the skin and may cause drying of the skin, which may lead to dermatitis from repeated exposures over long periods. Toxic effects may result from skin absorption. Open cuts, abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing dermatitis condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis. Ingestion of petroleum hydrocarbons may produce irritation of the pharynx, esophagus, stomach and small intestine with edema and mucosal ulceration. Resulting symptoms include a burning sensation in the mouth and throat. Large amounts may produce narcosis with nausea and vomiting, weakness or dizziness, slow and shallow respiration, swelling of the abdomen, unconsciousness and convulsions. Myocardial injury may produce arrhythmias, ventricular fibrillation and electrocardiographic changes. Central nervous system depression may also occur. Light aromatic hydrocarbons produce a warm, sharp, tingling sensation on contact with taste buds and may anesthetize the tongue. Aspiration into the lungs may produce coughing, gagging, and a chemical pneumonitis with pulmonary edema and hemorrhage.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following. Chronic poisoning may occur from vapor inhalation or skin absorption. The most significant toxic effect is insidious and irreversible injury to the blood-forming tissue by benzene. Leukemia may develop. Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes. Gasoline "sniffing" has caused severe nerve damage. Repeated or prolonged exposure to mixed hydrocarbons may produce narcosis with dizziness, weakness, irritability, concentration and/or memory loss, tremor in the fingers and tongue, vertigo, olfactory disorders, constriction of visual field, paresthesias of the extremities, weight loss and anemia and degenerative changes in the liver and kidney. Chronic exposure by petroleum workers to the lighter hydrocarbons has been associated with visual disturbances, damage to the central nervous system, peripheral neuropathies (including numbness and paresthesias), psychological and neurophysiological deficits, bone marrow toxicities (including hypoplasia, possibly due to benzene) and hepatic and renal involvement. Chronic dermal exposure to petroleum hydrocarbons may result in defatting which produces localized dermatoses. Surface cracking and erosion may also increase susceptibility to infection by microorganisms.

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Section 4 - First Aid Measures

See DOT ERG

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 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: 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: 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 petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

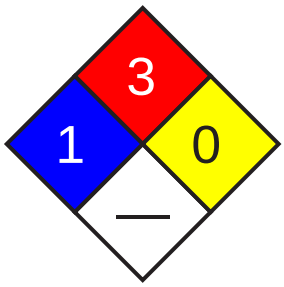
Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: -43 °C
Autoignition Temperature: 280 °C
LEL: 1.4% v/v
UEL: 7.6% v/v

Extinguishing Media: Foam. Dry chemical powder.
Bromochlorodifluoromethane (BCF) (where regulations permit). Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidizers. Vapor forms an explosive mixture with air. Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition. Heating may cause expansion/decomposition with violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO).



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents, i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc., as ignition may result.

Fire-Fighting Instructions: Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. If safe, switch off electrical equipment until vapour fire hazard removed. 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.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapors and contact with skin and eyes. Control personal contact by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind. Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite. Use only

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spark-free shovels and explosion proof equipment. Collect recoverable product into labeled containers for recycling. Absorb remaining product with sand, earth or vermiculite. Collect solid residues and seal in labelled drums for disposal. Wash area and prevent runoff into drains.
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 mist. Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs. Use in a well-ventilated area. Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked. Avoid smoking, bare lights, heat or ignition sources. When handling, DO NOT eat, drink or smoke. Vapor may ignite on pumping or pouring due to static electricity. DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling. Avoid contact with incompatible materials. Keep containers securely sealed. Avoid physical damage to containers. 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.

Recommended Storage Methods: Metal can, metal drum. Packing as recommended by manufacturer. Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. If inhalation risk of overexposure exists, wear a NIOSH approved organic-vapor respirator. Correct respirator fit is essential to obtain adequate protection. In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas.

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 with polyethylene gloves or PVC gloves. Safety footwear. Do NOT use this product to clean the skin.

Respiratory Protection:

Exposure Range >300 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >1000 to 15,000 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >15,000 to 300,000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >300,000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Ensure that there is ready access to eye wash unit. Ensure there is ready access to an emergency shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Purple, highly flammable, volatile liquid with characteristic sharp odor. Floats on water. Consists of a complex mixture of hydrocarbons with small amounts of residual benzene from the refining operations.

Physical State: Liquid
Vapor Pressure (kPa): 53.33 at 20 °C
Vapor Density (Air=1): > 2
Formula Weight: Not applicable.
Specific Gravity (H_2O=1, at 4 °C): 0.72-0.735 at 15 °C
Evaporation Rate: Fast
pH: Not applicable

pH (1% Solution): Not applicable.
Boiling Point: 38.89 °C (102 °F)
Freezing/Melting Point: Not available
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not available.
Water Solubility: Insoluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of incompatible materials. 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}: 18800 mg/kg

Irritation
Skin (rabbit): 500 mg/24h mild

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
Biochemical Oxygen Demand (BOD): 8%, 5 days

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible. Follow all applicable federal, state, and local laws. Incinerate residue at an approved site. Recycle containers where possible, or dispose of in an authorized landfil.
BEWARE: Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned, the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Gasoline
ID: UN1203
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: 139, B33, B101, T8
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** E **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

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.

OSHA PEL Vacated 1989 Limits
TWA: 2 ppm; 5 mg/m^3; STEL: 4 ppm; 10 mg/m^3.

ACGIH TLV
TWA: 2 ppm; STEL: 4 ppm.

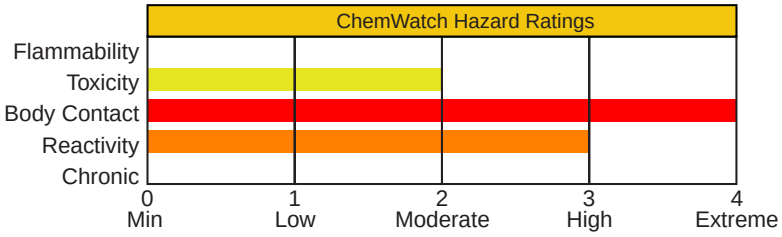
NIOSH REL
TWA: 2 ppm, 5 mg/m^3; STEL: 4 ppm, 10 mg/m^3.

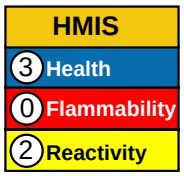
IDLH Level
25 ppm.

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.

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Reactions may occur following a single acute exposure or may only appear after repeated exposures.
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

See DOT ERG

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.

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Immediately transport to hospital or doctor. DO NOT delay.

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.

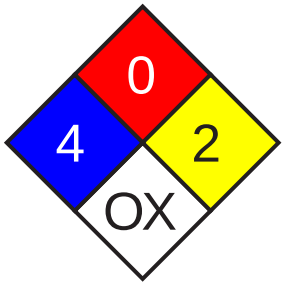
EYE:

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

See DOT ERG

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.

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
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

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Special hazards may exist - specialist advice may be required.

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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

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Xylene **CAS Number:** 1330-20-7
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
EINECS Number: 215-535-7
ACX Number: X1001166-8
Synonyms: BENZENE,DIMETHYL-; COMPONENT 1 (83%): XYLENES; COMPONENT 2 (17%): ETHYL BENZENE; DIMETHYLBENZENE; DIMETHYLBENZENES; EPA PESTICIDE CHEMICAL CODE 086802; KSYLEN; METHYL TOLUENE; METHYLTOLUENE; VIOLET 3; XILOLI; XYLENE; XYLENEN; XYLOL; XYLOLE
General Use: A strong solvent for general use in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
xylene	1330-20-7	> 95

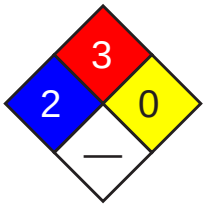
OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

NIOSH REL
TWA: 100 ppm, 435 mg/m^3; STEL: 150 ppm, 655 mg/m^3.

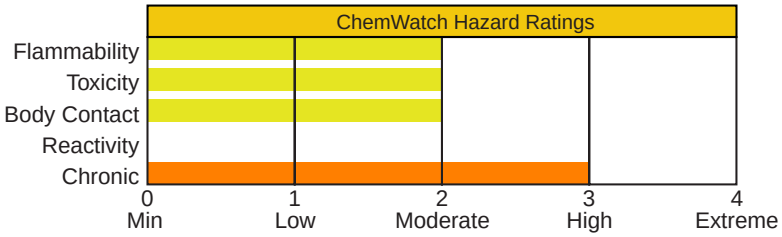
DFG (Germany) MAK
TWA: 100 ppm; PEAK: 200 ppm; skin.

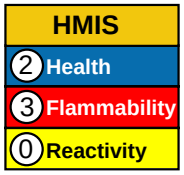
ACGIH TLV
TWA: 100 ppm; STEL: 150 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, nausea, drowsiness. Chronic Effects: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects (animal data). Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Acute Effects
Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

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Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is 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.

The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

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.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Small excess risks of spontaneous abortion and congenital malformation was reported amongst women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances.

Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

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.

See DOT ERG

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: 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: For acute or short-term repeated exposures to xylene:

1.Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended. The use of charcoal and cathartics is equivocal.

2.Pulmonary absorption is rapid with about 60-65% retained at rest.

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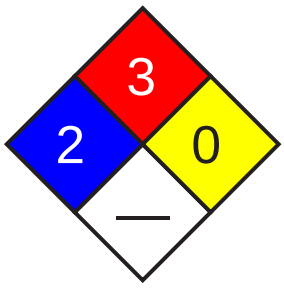
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures

Flash Point: 25.6 °C
Autoignition Temperature: 241 °C
LEL: 1.0% v/v
UEL: 7.0% v/v
Extinguishing Media: Alcohol stable foam; dry chemical powder; carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
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.

See DOT ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: 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 breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.

See DOT ERG

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Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
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 all personal contact, including inhalation.
Wear protective clothing when risk of overexposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
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.
Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Plastic containers may only be used if approved for flammable liquids.

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.
CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

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 with polyethylene gloves; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.

Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.

Glove Selection Index:

PE/EVAL/PE ..... Best selection
PVA ..... Best selection
VITON ..... Best selection
TEFLON ..... Best selection
PVDC/PE/PVDC ..... Poor to dangerous choice for other than short-term immersion
NATURAL+NEOPRENE..... Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL..... Poor to dangerous choice for other than short-term immersion
NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
HYPALON ..... Poor to dangerous choice for other than short-term immersion
NAT+NEOPR+NITRILE ..... Poor to dangerous choice for other than short-term immersion
BUTYL ..... Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE ..... Poor to dangerous choice for other than short-term immersion
NITRILE ..... Poor to dangerous choice for other than short-term immersion
NEOPRENE..... Poor to dangerous choice for other than short-term immersion
PVC..... Poor to dangerous choice for other than short-term immersion

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Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear colorless flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Evaporation Rate: 0.7 Bu Ac=1

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 137 °C (279 °F) to 140 °C (284 °F)
Freezing/Melting Point: -47 °C (-53 °F)
Volatile Component (% Vol): 100
Water Solubility: Practically insoluble in 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.

Section 11 - Toxicological Information

Toxicity
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 4300 mg/kg
Inhalation (human) TC_{Lo}: 200 ppm
Inhalation (man) LC_{Lo}: 10000 ppm/6h
Inhalation (rat) LC_{50}: 5000 ppm/4h
Reproductive effector in rats

Irritation
Skin (rabbit):500 mg/24h moderate
Eye (human): 200 ppm irritant
Eye (rabbit): 87 mg mild
Eye (rabbit): 5 mg/24h SEVERE

See *RTECS* ZE 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most of the xylenes are released into the atmosphere where they may photochemically degrade by reaction with hydroxyl radicals (half-life 1-18 hr). The dominant removal process in water is volatilization. Xylenes are moderately mobile in soil and may leach into groundwater where they are known to persist for several years, despite some evidence that they biodegrade in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD_{50} Goldfish 13 mg/l/24 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.22
BCF: estimated at 2.14 to 2.20
Octanol/Water Partition Coefficient: log K_{ow} = 3.12 to 3.20
Soil Sorption Partition Coefficient: K_{oc} = 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

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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: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: B1, IB3, T2, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U239 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 51/60

Material Name: Chrysene **CAS Number:** 218-01-9
Chemical Formula: $C_{18}H_{12}$
EINECS Number: 205-923-4
ACX Number: X1001743-5
Synonyms: BENZO (A) PHENANTHRENE; BENZO[A|PHENANTHRENE; 1,2-BENZOPHENANTHRENE; BENZO(A)PHENANTHRENE; 1,2-BENZPHENANTHRENE; BENZ(A)PHENANTHRENE; CHRYSENE; COAL TAR PITCH VOLATILES: CHRYSENE; 1,2,5,6-DIBENZONAPHTHALENE
Derivation: Distilled from coal tar, coal tar pitch. A small amount is produced from the distillation or pyrolysis of many fats and oils. By heating hydrogen and acetylene. Chrysene is not produced commercially in the U.S. (except as a laboratory research chemical).
General Use: Used in organic synthesis; as a research chemical. Occurs in cigarette smoke.

Section 2 - Composition / Information on Ingredients

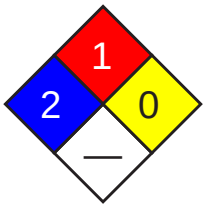
Name	CAS	%
No data found.		

OSHA PEL
TWA: 0.2 mg/m^3.

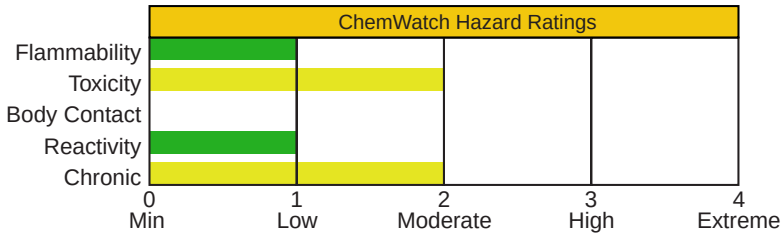
NIOSH REL

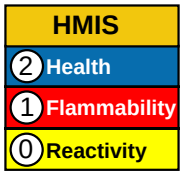
ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless to white crystals with reddish-blue fluorescence. May be irritating to eyes/skin/respiratory tract. Also causes: may be absorbed through skin. May be cancer-causing in humans. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory system
Primary Entry Routes: Skin absorption
Acute Effects *There is no human evidence available for the acute health effects of chrysene alone. There is, however, considerable data indicating that it is carcinogenic in humans. Based on the chemical properties of chrysene, as a polynuclear aromatic hydrocarbon, the following acute effects may occur.*
Inhalation: May cause irritation.
Eye: . May cause irritation.
Skin: May cause irritation or be absorbed.
Ingestion: None reported.
Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.
Medical Conditions Aggravated by Long-Term Exposure: None reported.

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Chronic Effects: Animal data indicate that chronic exposure to chrysene and other coal tar pitch volatiles probably causes cancer. May also cause respiratory, skin, or eye irritation; cough, bronchitis, photosensitivity, "coal tar warts" (precancerous lesions enhanced by UV light exposure), erythema (skin inflammation), dermal burns, acneiform lesions, hematuria (blood in urine). May alter genetic material. Exposure to PAH's is believed to cause leukoplakia (precancerous patches on the tongue), lip and oral cavity cancers, and bladder cancer.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

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

Note to Physicians: For high exposures, medical surveillance (skin, mouth, GI tract, respiratory system) may be necessary.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: Combustible solid

Autoignition Temperature: None reported.

LEL: None reported.

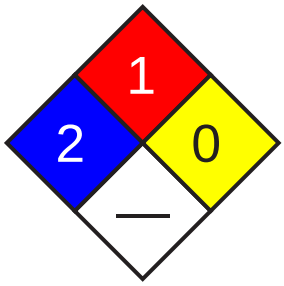
UEL: None reported.

Flammability Classification: Combustible solid

Extinguishing Media: Use water spray, carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Acrid smoke and fumes, including carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Tag container as defective and return to supplier. Use spark-proof tools and explosion-proof equipment.

Small Spills: *Do not* sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: Large spills of chrysene are unlikely. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid dust inhalation and skin and eye contact. Use only with adequate ventilation to maintain concentrations at nonhazardous levels (see Sec. 2). Wear personal protective clothing and equipment to prevent contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Ventilate at the site of chemical release. To prevent static sparks, electrically ground and bond all containers and equipment. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (see Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

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Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the skin and lungs.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Air purifying respirators may be adequate for handling small amounts of chrysene in a laboratory setting. For unlimited exposure ranges, wear a pressure-demand, full-face SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder clothing separately before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless to white rhombic plates with reddish-blue fluorescence.

Physical State: Solid

Vapor Pressure (kPa): 6.3 x10^{-7} mm Hg; 6.3 x10^{-9} mm Hg at 68 °F (20 °C)

Formula Weight: 228.28

Specific Gravity (H_2O=1, at 4 °C): 1.274 at 20 °C/4 °C

Refractive Index: 2610

Boiling Point: 838 °F (448 °C); sublimes easily in a vacuum

Freezing/Melting Point: 489 °F (254 °C) to 496 °F (258 °C)

Ionization Potential (eV): 7.59 +/- 0.2 eV

Water Solubility: Insoluble (0.0018 mg/kg)

Other Solubilities: Slightly soluble in 95% ethanol, acetone, carbon disulfide, ether, glacial acetic acid. Soluble in hot benzene, toluene.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Chrysene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat and ignition sources.

Storage Incompatibilities: Include strong oxidizers.

Hazardous Decomposition Products: Thermal oxidative decomposition of chrysene can produce acrid smoke and fumes, including carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Skin Effects:

Mouse, skin: 192 µmol/kg produced DNA adducts.

Mouse, skin, TD_{Lo}: 3600 µg/kg.

Other Effects:

Tumorgenicity, mouse, skin: 23 mg/kg; toxic effects: tumorigenic - neoplastic by RTECS criteria; skin and appendages - tumors.

Human, lymphocyte: 6 µmol/L produced mutation.

Mouse, intraperitoneal, LD_{50}: >320 mg/kg.

Tumorigenic Effects: Mouse, skin, 3600 mg/kg for 30 weeks, intermittent; toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors.

Hamster, intraperitoneal: 900 mg/24 hr induced sister chromatid exchange.

Bacteria, *S typhimurium*: 5 mg/plate (-S9) produced mutation.

See *RTECS* GC0700000, for additional data.

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Section 12 - Ecological Information

Environmental Fate: If released to water, it will adsorb very strongly to sediments and particulate matter, but will not hydrolyze or appreciably evaporate. It will bioconcentrate in species which lack microsomal oxidase. Calculated BCF: 4,230. K_{ow} indicates bioaccumulation, which could cause food-chain contamination. It will not hydrolyze or appreciably evaporate from soils or surfaces. The estimated biodegradation half-life in soil is 7 years. The estimated half-life of any gas phase in the atmosphere is 1.25 hours as a result of reaction with photochemically produced hydroxyl radicals. It will be subject to near-surface, direct photolysis with a half-life of 4.4 hours computed for exposure to sunlight at mid-day in midsummer at latitude 40°N. If released to air, it will be subject to direct photolysis, although adsorption to particulates may affect the rate of this process. If released to soil it will be expected to adsorb very strongly to the soil and will not be expected to leach appreciably to groundwater.

Ecotoxicity: *Anabaena flos-aquae* (algae), 2 weeks, EC_{35} growth: +/- 0.002 mg/L. *Daphnia magna* (crustaceans), 2 hr, LC_{50}: 1.9 mg/L. *Rana pipiens* (amphibians), 24 hr, LC_{50}: >6.7 mg/L. *Neanthes arenaceodentata* (fishes), 96 hr, LC_{50}: >1 mg/L.

Henry's Law Constant: 9.4×10^{-8}

Octanol/Water Partition Coefficient: log K_{ow} = 5.61 to 5.91

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. One method is to dissolve or mix the material with a combustible solvent and burn in an incinerator equipped with an afterburner and scrubber. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.
ID: UN3077
Hazard Class: 9 - Miscellaneous hazardous material
Packing Group: III - Minor Danger
Symbols: G - Technical Name Required
Label Codes: 9 - Class 9
Special Provisions: 8, 146, B54, IB8, N20
Packaging: **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U050 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Pyrene **CAS Number:** 129-00-0
Chemical Formula: $C_{16}H_{10}$
EINECS Number: 204-927-3
ACX Number: X1001901-7
Synonyms: BENZO(DEF)PHENANTHRENE; BENZO(D,E,F)PHENANTHRENE; COAL TAR PITCH VOLATILES:PYRENE; PYREN; BETA-PYRENE; PYRENE; PYRENE
General Use: Laboratory reference standard.
Occurs in coal tar or in destructive hydrogenation of hard coals.

Section 2 - Composition / Information on Ingredients

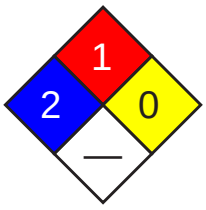
Name	CAS	%
pyrene	129-00-0	>98

OSHA PEL
TWA: 0.2 mg/m^3; as particulate polycyclical aromatic hydrocarbon.

NIOSH REL
TWA: 0.1 mg/m^3, cyclohexane-extractable fraction; as particulate polycyclic aromatic hydrocarbon.

ACGIH TLV

Section 3 - Hazards Identification



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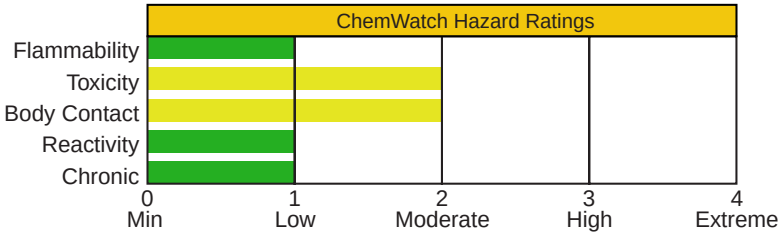

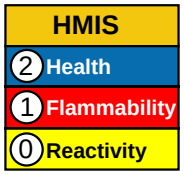

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless solid. Irritating to eyes/skin/respiratory tract. Also causes: conjunctival irritation, dermal irritation, ingestion may irritate and burn esophagus/gastrointestinal tract.

Potential Health Effects

Target Organs: skin, eyes, respiratory system
Primary Entry Routes: inhalation, ingestion, skin contact
Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract and may be fatal if inhaled.
Persons with impaired respiratory function, airway diseases, and conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.
Animal inhalation studies have demonstrated hepatic, pulmonary and intragastric pathologic changes. The levels of neutrophil, leukocyte and erythrocytes decreased.

Eye: The dust may be 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.

Skin: The material may be mildly discomforting to the skin.
Open cuts, abraded or irritated skin should not be exposed to this material.
Toxic effects may result from skin absorption.

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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 application resulted in hyperemia (blood engorgement), weight loss and hematopoietic (blood cell development) changes. Contact dermatitis was also evident.

Ingestion: The solid/dust is discomforting to the gastrointestinal tract and harmful if swallowed.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic exposure to pyrene results increase in blood leukocytes (leukocytosis).

The so-called polycyclic aromatic hydrocarbons (PAHs) comprise a large family; some members occur in coal tar, tobacco smoke, petroleum and air pollution. Some substituted derivatives have been identified, in animal studies, as amongst the most highly active carcinogens.

Rodent species are sensitive to some PAHs with skin application producing cancerous growths. Injection produces soft tissue tumors (sarcomas) in rats and mice.

Administration of PAHs to Rhesus monkey on the other hand has not yet proved successful in yielding tumors and there is inadequate date to support the proposition that individual PAHs produce cancer in humans. There are however a number of epidemiology and mortality studies that show increased incidence of cancer in humans exposed to mixtures of PAHs. Evidence exists of lung and genito-urinary cancer mortality amongst coke-oven workers and skin tumors in workers exposed to creosote. Exposures to other chemical mixtures containing PAHs such as cigarette smoke, coal tar, coal tar pitch and bitumens, have been associated with increased incidences of lung cancer in humans. Anthracene, the basic unit on which most PAHs are built, is not carcinogenic whereas benz[a]anthracene appears to have weak carcinogenicity. Additions of other benzene rings to select positions on the benz[a]anthracene skeleton results in agents with powerful carcinogenicity (e.g. dibenz[a,h]anthracene and benz[a]pyrene). Further substitution of methyl groups in position on the rings enhances carcinogenicity (7,12 dimethylbenz[a]anthracene is one of the most powerful PAH carcinogens known). Biotransformation to produce soluble metabolites suitable for excretion appears to transform some PAHs to reactive electrophiles (as epoxides) which bind to DNA. Initiation of carcinogenesis is thought to rely upon such interactions.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water.

Consider drinking water to remove dust from throat.

Lay patient down. Keep warm and rested.

Seek medical attention if irritation or discomfort persist.

See DOT ERG

Eye Contact: Immediately hold the eyes open and flush with fresh running water.

Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.

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: Contact a Poison Control Center.

If more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.

Note: DO NOT INDUCE VOMITING in an unconscious person.

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

Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably combustible

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

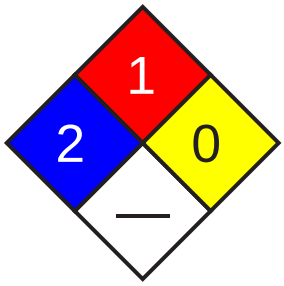
Water spray or fog - Large fires only.

See DOT ERG

General Fire Hazards/Hazardous Combustion Products: Solid which exhibits difficult combustion or is difficult to ignite.

Avoid generating dust, particularly clouds of dust in a confined or unventilated space. Dust may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.

Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport. Build-up of electrostatic charge may be prevented by bonding and grounding.



Fire Diamond

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Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves for fire only. 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.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.
Wear protective clothing, gloves, safety glasses and dust respirator.
Use dry clean-up procedures and avoid generating dust.
Vacuum up or sweep up. Place in clean drum then flush area with water.

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, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor.
Contain or absorb spill with sand, earth or vermiculite.
Collect recoverable product into labeled containers for recycling.
Collect solid residues and seal in labeled drums for disposal.
Wash area 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 all personal contact, including inhalation.
Wear protective clothing when risk of overexposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
DO NOT allow material to contact humans, exposed food or food utensils.
Avoid smoking, bare lights or ignition sources. When handling, DO NOT eat, drink or smoke. Avoid contact with incompatible materials.
Keep containers securely sealed when not in used. Avoid physical damage to containers. Always wash hands with soap and water after handling. Working clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing/handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Glass container; plastic container.
Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

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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: Colorless crystalline solid when pure. Contamination by tetracene results in slight yellowing. Solid and solutions have slight blue fluorescence.

Physical State: Divided solid
Vapor Pressure (kPa): Negligible
Formula Weight: 202.24
Specific Gravity (H_2O=1, at 4 °C): 1.271
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: 393 °C (739 °F) at 760 mm Hg
Freezing/Melting Point: 156 °C (312.8 °F)
Volatile Component (% Vol): Negligible
Water Solubility: 0.135 mg/L (+ or - 0005 mg/L) in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 2700 mg/kg
Inhalation (rat) LC_{50}: 170 mg/m^3
Oral (mouse) LD_{50}: 800 mg/kg
Intraperitoneal (mouse) LD_{50}: 514 mg/kg
Conjunctival irritation, excitement and muscle contraction recorded.
NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

Irritation
Skin (rabbit): 500 mg/24h - mild

See *RTECS* UR 2450000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Although environmental concentrations are highest near sources, its presence in places distant from primary sources indicates that it is reasonably stable in the atmosphere and capable of long distance transport. When released to air it may be subject to direct photolysis, although adsorption to particulates apparently can retard this process. Half-lives for reaction of vapor phase with atmospheric pollutants are: O3, 0.67 days, NO2, 14 days; estimated half-life for reaction with photochemically produced hydroxyl radicals is 1.12 days. If released to water, it will adsorb very strongly to sediments and particulate matter, bioconcentrate in aquatic organisms slightly to moderately, but will not hydrolyze. It may be subject to significant biodegradation, and direct photolysis may be important near the surface of waters. Evaporation may be important with a half-life of 4.8 to 39.2 days predicted for evaporation from a river 1 m deep, flowing at 1 m/sec with a wind velocity of 3 m/sec; half-life for evaporation from a model pond was 1176 days. Adsorption to sediments and particulates will limit evaporation. If released to soil it will be expected to adsorb very strongly to the soil and will not be expected to appreciably leach to the groundwater, although its presence in groundwater illustrates that it can be transported there. It will not be expected to hydrolyze or significantly evaporate from soils and surfaces. It may be subject to appreciable biodegradation in soils.
Ecotoxicity: TL_m (Median threshold limit) Mosquito fish 0.0026 mg/l/96 hr at 24-27 °C in a static bioassay
Henry's Law Constant: calculated at 5.42 x10^{-5}
BCF: rainbow trout 72
Octanol/Water Partition Coefficient: log K_{ow} = 4.88
Soil Sorption Partition Coefficient: K_{oc} = soils 57 to 764

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.

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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: Toxic solids, organic, n.o.s.
ID: UN2811
Hazard Class: 6.1 - Poisonous materials
Packing Group: I - Great Danger
Symbols: G - Technical Name Required
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB7
Packaging: **Exceptions:** None **Non-bulk:** 211 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 kg **Cargo aircraft only:** 50 kg
Vessel Stowage: **Location:** B **Other:**

Shipping Name and Description: Toxic solids, organic, n.o.s.
ID: UN2811
Hazard Class: 6.1 - Poisonous materials
Packing Group: II - Medium Danger
Symbols: G - Technical Name Required
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB8, IP2, IP4
Packaging: **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg
Vessel Stowage: **Location:** B **Other:**

Shipping Name and Description: Toxic solids, organic, n.o.s.
ID: UN2811
Hazard Class: 6.1 - Poisonous materials
Packing Group: III - Minor Danger
Symbols: G - Technical Name Required
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB8, IP3
Packaging: **Exceptions:** 153 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** 100 kg **Cargo aircraft only:** 200 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 307(a)
- **SARA 40 CFR 372.65:** Not listed
- **SARA EHS 40 CFR 355:** Listed
  - **RQ:** 5000 lb
  - **TPQ:** 1000/10000 lb
- **TSCA:** Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 44/60

Material Name: Anthracene **CAS Number:** 120-12-7
Chemical Formula: $C_{14}H_{10}$
Structural Chemical Formula: $(C_6H_4CH)_2$
EINECS Number: 204-371-1
ACX Number: X1001589-1
Synonyms: ANTHRACEN; ANTHRACENE; ANTHRACENE OIL; ANTHRACIN; COAL TAR PITCH VOLATILES:ANTHRACENE; GREEN OIL; P-NAPHTHALENE; PARANAPHTHALENE; PARANAPTHALENE; TETRA OLIVE N2G
Derivation: Occurs naturally in smoke (gasoline, coal, cigarette, etc.), charbroiled foods, and coal tar pitch volatiles. Obtained by distilling crude anthracene oil with alkali carbonate in iron retorts (phenanthrene is removed via carbon disulfide) *or* by salting out from crude anthracene oil and draining; the crude salts are then purified by pressing and the use of various solvents (phen-anthrene and carbazole are removed).
General Use: Used in chemical manufacture (phenanthrene, carbazole, anthraquinone), in calico printing; as a component of dyes, scintillation fluid, smoke screens; and in organic semi-conductor research.

Section 2 - Composition / Information on Ingredients

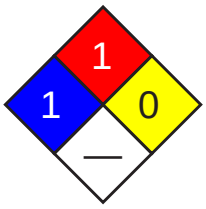
Name	CAS	%
Anthracene	120-12-7	ca 90 to 95% wt (commercial grade); 90 to 98% wt (technical grade)

Trace Impurities: phenanthrene, carbazole, chrysene, pyridine (0.2%), iron (0.03%)

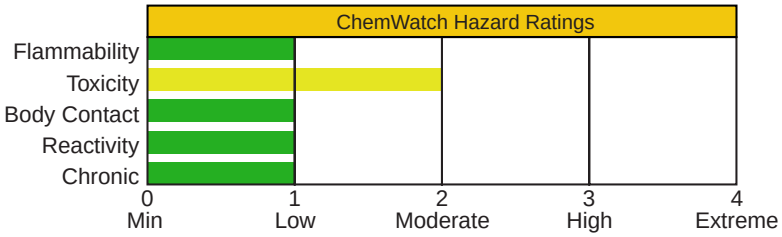
OSHA PEL **NIOSH REL**

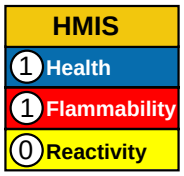
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless crystals with violet fluorescence (pure) or yellow crystals with green fluorescence. Irritating to eyes/skin/respiratory tract. Other Acute Effects: sun exposure can aggravate skin irritation and cause dermatitis. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory and digestive tracts.
Primary Entry Routes: Inhalation, skin/eye contact
Acute Effects
Inhalation: Symptoms include irritation of the respiratory tract, headache, nausea and vomiting, loss of appetite, slowed reactions, and adynamia (lack or loss of strength due to disease or other outside agent). Acute symptoms disappear within several days of last exposure.
Eye: Irritation of the conjunctiva with burning, itching and watering.
Skin: Irritation with burning, itching, and edema (fluid build-up). Volunteers with a 2% crude tar solution applied to the skin showed anthracene absorption via blood tests.

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Ingestion: Gastrointestinal tract irritation.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Dermatitis.

Chronic Effects: Repeated skin contact can cause pigmentation of the skin with cornification of surface layers and telangioectasis (an abnormal dilatation of capillary vessels that often form small, raised, red, wart-like spots). Sensitization (including photo- sensitization) may also occur. Anthracene appears to concentrate in the fat and liver.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult an ophthalmologist if pain and irritation persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Vomiting may be spontaneous.

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

Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: 250 °F (121 °C), Closed Cup

Autoignition Temperature: 1004 °F (540 °C)

LEL: 0.6% v/v

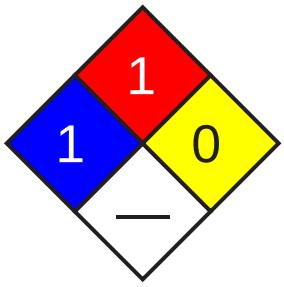
UEL: Not reported.

Flammability Classification: Combustible

Extinguishing Media: Use water spray, carbon dioxide, dry chemical, or foam.

General Fire Hazards/Hazardous Combustion Products: Include carbon oxide(s) and irritating, acrid smoke. May explode in air.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should protect against inhalation and skin/eye contact.

Small Spills: Carefully scoop up or vacuum (with appropriate filter) and place in suitable containers for disposal.

Large Spills: Use water to flush large spills to containment area for later disposal. Do not release into sewers or waterways. Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: *Do not* use near heat or flame. Wear appropriate PPE. Never eat, drink, or smoke in work areas. Practice good personal hygiene after using anthracene, especially before eating, drinking, smoking, using the toilet, or applying cosmetics. Skin cleansers (ex. 55% kaolin, 25% neutral soap, 20% bran) are recommended.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 10).

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond equipment used with and around anthracene. Enclosure of equipment and mechanization of processes will aid in exposure control. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.

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Personal Protective Clothing/Equipment: Limit work in sunlight as much as possible to prevent photosensitization. Photoprotective creams or pastes must be applied to bare skin regions. Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Polyvinyl chloride is a suitable material for PPE. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For any detectable concentration, use a SCBA or supplied-air respirator with a full facepiece and operated in pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes and place in closed containers until laundered. Remove anthracene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless crystals with a violet fluorescence (pure), yellow crystals with a green fluorescence (due to tetracene and naphthacene).

Physical State: Solid

Vapor Pressure (kPa): 1mm Hg at 293 °F (145 °C)

Formula Weight: 178.22

Density: 1.25 g/cm^3 at 80.6 °F (27 °C)

Boiling Point: 644 °F (340 °C)

Freezing/Melting Point: 423 °F (217 °C)

Water Solubility: 1.29 mg/L at 77 °F/25 °C (*distilled water*), 0.6 mg/L at 77 °F/25 °C (*salt water*)

Other Solubilities: 1 g in 67 mL absolute alcohol, 70 mL methanol, 62 mL benzene, 85 mL chloroform, 200 mL ether, 31 mL carbon disulfide, 86 mL carbon tetrachloride, and 125 mL toluene. Also soluble in acetone.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Anthracene darkens upon exposure to sunlight (transformed to *para*-anthracene). Hazardous polymerization *does not* occur. Exposure to heat, ignition sources, sunlight, and incompatibles.

Storage Incompatibilities: Include calcium hypochlorite (exothermic), fluorine (explodes), chromic acid, and calcium oxychloride.

Hazardous Decomposition Products: Thermal oxidative decomposition of anthracene can produce carbon oxide(s) and acrid, irritating smoke.

Section 11 - Toxicological Information

Acute Oral Effects:

Mouse, oral, LD: > 17 g/kg caused fatty liver degeneration.

Irritation Effects:

Mouse, skin: 118 µg caused mild irritation.

Other Effects:

Rat, oral: 20 g/kg intermittently for 79 weeks caused liver tumors.

Genetic Effects - Rat, liver cell: 300 µmoL caused DNA damage.

See *RTECS* CA9350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, anthracene is expected to absorb strongly and not leach to groundwater. It will not hydrolyze, but may be subject to biodegradation, the rate of which depends on soil type. In water, anthracene is subject to direct photolysis near the surface and undergoes significant biodegradation. Biodegradation in water is faster with increased temperature, increased oxygen, and acclimated microbes. Evaporation may also be significant with an estimated half-life range of 4.3 to 5.9 days from a river 1 m deep, flowing 1 m/sec, with a wind velocity of 3 m/sec. In the air, photolysis and reaction with photochemically-produced hydroxyl radicals (half-life: 1.67 days). Vapor phase anthracene is expected to degrade faster than particle-sorbed anthracene. A K_{oc} of 26,000 suggests anthracene is relatively immobile in soil and unlikely to leach to groundwater; it will absorb strongly to soil.

Ecotoxicity: *Leponis macrochirus* (bluegill sunfish), LC_{50} = 11.9 µg/L/96 hr; *Rana pipiens* (leopard frog), LC_{50} = 0.065 ppm/30 min & 0.025 ppm/5 hr. BCF (bioconcentration factor): goldfish (162), rainbow trout (4400-9200). Bioconcentration occurs most heavily in organisms which lack the enzyme microsomal oxidase. Anthracene can become concentrated on the waxy surface of some plant leaves and fruits.

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Octanol/Water Partition Coefficient: log K_{ow} = 4.45 (calc.)

Section 13 - Disposal Considerations

Disposal: Anthracene is a waste chemical stream constituent which may be subjected to ultimate disposal by controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.
ID: UN3077
Hazard Class: 9 - Miscellaneous hazardous material
Packing Group: III - Minor Danger
Symbols: G - Technical Name Required
Label Codes: 9 - Class 9
Special Provisions: 8, 146, B54, IB8, N20
Packaging: **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit
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 307(a) 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Toluene **CAS Number:** 108-88-3
Chemical Formula: C_7H_8
Structural Chemical Formula: $C_6H_5CH_3$
EINECS Number: 203-625-9
ACX Number: X1001512-0
Synonyms: ANTISAL 1A; BENZENE,METHYL-; CP 25; METHACIDE; METHANE,PHENYL-; METHYL BENZENE; METHYL BENZOL; METHYLBENZENE; METHYLBENZOL; PHENYL METHANE; PHENYLMETHANE; TOLUEEN; TOLUEN; TOLUENE; TOLUENO; TOLUOL; TOLUOLO; TOLU-SOL
General Use: Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners; in gasoline and aviation fuel. Used in the manufacture of chemicals, dyes, explosives, benzoic acid.
Some grades of toluene may contain traces of xylene and benzene.
Odor threshold: 2 ppm approx. Odor is not a reliable warning property due to olfactory fatigue.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
toluene	108-88-3	> 99.5

OSHA PEL
TWA: 200 ppm; Ceiling: 300 ppm; 500 ppm, 10-minute maximum peak.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 375 mg/m^3; STEL: 150 ppm; 560 mg/m^3.

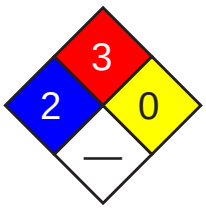
ACGIH TLV
TWA: 50 ppm; skin.

NIOSH REL
TWA: 100 ppm, 375 mg/m^3; STEL: 150 ppm, 560 mg/m^3.

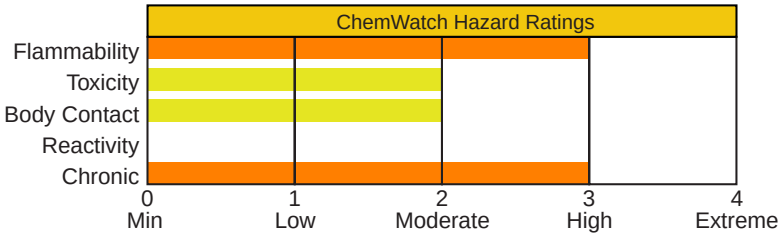
IDLH Level
500 ppm.

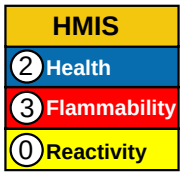
DFG (Germany) MAK
TWA: 50 ppm; PEAK: 200 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sickly, sweet odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: weakness, headache, dizziness, confusion, insomnia. Chronic Effects: liver/kidney damage, may cause birth defects. Flammable.

Potential Health Effects

Target Organs: Skin, liver, kidneys, central nervous system.
Primary Entry Routes: Inhalation, skin contact/absorbtion.
Acute Effects
Inhalation: The vapor is highly discomforting to the upper respiratory tract. Inhalation hazard is increased at higher temperatures.

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Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.
Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness.
Serious poisonings may result in respiratory depression and may be fatal.

Eye: The liquid produces a high level of eye discomfort 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 vapor is discomforting to the eyes if exposure is prolonged.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.
Defatting and/or drying of the skin may lead to dermatitis and it is absorbed by skin.
Toxic effects may result from skin absorption.
Open cuts, abraded or irritated skin should not be exposed to this material.
The material may accentuate any pre-existing skin condition.
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.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.
Chronic toluene habituation occurs following intentional abuse (glue-sniffing) or from occupational exposure. Ataxia, incoordination and tremors of the hands and feet (as a consequence of diffuse cerebral atrophy), headache, abnormal speech, transient memory loss, convulsions, coma, drowsiness, reduced color perception, frank blindness, nystagmus (rapid, involuntary eye-movements), decreased hearing leading to deafness and mild dementia have all been associated with chronic abuse.
Peripheral nerve damage, encephalopathy, giant axonopathy, electrolyte disturbances in the cerebrospinal fluid and abnormal computer tomographic (CT) scans are common amongst toluene addicts. Although toluene abuse has been linked with kidney disease, this does not commonly appear in cases of occupational toluene exposures. Cardiac and hematological toxicity are however associated with chronic toluene exposure. Cardiac arrhythmia, multifocal and premature ventricular contractions and supraventricular tachycardia are present in 20% of patients who abused toluene-containing paints.
Previous suggestions that chronic toluene inhalation produced human peripheral neuropathy have largely been discounted. However central nervous system (CNS) depression is well documented where blood toluene levels exceed 2.2 mg%. Toluene abusers can achieve transient circulating concentrations of 6.5 mg%. Amongst workers exposed for a median time of 29 years to toluene no subacute effects on neurasthenic complaints and pyschometric test results could be established.
The prenatal toxicity of very high toluene concentrations has been documented for several animal species and man. Malformations indicative of specific teratogenicity have not generally been found. The toxicity described in the literature takes the form of embryo death or delayed fetal growth and delayed skeletal system development. Permanent damage of children has been seen only when mothers had suffered from chronic intoxication as a result of "sniffing".

Section 4 - First Aid Measures

See DOT ERG

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.

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Ingestion: 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: Following acute or short-term repeated exposures to toluene:

1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.
The tissue/blood proportion is 1/3 except in adipose where the proportion is 8/10.
2.Metabolism by microsomal mono-oxygenation, results in the production of hippuric acid. This may be detected in the urine in amounts between 0.5 and 2.5 g/24hr which represents, on average 0.8 gm/gm of creatinine.
The biological half life of hippuric acid is in the order of 1-2 hours.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
8.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

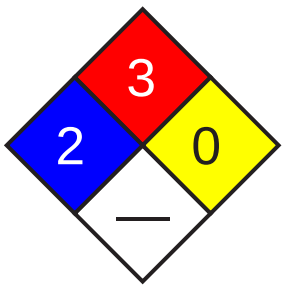
Determinant	Index	Sampling Time	Comments
Hippuric acid in urine	2.5 gm/gm creatinine	End of shift Last 4 hrs of shift	B,NS
Toluene in venous blood	1 mg/L	End of shift	SQ
Toluene in end-exhaled air		End of shift	SQ

NS: Non-specific determinant; also observed after exposure to other material
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.
B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: 4 °C Closed Cup
Autoignition Temperature: 480 °C
LEL: 1.2% v/v
UEL: 7.1% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).

See DOT ERG



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Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Nitric acid with toluene, produces nitrated compounds which are explosive.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the 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 protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: 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 breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
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 all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
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.

Recommended Storage Methods: Metal can; Metal drum; Metal safety cans. Packing as supplied by manufacturer.
Plastic containers may only be used if approved for flammable liquid.
Check that containers are clearly labeled and free from leaks.

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.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in special circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.
Provide adequate ventilation in warehouses and enclosed storage areas.

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In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; 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: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:
Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face Cartridge Color: black

Other: Overalls. Barrier cream. Eyewash unit.

Glove Selection Index:

PE/EVAL/PE ..... Best selection
VITON/CHLOROBUTYL ..... Best selection
VITON ..... Best selection
PVA ..... Best selection
TEFLON ..... Satisfactory; may degrade after 4 hours continuous immersion
SARANEX-23 2-PLY..... Poor to dangerous choice for other than short-term immersion
CPE ..... Poor to dangerous choice for other than short-term immersion
VITON/NEOPRENE ..... Poor to dangerous choice for other than short-term immersion
SARANEX-23 ..... Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL..... Poor to dangerous choice for other than short-term immersion
NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
NITRILE ..... Poor to dangerous choice for other than short-term immersion
BUTYL ..... Poor to dangerous choice for other than short-term immersion
PVC..... Poor to dangerous choice for other than short-term immersion
NEOPRENE..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 2.93 at 20 °C
Vapor Density (Air=1): 3.2
Formula Weight: 92.14
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 20 °C
Evaporation Rate: 2.4 (BuAc=1)
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 111 °C (232 °F) at 760 mm Hg
Freezing/Melting Point: -95 °C (-139 °F)
Volatile Component (% Vol): 100
Water Solubility: < 1 mg/mL at 18 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from strong oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 636 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm
Inhalation (man) TC_{Lo}: 200 ppm
Inhalation (rat) LC_{50}: > 26700 ppm/1h
Dermal (rabbit) LD_{50}: 12124 mg/kg
Reproductive effector in rats

Irritation

Skin (rabbit): 20 mg/24h-moderate
Skin (rabbit): 500 mg - moderate
Eye (rabbit): 0.87 mg - mild
Eye (rabbit): 2 mg/24h - SEVERE
Eye (rabbit): 100 mg/30sec - mild

See *RTECS* XS 5250000, for additional data.

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Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be lost by evaporation from near-surface soil and by leaching to the groundwater. Biodegradation occurs both in soil and groundwater, but it is apt to be slow especially at high concentrations, which may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation. It will not significantly hydrolyze in soil or water under normal environmental conditions. If released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It will not significantly adsorb to sediment or bioconcentrate in aquatic organisms. If released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis.

Ecotoxicity: LC_{50} Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC_{50} Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Calandra granaria (grain weevil) 210 mg/l /in air; LC_{50} Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC_{50} Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolarvae), and 26-31 mg/l (30-day-old minnows)/ 96 hour /Conditions of bioassay not specified

Henry's Law Constant: 0.0067

BCF: eels 13.2

Biochemical Oxygen Demand (BOD): 0%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.69

Soil Sorption Partition Coefficient: K_{oc} = silty loam 37

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
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: Toluene
ID: UN1294
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U220 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Styrene **CAS Number:** 100-42-5
Chemical Formula: C_8H_8
Structural Chemical Formula: $C_6H_5CH{=}CH_2$
EINECS Number: 202-851-5
ACX Number: X1001136-0
Synonyms: BENZENE,ETHENYL-; BENZENE,VINYL-; CINNAMENE; CINNAMENOL; CINNAMOL; DIAREX HF 77; ETHENYL BENZENE; ETHENYLBENZENE; ETHYLENE,PHENYL-; PHENETHYLENE; PHENYLETHENE; PHENYLETHYLENE; STIROLO; STYREEN; STYREN; STYRENE; STYRENE MONOMER; STYRENE MONOMER,INHIBITED; STYRENE,MONOMER; STYROL; STYROLE; STYROLENE; STYRON; STYROPOL; STYROPOR; VINYL BENZENE; VINYLBENZEN; VINYLBENZENE; VINYLBENZOL
General Use: Widely used in polymer manufacture: polystyrene; SBR, ABS, SAN resins and rubber modified polystyrene for plastics; styrene-butadiene rubber latex.
Styrene polyesters for GRP, FRP molding resins; styrene copolymer resins for coatings; chemical intermediate.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
styrene	100-42-5	>99

OSHA PEL
TWA: 100 ppm; Ceiling: 200 ppm; 600 ppm, 5-minute maximum peak in any 3 hours.

OSHA PEL Vacated 1989 Limits
TWA: 50 ppm; 215 mg/m^3; STEL: 100 ppm; 425 mg/m^3.

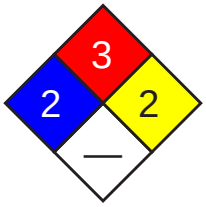
ACGIH TLV
TWA: 20 ppm; STEL: 40 ppm.

NIOSH REL
TWA: 50 ppm, 215 mg/m^3; STEL: 100 ppm, 425 mg/m^3.

IDLH Level
700 ppm.

DFG (Germany) MAK
TWA: 20 ppm; PEAK: 40 ppm.

Section 3 - Hazards Identification



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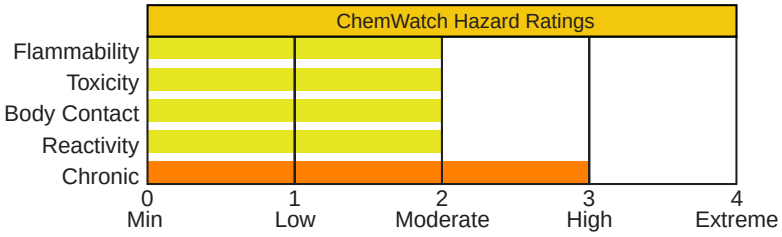

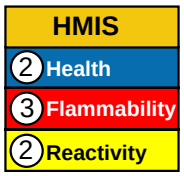

ANSI Signal Word

Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless-yellow, oily liquid; sweet odor. Irritating. Other Acute Effects: difficulty breathing, dizziness. Chronic Effects: dermatitis, nervous system disorders, blood/liver damage, reproductive/teratogenic effects (animal studies). Possible cancer hazard. Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, respiratory system, skin
Primary Entry Routes: inhalation, skin contact/absorption
Acute Effects
Inhalation: The vapor is highly discomforting to the upper respiratory tract if inhaled and may be harmful if exposure is prolonged.

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Inhalation hazard is increased at higher temperatures.
Acute effects from inhalation of high vapor concentrations may be chest and nasal irritation with coughing, sneezing, headache and even nausea.
If exposure to highly concentrated vapor atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma, and unless resuscitated, death.
Central nervous system (CNS) depression is seen at styrene exposures exceeding 50 ppm, whilst headache, fatigue, nausea and dizziness are reported consistently at exposures of 100 ppm.
Evidence exists that 5% to 10% reductions in sensory nerve conduction occur at 100 ppm and that slowed reaction times occur after exposure to 50 ppm.
Exposure at 376 ppm produces unpleasant subjective symptoms and signs of neurological impairment.
High vapor concentrations may have toxic and anesthetic effects, which may lead to unconsciousness or death.
Exposure at 1000 ppm can rapidly lead to unconsciousness.
Exposure at 10000 ppm may cause death in less than one hour.
Simple reaction times were increased and coordination decreased amongst volunteers inhaling 350 ppm (via mouth tube) for 30 minutes. Controlled inhalation studies with 300 ppm (via mouth tube) for 1 hour found reduced ocular tracking abilities but no changes in balance or coordination.

Eye: The liquid is highly 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 vapor is highly discomforting to the eyes if exposure is prolonged.
The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.
The vapor when concentrated has pronounced eye irritation; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is highly discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.
Toxic effects may result from skin absorption.
Bare unprotected skin should not be exposed to this material.
The material may accentuate any pre-existing dermatitis condition.
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.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid is extremely discomforting and moderately toxic if swallowed.
Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Neuro-optic pathways have been shown to be particularly vulnerable to organic solvent exposure and studies support the proposition that styrene exposure can induce a dose dependent color vision loss.
Chromosomal abnormalities (micronuclei, chromosome gaps or breaks, nuclear bridges and unscheduled DNA synthesis in peripheral lymphocytes) have been recorded in workers exposed to styrene. Such aberrations however are not always apparent in epidemilogical studies and the status of styrene as DNA effector is equivocal.
Deaths due to cancers among workers exposed to styrene is statistically unremarkable.
The dominant first metabolite of styrene is styrene-7,8-oxide which binds covalently to DNA and shows activity in various in-vitro and in-vivo assays for genetic effects where it induces dose-related responses of chromosomal damage at low concentrations. Styrene-7,8-oxide is detected in the blood of workers exposed to styrene. Adducts in hemoglobin and DNA, DNA single-strand breaks/ alkali-labile sites as well as significant increases in the frequency of chromosomal damage has been found in workers exposed to styrene in the reinforced plastics industry.
Exposure to styrene may aggravate C.N.S. disorders, chronic respiratory disease, skin disease, kidney disease and liver disease.

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.

See DOT ERG

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.

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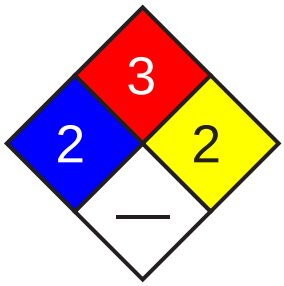
Skin Contact: Quickly but gently, wipe material off skin with a dry, clean cloth.
Immediately remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.
Ingestion: Contact a Poison Control Center. 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 styrene:
INHALATION:
1. Severe exposures should have cardiac monitoring to detect arrhythmia.
2. Catecholamines, especially epinephrine (adrenalin) should be used cautiously (if at all).
3.Aminophylline and inhaled & beta-two selective bronchodilators (e.g. salbutamol) are the drugs of choice for treatment of bronchospasm.
INGESTION:
1. Ipecac syrup should be given for ingestions exceeding 3 mL (styrene)/kg.
2. For patients at risk of aspiration because of obtundation, intubation should precede lavage.
3. Pneumonitis is a significant risk. Watch the patient closely in an upright (alert patient) or left lateral head-down position (obtunded patient) to reduce aspiration potential.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Mandelic acid in Urine	800 mg/gm creatinine	End of shift	NS
	300 mg/gm creatinine	Prior to next shift	NS
Phenylglyoxylic acid in urine	240 mg/gm creatinine	End of shift	B,NS
	100 mg/gm creatinine	Prior to next shift	
Styrene in venous Blood	0.55 mg/L	End of shift	SQ
	0.02 mg/L	Prior to next shift	SQ

NS: Non-specific determinant; also seen after exposure to other materials.
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.
B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: 34.4 °C Tag Closed Cup
Autoignition Temperature: 490 °C
LEL: 1.1% v/v
UEL: 7.0% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit clouds of acrid smoke.
Fire Incompatibility: WARNING: May decompose violently or explosively on contact with other substances.
This substance is one of the relatively few compounds which are described as "endothermic" i.e. heat is absorbed into the compound, rather than released from it, during its formation.



Fire Diamond

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The majority of endothermic compounds are thermodynamically unstable and may decompose explosively under various circumstances of initiation.
Many but not all endothermic compounds have been involved in decompositions, reactions and explosions and, in general, compounds with significantly positive values of standard heats of formation, may be considered suspect on stability grounds.
Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous.
Contamination with polymerization catalysts - peroxides, persulfates, oxidizing agents - also strong acids, strong alkalies, will cause polymerization with exotherm - generation of heat.
Polymerization of large quantities may be violent - even explosive.
Polymerization may occur at elevated temperatures.
Polymerization may be accompanied by generation of heat as exotherm.
Process is self accelerating as heating causes more rapid polymerization.
Exotherm may cause boiling with generation of acrid, toxic and flammable vapor.
Polymerization and exotherm may be violent if contamination with strong acids, amines or catalysts occurs.
Polymerization and exotherm of material in bulk may be uncontrollable and result in rupture of storage tanks.
Polymerization may occur if stabilizing inhibitor becomes depleted by aging.
Stabilizing inhibitor requires dissolved oxygen to be present in liquid for effective action.
Specific storage requirements must be met for stability on ageing and transport.
Contact with alkali solutions or glycols will remove inhibitor and render material unstable on storage.

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.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the 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.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: 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.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor.
Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
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 all personal contact, including inhalation.
Wear protective clothing when risk of overexposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
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.

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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.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage area.

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: Butyl rubber gloves. Safety footwear.

Respiratory Protection:
Exposure Range >100 to <700 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 700 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Barrier cream. Skin cleansing cream.
Impervious apron.
Overalls.
Eyewash unit.
Ensure there is ready access to a safety shower.

Glove Selection Index:
PE/EVAL/PE ..... Best selection
PVA ..... Best selection
TEFLON ..... Best selection
SARANEX-23 ..... Poor to dangerous choice for other than short-term immersion
NITRILE ..... Poor to dangerous choice for other than short-term immersion
NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER..... Poor to dangerous choice for other than short-term immersion
PVC..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless flammable liquid; floats on water. Soluble in alcohol and hydrocarbons. Contains stabilizing Inhibitor. Sweet aromatic odor at low concentrations. Sharp, penetrating odor at high concentrations.

Physical State: Liquid
Vapor Pressure (kPa): 1.27 at 30 °C
Vapor Density (Air=1): 3.6
Formula Weight: 104.16
Specific Gravity (H_2O=1, at 4 °C): 0.99 at 25 °C
Evaporation Rate: 0.49 (BuAc=1)
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 145 °C (293 °F)
Freezing/Melting Point: -31 °C (-23.8 °F)
Volatile Component (% Vol): 100
Water Solubility: Sparingly soluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Material contains a stabilizer/polymerization inhibitor system that provides workable but not indefinite shelf life.
Storage at higher temperatures and long term storage may result in polymerization with solidification. In larger quantities, e.g. 200 liter drums, this may result in generation of heat (exotherm); which may release highly irritating hot styrene vapor. Do not open hot exotherming drums - cool externally with water to avoid vapor release.
Polymerization may occur at elevated temperatures. Polymerization may be accompanied by generation of heat as exotherm. Process is self accelerating as heating causes more rapid polymerization. Exotherm may cause boiling with generation of acrid, toxic and flammable vapor.
Polymerization and exotherm may be violent if contamination with strong acids, amines or catalysts occurs.
Polymerization and exotherm of material in bulk may be uncontrollable and result in rupture of storage tanks.
Polymerization may occur if stabilizing inhibitor becomes depleted by aging.
Stabilizing inhibitor requires dissolved oxygen to be present in liquid for effective action.
Specific storage requirements must be met for stability on ageing and transport.

Storage Incompatibilities: WARNING: May decompose violently or explosively on contact with other substances.

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This substance is one of the relatively few compounds which are described as "endothermic" i.e. heat is absorbed into the compound, rather than released from it, during its formation.
The majority of endothermic compounds are thermodynamically unstable and may decompose explosively under various circumstances of initiation. Many but not all endothermic compounds have been involved in decompositions, reactions and explosions and, in general, compounds with significantly positive values of standard heats of formation, may be considered suspect on stability grounds. Segregate from strong oxidizers and acids.
DO NOT USE brass or copper containers/stirrers.
Attacks, softens and may dissolve rubber, many plastics, paints and coatings.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 5000 mg/kg
Inhalation (human)LC_{Lo}: 10000 ppm/30m.
Inhalation (human) TC_{Lo}: 0.02 mg/m^3
Inhalation (human) TC_{Lo}: 600 ppm
Inhalation (rat): 24000 mg/m^3/4h

Irritation
Skin (human): 500 mg - no skin effects.
Skin (rabbit): 500 mg - mild
Skin (rabbit): 100% - moderate
Eye (rabbit): 18 mg
Eye (rabbit): 100 mg/24h - moderate

See *RTECS* WL 3765000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it will react rapidly with both hydroxyl radicals and ozone with a combined, calculated half-life of about 5 hours. In night-time air, it will degrade rapidly by reaction with atmospheric nitrate radicals. If released to environmental bodies of water, it will volatilize relatively rapidly and biodegrade, but is not expected to hydrolyze. If released to soil it will biodegrade and have a low soil mobility.
Ecotoxicity: TL_m Lepomis macrochirus (bluegill) 25.1 mg/l/96 hr in water hardness of 20 mg/l calcium carbonate /Static bioassay; LC_{50} Cyprinodon variegatus (sheepshead minnow) 9.1 mg/l/96 hr, ambient salinity from 10-30 parts per trillion and temp from 25-31 °C /Static bioassay; TL_m Artemia salina (Brine shrimp) 68 mg/l/24 hr; 52 mg/l/48 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.00275
BCF: not expected
Biochemical Oxygen Demand (BOD): theoretical 18%, 5 days
Octanol/Water Partition Coefficient: log K_{ow} = 2.95
Soil Sorption Partition Coefficient: K_{oc} = estimated at 550 to 555

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.
BEWARE: Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Styrene monomer, stabilized
ID: UN2055
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: B1, IB3, T2, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L

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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: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Ethylbenzene **CAS Number:** 100-41-4
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_5 \cdot C_2H_5$
EINECS Number: 202-849-4
ACX Number: X1003016-1
Synonyms: AETHYLBENZOL; BENZENE,ETHYL-; EB; ETHYL BENZENE; ETHYLBENZEEN; ETHYLBENZENE; ETHYLBENZOL; ETILBENZENE; ETYLOBENZEN; PHENYLETHANE
General Use: Used in the manufacture of cellulose acetate, styrene and synthetic rubber; solvent or diluent; component of automotive and aviation gasoline.
Component of many petroleum hydrocarbon solvents, thinners.
The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
ethylbenzene	100-41-4	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 435 mg/m^3;
STEL: 125 ppm; 545 mg/m^3.

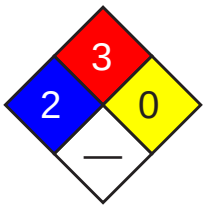
ACGIH TLV
TWA: 100 ppm; STEL: 125 ppm.

NIOSH REL
TWA: 100 ppm, 435 mg/m^3;
STEL: 125 ppm, 545 mg/m^3.

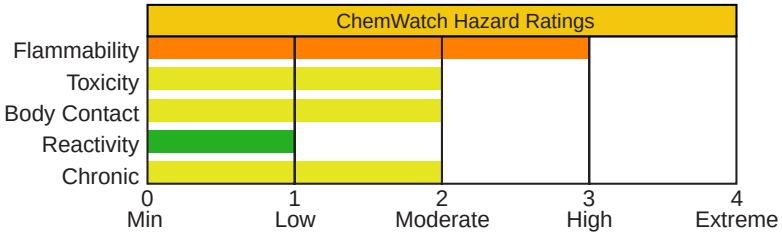
IDLH Level
800 ppm (10% LEL).

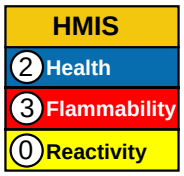
DFG (Germany) MAK
Skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pungent odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: chest constriction, vertigo, narcosis, cramps, respiratory paralysis. Chronic Effects: fatigue, sleepiness, headache, blood disorders, lymphocytosis. Flammable.

Potential Health Effects

Target Organs: eyes, respiratory system, skin, central nervous system (CNS), blood
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

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If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.
Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.
When humans were exposed to the 100 and 200 ppm for 8 hours about 45-65% is retained in the body. Only traces of unchanged ethyl benzene are excreted in expired air following termination of inhalation exposure.
Humans exposed to concentrations of 23-85 ppm excreted most of the retained dose in the urine (mainly as metabolites).
Guinea pigs that died from exposure had intense congestion of the lungs and generalized visceral hyperemia. Rats exposed for three days at 8700 mg/m^3 (2000 ppm) showed changes in the levels of dopamine and noradrenaline in various parts of the brain.

Eye: The liquid is 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.
The vapor is discomforting to the eyes.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Two drops of the material in to the conjunctival sac produced only slight irritation of the conjunctival membrane but no corneal injury.

Skin: The liquid is discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis.
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.
The mean rate of absorption of liquid ethyl benzene applied to 17.3 cm2 area of the forearm of seven volunteers for 10-15 minutes was determined to be 38 mg/cm2/hr. Immersion of the whole hand in aqueous solutions of ethyl benzene (112-156 mg/l) for 1 hour yielded mean absorption rates of 118 and 215.7 ug/cm2/hr. The rate of absorption is thus greater than that of aniline, benzene, nitrobenzene, carbon disulfide and styrene.
Repeated application of the undiluted product to the abdominal area of rabbits (10-20 applications over 2-4 weeks) resulted in erythema, edema and superficial necrosis. The material did not appear to be absorbed through the skin in sufficient quantity to produce outward signs of toxicity.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid may produce considerable gastrointestinal discomfort and may be harmful or toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.
Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.
Industrial workers exposed to a maximum level of ethyl benzene of 0.06 mg/l (14 ppm) reported headaches and irritability and tired quickly. Functional nervous system disturbances were found in some workers employed for over 7 years whilst other workers had enlarged livers.

Section 4 - First Aid Measures

See DOT ERG

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. DO NOT induce vomiting.
Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink.
Transport to hospital or doctor without delay.

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

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

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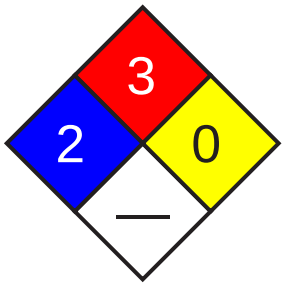
1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

Flash Point: 12.8 °C Closed Cup
Autoignition Temperature: 432 °C
LEL: 1.6% v/v
UEL: 7% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit clouds of acrid smoke.
Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
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.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: 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 breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.

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Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
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.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
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 with polyethylene gloves or Nitrile gloves.
Protective footwear.
Respiratory Protection:
Exposure Range >100 to <800 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 800 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Eyewash unit.
Glove Selection Index:
VITON ..... Best selection
TEFLON ..... Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid; floats on water. Aromatic solvent odor. Soluble in alcohol, benzene, carbon tetrachloride and ether.

Physical State: Liquid
Vapor Pressure (kPa): 1.333 at 25.9 °C
Vapor Density (Air=1): 3.66
Formula Weight: 106.17
Specific Gravity (H_2O=1, at 4 °C): 0.8670 at 20 °C
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 136.2 °C (277 °F) at 760 mm Hg
Freezing/Melting Point: -95 °C (-139 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.01% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

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Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 3500 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm/8h
Inhalation (rat) LC_{Lo}: 4000 ppm/4h
Intraperitoneal (mouse) LD_{50}: 2642 mg/kg~
Dermal (rabbit) LD_{50}: 17800 mg/kg~
Liver changes, utheral tract, effects on fertility, specific developmental abnormalities (musculoskeletal system) recorded.
NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

Irritation
Skin (rabbit): 15 mg/24h mild
Eye (rabbit): 500 mg - SEVERE

See *RTECS* DA 0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it exist predominantly in the vapor phase based on its vapor pressure where it will photochemically degrade by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially return to earth in rain. It will not be subject to direct photolysis. Releases into water will decrease in concentration by evaporation and biodegradation. The time for this decrease and the primary loss processes will depend on the season, and the turbulence and microbial populations in the particular body of water. Representative half-lives are several days to 2 weeks. Some may be adsorbed by sediment but significant bioconcentration in fish is not expected to occur based upon its octanol/water partition coefficient. It is only adsorbed moderately by soil. It will not significantly hydrolyze in water or soil.
Ecotoxicity: LC_{50} Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC_{50} Pimephales promelas (fathead minnow) 12.1 mg/l/96 hr (confidence limit 11.5 - 12.7 mg/l), flow-through bioassay with measured concentrations, 26.1 °C, dissolved oxygen 7.0 mg/l, hardness 45.6 mg/l calcium carbonate, alkalinity 43.0 mg/l; Toxicity threshold (cell multiplication inhibition test): Pseudomonas putida (bacteria) 12 mg/l ; LC_{50} Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC_{50} Palaemonetes pugio (grass shrimp, larva) 10,200 ug/l/24 hr in a static unmeasured bioassay; Toxicity threshold (cell multiplication inhibition test): Microcystis aeruginosa (algae) 33 mg/l; Scenedesmus quadricauda (green algae) > 160 mg/l
Henry's Law Constant: 8.44×10^{-3}
BCF: goldfish 1.9
Biochemical Oxygen Demand (BOD): theoretical 2.8%, 5 days
Octanol/Water Partition Coefficient: log K_{ow} = 3.15
Soil Sorption Partition Coefficient: K_{oc} = 164

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
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: Ethylbenzene
ID: UN1175
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

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Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 50/60

Material Name: Naphthalene **CAS Number:** 91-20-3
Chemical Formula: $C_{10}H_8$
EINECS Number: 202-049-5
ACX Number: X1001294-7
Synonyms: ALBOCARBON; CAMPHOR TAR; DEZODORATOR; FAULDING NAPHTHALENE FLAKES; MIGHTY 150; MIGHTY RD1; MOTH BALLS; MOTH FLAKES; MOTHBALLS; NAFTALEN; NAPHTHALENE; NAPHTHALIN; NAPHTHALINE; NAPHTHENE; TAR CAMPHOR; WHITE TAR
Derivation: From coal tar; from petroleum fractions after various catalytic processing operations.
General Use: Used as a moth repellent, an antiseptic, toilet bowl deodorant, heat transfer agent, fungicide, smokeless powder, cutting fluid, lubricant, wood preservative; an intermediate for naphthol, phthalic anhydride, chlorinated naphthalenes, Tertralin, Decalin, naphthyl and naphthol derivatives, and dyes; in synthetic resins, synthetic tanning, textile chemicals, scintillation counters, and emulsion breakers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Naphthalene	91-20-3	ca 100% wt.

Grade - By melting point, 165 °F (74 °C) min (crude) to greater than 174 °F (79 °C) (refined); scintillation 176-177 °F (80-81 °C)

OSHA PEL
TWA: 10 ppm; 50 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 10 ppm; 50 mg/m^3; STEL: 15 ppm; 75 mg/m^3.

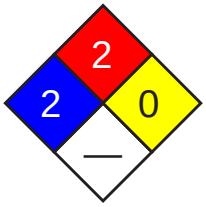
ACGIH TLV
TWA: 10 ppm; STEL: 15 ppm; skin.

NIOSH REL
TWA: 10 ppm, 50 mg/m^3; STEL: 15 ppm, 75 mg/m^3.

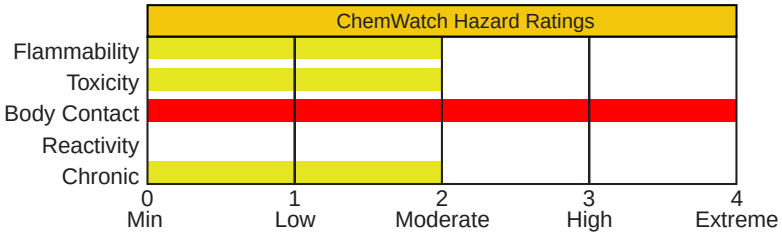
IDLH Level
250 ppm.

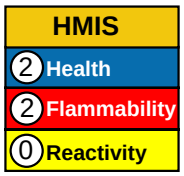
DFG (Germany) MAK
Skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White crystalline solid; "moth ball" or coal-tar odor. Irritating to eyes/skin/respiratory tract. Toxic by ingestion. Combustible solid. Dust may form explosive mixtures in air.

Potential Health Effects

Target Organs: Blood (red blood cell effects), eyes, skin, central nervous system (CNS), liver and kidneys
Primary Entry Routes: Inhalation, skin absorption, skin and/or eye contact
Acute Effects
Inhalation: Vapor inhalation causes headache, confusion, nausea, sometimes vomiting, loss of appetite, extensive sweating, dysuria (painful urination), hematuria (blood in the urine), and hemolysis (destruction of red blood cells).
Eye: Irritation, conjunctivitis, and corneal injury upon prolonged contact.
Skin: Irritation and hypersensitivity dermatitis.

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Ingestion: Unlikely. However, ingestion causes irritation of the mouth and stomach, hemolytic anemia with hepatic and renal lesions and vesical congestion, kidney failure, hematuria, jaundice, depression of CNS, nausea, vomiting, abdominal pain, blue face, lips, or hands, rapid and difficult breathing, headache, confusion, excitement, malaise, fever, perspiration, urinary tract pain, dizziness, convulsions, coma, and death. Symptoms may appear 2 to 4 hours after exposure.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver and kidneys; individuals with a hereditary deficiency of the enzyme glucose-6-phosphate dehydrogenase in red blood cells are particularly susceptible to the hemolytic properties of naphthalene metabolites.

Chronic Effects: May cause optical neuritis, corneal injuries, cataracts, kidney damage. There are two reports of naphthalene crossing the placenta in humans.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed. Contact a physician immediately if symptoms of systemic poisoning are present.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area thoroughly with soap and water. For reddened or blistered skin, consult a physician. Contact a physician immediately if symptoms of systemic poisoning are present.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water, then induce vomiting. Contact a physician immediately.

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

Note to Physicians: Obtain baseline CBC, electrolytes, liver and renal function rests, glucose-6-phosphatase dehydrogenase level, urinalysis, and benzidine dipstick to check for hemoglobinuria. Urinary metabolite, 1-naphthol or mercapturic acid, may help confirm the diagnosis.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: 174 °F (79 °C) OC; 190 °F (88 °C) CC

Autoignition Temperature: 979 °F (526 °C)

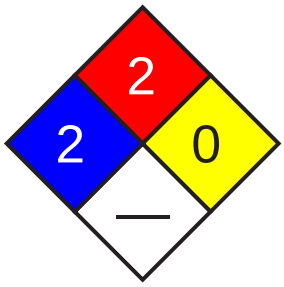
LEL: 0.9% v/v

UEL: 5.9% v/v

Flammability Classification: Combustible solid

Extinguishing Media: Use dry chemical, foam, carbon dioxide (CO_2), or water spray. Water or foam may cause frothing. Use water spray to keep fire-exposed containers cool.

General Fire Hazards/Hazardous Combustion Products: Toxic vapors including carbon monoxide. Volatile solid that gives off flammable vapors when heated. Dust may explode in air if an ignition source is provided.



Fire Diamond

Fire-Fighting Instructions: Move containers from the fire area if it can be done without risk. Otherwise cool fire-exposed containers until well after the fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Wear full protective clothing. Structural clothing is permeable, remain clear of smoke, water fall out, and water run off.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Stop leak if you can do it without risk. Use spark-proof tools and explosion proof equipment. Cleanup personnel should wear personal protective equipment to protect against exposure.

Small Spills: Do not sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 7 - Handling and Storage

Handling Precautions: To avoid vapor inhalation use only with ventilation sufficient to reduce airborne concentrations to nonhazardous levels. Avoid skin and eye contact. Wear personal protective clothing and equipment to prevent any contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed, explosion-proof containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles (see Sec. 10). May be stored under nitrogen gas. Protect containers against physical damage. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid vapor and dust dispersion into the work area. Ventilate at the site of chemical release. During the fractional distillation of naphthalene and in any operation entailing the heating or volatilization of naphthalene, enclosed apparatus should be employed. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with naphthalene. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the eyes, skin, liver, kidneys, CBC (RBC count, WBC count, differential count of a stained smear, hemoglobin, and hematocrit), and urinalysis including at a minimum specific gravity, albumin, glucose, and a microscopic examination on centrifuged sediment.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Teflon is recommended. *Do not* use butyl rubber, natural rubber, neoprene or polyvinyl chloride. Wear chemical dust-proof safety goggles and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove naphthalene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White volatile flakes, cakes, cubes, spheres, or powder; strong coal-tar or moth ball odor.

Physical State: Crystalline solid

Odor Threshold: 0.084 ppm to 0.3 ppm

Vapor Pressure (kPa): 0.05 mm Hg at 68 °F (20 °C); 1.0 mm Hg at 127 °F (53 °C)

Formula Weight: 128.2

Density: 1.145 g/cm^3 at 68 °F (20 °C)

Boiling Point: 424 °F (218 °C)

Freezing/Melting Point: 176 °F (80.2 °C)

Water Solubility: Insoluble [31.7 mg/L at 68 °F (20 °C)]

Other Solubilities: Benzene, absolute alcohol; very soluble in ether, chloroform, carbon disulfide, hydronaphthalenes, fixed and volatile oils

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Naphthalene is stable at room temperature in closed containers under normal storage and handling conditions. It volatilizes at room temperature. Hazardous polymerization cannot occur. Exposure to heat and ignition sources, incompatibles.

Storage Incompatibilities: Include aluminum chloride, benzoyl chloride, chromic acid, chromium trioxide, oxidizers. Explosive reaction with dinitrogen pentaoxide. Melted naphthalene will attack some forms of plastics.

Hazardous Decomposition Products: Thermal oxidative decomposition of naphthalene can produce toxic fumes including carbon monoxide.

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Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 490 mg/kg.
Mouse, oral, LD_{50}: 533 mg/kg.
Human (child), oral, LD_{Lo}: 100 mg/kg.
Acute Inhalation Effects:
Rat, inhalation, LC_{50}: >340 mg/m^3 produced lacrimation and somnolence.
Irritation Effects:
Rabbit, eye, standard Draize test: 100 mg produced mild irritation.
Rabbit, skin, open Draize test: 495 mg produced mild irritation.
Other Effects:
Rat, oral: 4500 mg/kg administered on gestational days 6-15 produced fetotoxicity and other developmental abnormalities.
Man, unreported, LD_{Lo}: 74 mg/kg.
Mouse, inhalation: 30 ppm/6 hr/2 yr administered intermittently produced toxic effects: tumorigenic - neoplastic by RTECS criteria; lungs, thorax, or respiration - tumors.
Hamster, ovary: 15 mg/L induced sister chromatid exchange.

See *RTECS* QJ0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, naphthalene rapidly photodegrades with a half-life of 3-8 hr. Volatilization, photolysis, adsorption, and biodegradation are important loss mechanisms for naphthalene discharged into water. Depending on local conditions, the half-lives range from a couple of days to a few months. If released on land, it is adsorbed moderately to soil, undergoes biodegradation; but in some cases biodegradation may still occur if conditions are aerobic. Bioconcentration occurs to a moderate extent, but is a temporary problem since depuration and metabolism readily proceed in aquatic organisms.
Ecotoxicity: *Oncorhynchus gorbuscha* (pink salmon): 1.37 ppm/96 hr at 39 °F (4 °C). *Pimephales promelas* (fathead minnow): 7.76 mg/L/24 hr.
Octanol/Water Partition Coefficient: log K_{ow} = 3.30

Section 13 - Disposal Considerations

Disposal: Consider rotary kiln or fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Naphthalene, crude *or* Naphthalene, refined
ID: UN1334
Hazard Class: 4.1 - Flammable solid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 4.1 - Flammable Solid
Special Provisions: A1, IB8, IP3
Packaging: **Exceptions:** 151 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U165 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

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Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 44/60

Material Name: Phenanthrene **CAS Number:** 85-01-8
Chemical Formula: $C_{14}H_{10}$
Structural Chemical Formula: $(C_6H_4CH)_2$
EINECS Number: 201-581-5
ACX Number: X1001897-8
Synonyms: COAL TAR PITCH VOLATILES: PHENANTHRENE; PHENANTHREN; PHENANTHRENE; PHENANTRIN
Derivation: A polynuclear aromatic hydrocarbon found as a component of coal tar pitch volatiles (products of bituminous coal distillation). Produced from toluene, bibenzil, 9-methyl fluorene or stilbene by passage through red hot tubes or by diene synthesis of 1-vinyl naphthalene and maleic anhydride.
General Use: Used in the manufacture of dyestuffs and explosives; in biological research or drug synthesis.

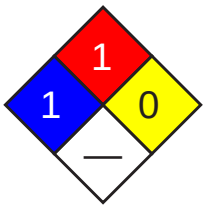
Section 2 - Composition / Information on Ingredients

Name	CAS	%
Phenanthrene	85-01-8	ca 100 % wt

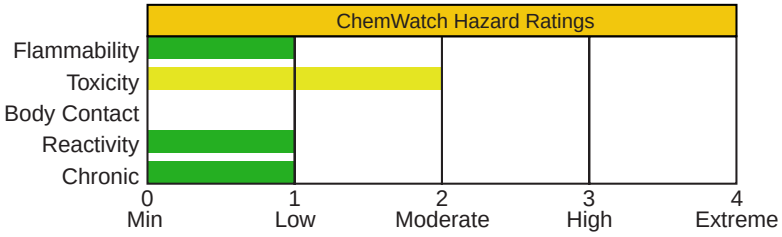
OSHA PEL **NIOSH REL**

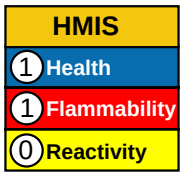
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Shiny crystals; faint, aromatic odor. Acute Effects: skin photosensitization. Combustible. Reacts dangerously with oxidizers.

Potential Health Effects

Target Organs: Skin.
Primary Entry Routes: Skin contact.
Acute Effects
Inhalation: Effects not reported.
Eye: Effects not reported.
Skin: Can cause photosensitization of the skin.
Ingestion: Effects not reported.
Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.
Medical Conditions Aggravated by Long-Term Exposure: Skin disorders.
Chronic Effects: None reported.

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Section 4 - First Aid Measures

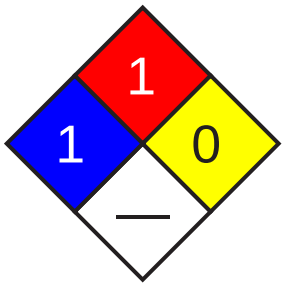
See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin Contact: *Quickly* remove contaminated clothing. Rinse exposed area with flooding amounts of water to remove loose material and then move quickly to a soap and water wash. For reddened or blistered skin, consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: 340 °F (171 °C), Open Cup
LEL: Not reported.
UEL: Not reported.
Flammability Classification: Class IIIB Combustible liquid
Extinguishing Media: Use dry chemical or carbon dioxide; water spray or foam may cause frothing.
General Fire Hazards/Hazardous Combustion Products: Carbon oxides (CO_x) and acrid smoke
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against skin contact.
Small Spills: To avoid dust generation, *do not* sweep! Carefully scoop up or vacuum (with appropriate filter). Damp mop residue.
Large Spills: Flush large spill to containment area for later disposal. Do not release into sewers or waterways. Mop up any residue.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use nonsparking tools to open containers.
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.
Recommended Storage Methods: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, ignition sources, and strong oxidizers.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around phenanthrene. Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.
Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.
Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

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Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendation is for *coal-tar pitch volatiles*: For any detectable concentration, use a SCBA or supplied-air respirator (with auxiliary SCBA) with a full facepiece and operated in pressure-demand or other positive pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, shiny crystals with a faint, aromatic odor.

Physical State: Solid

Vapor Pressure (kPa): 1 mm Hg at 244.76 °F (118.2 °C); 400 mm Hg at 586.4 (308 °C)

Formula Weight: 178.22

Density: 1.179 g/L at 77 °F (25 °C)

Refractive Index: 1.59427

Boiling Point: 644 °F (340 °C)

Freezing/Melting Point: 213 °F (101 °C)

Water Solubility: 1.6 mg/L at 59 °F (15 °C)

Other Solubilities: 1 g in: 2.4 mL toluene, 2.4 mL carbon tetrachloride, 2 mL benzene, 1 mL carbon disulfide, 25 mL absolute alcohol, 60 mL cold 95% alcohol, 10 mL boiling 95% alcohol and 3.3 mL anhydrous ether. Also soluble in glacial acetic acid, chloroform, and hot pyridine.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Phenanthrene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization does not occur. Phenanthrene dust generation and exposure to heat ignition sources, or oxidizers.

Storage Incompatibilities: Strong oxidizers.

Hazardous Decomposition Products: Thermal oxidative decomposition of phenanthrene can produce carbon oxide(s).

Section 11 - Toxicological Information

Acute Oral Effects:

Mouse, oral, LD_{50}: 700 mg/kg.

Other Effects:

Tumorgenicity, mouse, skin: 71 mg/kg produced tumors at site of application.

Genetic Effects - Rat, liver cell: 3 mmol/L caused DNA damage.

Human, lymphocyte: 100 µmol/L caused mutation.

See *RTECS* SF7175000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, some phenanthrene may biodegrade but the majority will bind to the soil without much leaching to groundwater. Volatilization is not expected to be significant. In water, it will adhere to particulates and sediment. Photolysis may occur near the surface producing toxic substances. Photolysis/photooxidation half-life = 8.4 hr. In the air, it will react with photochemically generated hydroxyl radicals (half-life = 1.67 days). Phenanthrene absorbs strongly to soil and sediment in water.

Ecotoxicity: *Neanhes arenaceodentata*, TL_m = 0.6 ppm/96 hr, sea water at 71.6 °F (22 °C)

Octanol/Water Partition Coefficient: log K_{ow} = 4.57

Section 13 - Disposal Considerations

Disposal: For treatment of phenanthrene contaminated water, the particulate bound portion can be removed by sedimentation, flocculation, and filtration. Chlorination is not recommended as it has been shown to produce mutagenic substances. The dissolved portion requires oxidation for partial removal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

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Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.
ID: UN3077
Hazard Class: 9 - Miscellaneous hazardous material
Packing Group: III - Minor Danger
Symbols: G - Technical Name Required
Label Codes: 9 - Class 9
Special Provisions: 8, 146, B54, IB8, N20
Packaging: **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit
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 307(a) 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Benzene **CAS Number:** 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
EINECS Number: 200-753-7
ACX Number: X1001488-9
Synonyms: Benzene; BENZENE; (6)ANNULENE; BENZEEN; BENZEN; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

OSHA PEL
TWA: 1 ppm; STEL: 5 ppm.

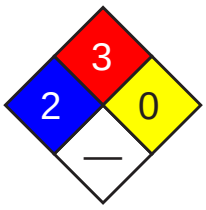
NIOSH REL
TWA: 0.1 ppm; STEL: 1 ppm.

DFG (Germany) MAK
Skin.

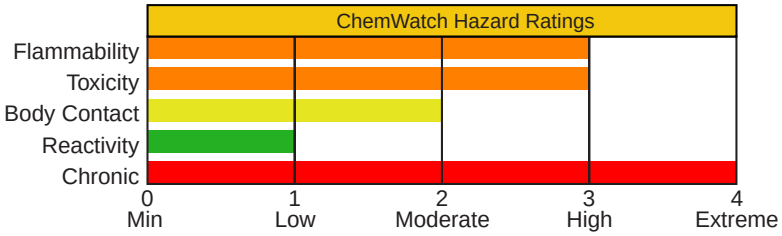
ACGIH TLV
TWA: 0.5 ppm; STEL: 2.5 ppm; skin.

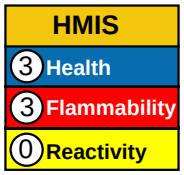
IDLH Level
500 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: headache, dizziness, drowsiness. Absorbed through skin. Chronic Effects: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Primary Entry Routes: inhalation, skin contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

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Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation hazard is increased at higher temperatures.

The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.

Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.

Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.

Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.

Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption 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.

The vapor is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

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.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.

Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.

Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.

Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

Section 4 - First Aid Measures

See DOT ERG

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.

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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: 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: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.

3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.

4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.

5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.

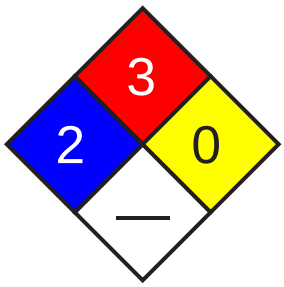
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients. Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% v/v
UEL: 7.1% v/v

See DOT ERG



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

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.
If safe, switch off electrical equipment until vapor fire hazard removed.
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.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

See DOT ERG

Large Spills: Pollutant - contain spillage. 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 breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

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No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
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 all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
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.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Note: must change cartridge at beginning of each shift

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:
PE/EVAL/PE ..... Best selection
PVA ..... Best selection
TEFLON ..... Best selection
VITON ..... Best selection
VITON/NEOPRENE ..... Best selection

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NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
BUTYL ..... Poor to dangerous choice for other than short-term immersion
NITRILE ..... Poor to dangerous choice for other than short-term immersion
NEOPRENE..... Poor to dangerous choice for other than short-term immersion
PVC..... Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER..... Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 80.1 °C (176 °F)
Freezing/Melting Point: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.18 g/100 g of water at 25 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

Irritation
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

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Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3×10^{-3}

BCF: eels 3.5

Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.13

Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
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: Benzene
ID: UN1114
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:** 40

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U019 Toxic Waste, Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 51/60

Material Name: Methanol **CAS Number:** 67-56-1
Chemical Formula: CH_4O
Structural Chemical Formula: CH_3OH
EINECS Number: 200-659-6
ACX Number: X1001287-2
Synonyms: ALCOHOL,METHYL; ALCOOL METHYLIQUE; ALCOOL METILICO; CARBINOL; X-CIDE 402 INDUSTRIAL BACTERICIDE; COAT-B1400; COLONIAL SPIRIT; COLONIAL SPIRITS; COLUMBIAN SPIRIT; COLUMBIAN SPIRITS; EPA PESTICIDE CHEMICAL CODE 053801; EUREKA PRODUCTS CRIOSINE DISINFECTANT; EUREKA PRODUCTS,CRIOSINE; FREERS ELM ARRESTER; IDEAL CONCENTRATED WOOD PRESERVATIVE; METANOL; METANOLO; METHANOL; METHYL ALCOHOL; METHYL HYDRATE; METHYL HYDROXIDE; METHYLALKOHOL; METHYLOL; METYLOWY ALKOHOL; MONOHYDROXYMETHANE; PMC REJEX-IT F-40ME; PYROLIGNEOUS SPIRIT; PYROXYLIC SPIRIT; PYROXYLIC SPIRITS; SURFLO-B17; WILBUR-ELLIS SMUT-GUARD; WOOD ALCOHOL; WOOD NAPHTHA; WOOD SPIRIT
Derivation: Prepared by wood pyrolysis; non-catalytic oxidation of hydrocarbons; as a by-product in the fisher-tropsch synthesis; or by reduction of carbon monoxide.
General Use: Used as an industrial solvent; starting material for organic synthesis; antifreeze for windshield washer fluid; in fuel antifreezes; gasoline octane booster; fuel for stoves; extractant for oils; denaturing ethanol; softening agent; food additive; in paint, varnish removers, and embalming fluids; in the manufacture of photographic film, celluloid, textile soap, wood stains, coated fabrics, shatterproof glass, paper coating, waterproofing formulations, artificial leather, dyes.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Methanol	67-56-1	ca 100% vol

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

OSHA PEL
TWA: 200 ppm; 260 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 200 ppm; 260 mg/m^3;
STEL: 250 ppm; 325 mg/m^3.

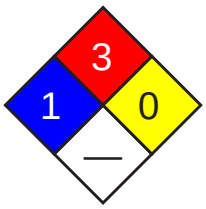
ACGIH TLV
TWA: 200 ppm; STEL: 250 ppm; skin.

NIOSH REL
TWA: 200 ppm, 260 mg/m^3;
STEL: 250 ppm, 325 mg/m^3;
skin.

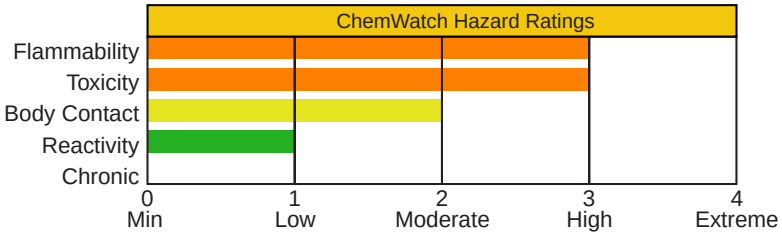
IDLH Level
6000 ppm.

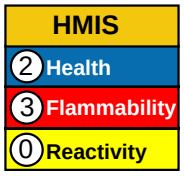
DFG (Germany) MAK
TWA: 200 ppm; PEAK: 800 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

Flammable

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☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; slight alcohol odor when pure or disagreeably pungent odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: headache, visual disturbance, blindness, respiratory failure. Chronic Effects: reproductive effects reported in animal testing. Flammable; moderate explosion hazard.

Potential Health Effects

Target Organs: Eyes, skin, central nervous system (CNS), gastrointestinal (GI) tract, respiratory system
Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption
Acute Effects

Inhalation: Irritation, breathing difficulty, headache, drowsiness, vertigo, light-headedness, nausea, vomiting, acidosis (decreased blood alkalinity), visual disturbance, and at high concentrations, CNS damage, convulsions, circulatory collapse, respiratory failure, coma and blindness can result from inhalation of methanol vapor. Concentration >= 200 ppm may cause headache; 50,000 ppm can cause death within 1-2 hrs.

Eye: Contact with liquid may result in irritation, inflamed lids, light sensitization, and superficial lesions.

Skin: Contact may cause irritation, dermatitis, swelling, scaling, and systemic effects.

Ingestion: GI irritation and systemic effects. Symptoms may be delayed 18-48 hours. Fatal dose - 2 to 8 ounces.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Exposure to methanol vapors has caused conjunctivitis, headache, giddiness, insomnia, GI disturbance, impaired vision. CNS damage is also likely. Methanol is slowly eliminated from the body; exposure is considered cumulative over the short term.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation develops.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

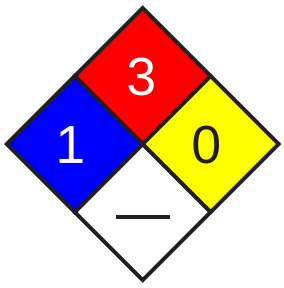
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Follow emesis with rehydration, correction of acidosis, and folate to enhance formate oxidation. Consider IV administration of ethanol (if blood methanol >20 mg/dL) to show metabolic oxidation of methanol. Assay formic acid in urine, blood pH and plasma bicarbonate.

Section 5 - Fire-Fighting Measures

See DOT ERG

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



Fire Diamond

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, fog or alcohol-resistant foam. A water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.

General Fire Hazards/Hazardous Combustion Products: Heating methanol to decomposition can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes. Can form explosive mixtures in the air. The heavier-than-air vapors of methanol may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Fire-Fighting Instructions: *Do not* scatter material with any more water than needed to extinguish fire. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

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Section 6 - Accidental Release Measures

Spill/Leak Procedures: Isolate spill area for at least 330-660 feet (100-200 m) in all directions. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors.

See DOT ERG

Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Use clean non-sparking tools to collect absorbed material.

Large Spills: Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Ground all equipment. Use non-sparking tools.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations. Also 29 CFR 1910.106 for Class 1B Flammable Liquids.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Enclose operations and/or provide local explosion-proof exhaust ventilation at the site of chemical release. Where possible, transfer methanol from drums or other storage containers to process containers. Minimize sources of ignition in surrounding areas.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets of butyl rubber, Teflon, Viton, Saranex, 4H, Responder, Trellchem HPS, or Tychem 10000 (Breakthrough Time (BT) >8 hr) to prevent skin contact. Natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl alcohol and CPF 3 may degrade after contact and are not recommended. Wear splash-proof chemical safety goggles, and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/ NIOSH-approved respirator. For concentrations <= 2000 ppm, use a supplied air respirator; <= 5000 ppm, supplied air (SA) respirator in continuous flow mode; <= 6000 ppm, SA respirator with tight-fitting face mask operated in continuous flow mode, or SCBA with full facepiece, or SA respirator with full facepiece; > IDLH/unknown/emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or SA respirator with full facepiece operated in pressure-demand or other positive-pressure mode in combination with auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For escape, use an appropriate escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen- deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless; slight alcohol odor when pure, disagreeably pungent odor when crude.

Physical State: Liquid

Vapor Pressure (kPa): 127 mm Hg at 77 °F (25 °C)

Vapor Density (Air=1): 1.11

Bulk Density: 6.59 lbs/gal at 68 F (20 °C)

Formula Weight: 32.04

Density: 0.796 g/mL at 59 °F (15 °C)

Specific Gravity (H_2O=1, at 4 °C): 0.81 at 0 °C/4 °C

Refractive Index: 1.3292 at 68 °F (20 °C)

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pH: Slightly acidic
Boiling Point: 148 °F (64.7 °C) at 760 mm Hg
Freezing/Melting Point: -144.04 °F (-97.8 °C)
Viscosity: 0.614 mPa sec
Surface Tension: 22.61 dynes/cm
Ionization Potential (eV): 10.84 eV
Water Solubility: Miscible
Other Solubilities: Ethanol, acetone, benzene, chloroform, DMSO, ether, ketones, most organic solvents.

Section 10 - Stability and Reactivity

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

Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 5628 mg/kg.
Human, oral, LD_{Lo}: 428 mg/kg produced toxic effects: behavioral - headache; lungs, thorax, or respiration - other changes.
Human, oral, LD_{Lo}: 143 mg/kg produced optic nerve neuropathy, dyspnea, nausea or vomiting.
Acute Inhalation Effects:
Rat, inhalation, LC_{50}: 64000 ppm/4 hr.
Human, inhalation, TC_{Lo}: 300 ppm produced visual field changes, headache; lungs, thorax, or respiration - other changes.
Acute Skin Effects:
Rabbit, skin, LD_{50}: 15800 mg/kg.
Monkey, skin, LD_{Lo}: 393 mg/kg.
Irritation Effects:
Rabbit, standard Draize test: 100 mg/24 hr resulted in moderate irritation.
Rabbit, standard Draize test: 20 mg/24 hr resulted in moderate irritation.
Other Effects:
Rat, oral: 10 µmol/kg resulted in DNA damage.
Rat, inhalation: 50 mg/m^3/12 hr/13 weeks intermittently produced degenerative changes to brain and coverings; muscle contraction or spasticity.
Rat, inhalation: 2610 ppm/6 hr/4 weeks intermittently produced toxic effects: endocrine - changes in spleen weight.
Multiple Dose Toxicity Effects - Rat, oral: 12 g/kg/8 weeks intermittently produced toxic effects: behavioral - ataxia; behavioral - alteration of operant conditioning.
Human, lymphocyte: 300 mmol/L resulted in DNA inhibition.
Rat (female), oral: 7500 mg/kg, administered during gestational days 17-19 produced effects on newborn - behavioral.
Rat (female), oral: 35295 mg/kg administered during gestational days 1-15 produced effects on the fertility index; pre implantation mortality; and post-implantation mortality.
Rat (female), inhalation: 20000 ppm/7 hr, administered during gestational days 1-22 produced specific developmental abnormalities - musculoskeletal system; cardiovascular (circulatory) system; urogenital system.
Rat (male), oral: 200 ppm/20 hr, 78 weeks prior to mating produced paternal effects - testes, epididymis, sperm duct.

See *RTECS* PC1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Bioconcentration (BCF, estimated at 0.2) is not expected to be significant. Physical removal from air can occur via rainfall. Relatively rapid evaporation from dry surfaces is likely to occur. If released to the atmosphere, it degrades via reaction with photochemically produced hydroxyl radicals with an approximate half-life of 17.8 days. If released to water or soil, biodegradation is expected to occur. A low K_{oc} indicates little sorption and high mobility in the soil column.
Ecotoxicity: Trout, LC_{50}: 8,000 mg/L/48 hr; *Pimephales promelas* (fathead minnow) LC_{50}: 29.4 g/L/96 hr.
Henry's Law Constant: 4.55 $x10^{-6}$ atm-m^3/mole at 77 °F (25 °C)
Octanol/Water Partition Coefficient: log K_{ow} = -0.77
Soil Sorption Partition Coefficient: K_{oc} = 0.44

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Section 13 - Disposal Considerations

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

Section 14 - Transport Information

DOT 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: Methanol
ID: UN1230
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols: + I
Label Codes: 3 - Flammable Liquid, 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB2, T7, TP2
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:** 40

Shipping Name and Description: Methanol
ID: UN1230
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols: D - Domestic transportation
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T7, TP2
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U154 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 54/60

Material Name: Cyanide Ion **CAS Number:** 57-12-5
Chemical Formula: CN
Structural Chemical Formula: CN
ACX Number: X1002896-5
Synonyms: CARBON NITRIDE ION; CYANIDE; CYANIDE(1-); CYANIDE ANION; CYANIDE ION; CYANIDE(1-) ION; CYANIDE SOLUTIONS; CYANIDE,DRY; CYANURE; HYDROCYANIC ACID,ION(1-); ISOCYANIDE
General Use: Available ONLY for industrial and manufacturing purposes.

Section 2 - Composition / Information on Ingredients

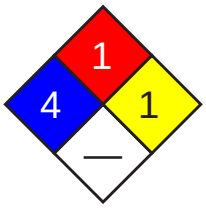
Name	CAS	%
cyanide ion	57-12-5	100

OSHA PEL
TWA: 5 mg/m^3.

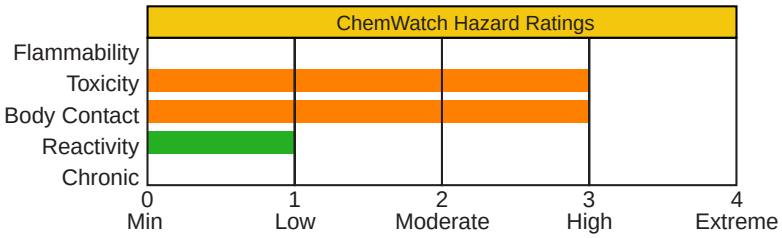
NIOSH REL

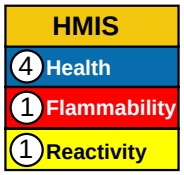
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!

Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Almond odor. Poison. Irritating to the eyes/respiratory tract. Fast acting chemical asphyxiant that prevents tissue utilization of oxygen. Chronic Effects: skin rash, appetite loss, weakness, dizziness, chest discomfort, nose bleed, hearing changes.

Potential Health Effects

Target Organs: brain, heart, lungs, skin, blood
Primary Entry Routes: inhalation, ingestion, skin absorption
Acute Effects

Inhalation: The dust is highly discomforting to the upper respiratory tract and extremely toxic and may be fatal. As little as a few breaths of higher concentrations of hydrogen cyanide vapor, given off from moist material, may cause instant collapse and stop breathing.

Eye: The solid/dust is corrosive to the eyes and is capable of causing severe damage with loss of sight. The material may be absorbed in toxic amounts through the eyes.

Skin: The solid/dust is highly discomforting to the skin and it is absorbed by the skin and may be fatal. The material is capable of causing chemical burns, ulceration and skin reactions which may lead to dermatitis. Exposure limits with "skin" notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard.
The material may cause second degree burns and deep ulcers. Prolonged or repeated skin contact with low concentrations of the dust may result in `cyanide rash' characterized by itching and skin eruptions.

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Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The solid/dust is extremely toxic and may be fatal if swallowed unless immediate treatment is applied.
The adult lethal dose is less than 250 mg.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Cyanide prevents body cells from using oxygen.
Overexposure causes headache, dizziness, sweating, ineffective breathing and nausea which can be followed by a weak and irregular heartbeat, unconsciousness, convulsions, coma and death. Chronic exposure may interfere with iodine uptake by the thyroid and lead to its enlargement and related thyroid disorders. Loss of weight and appetite, mental deterioration, weakness and nervous system abnormalities may result.
Sodium cyanide is alkaline and is irritating and corrosive to body tissue.
Repeated minor contact causes cyanide rash, also itching, papules (small, superficial raised spots on the skin).
Inhalation may result in obstruction, bleeding, sloughs and in some cases perforations of the septum.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove to fresh air, lay down and rest.
If not breathing, ensure clear airway, apply resuscitation.
Keep patient warm.
Use approved cyanide antidote kit.
Transport to hospital.

Eye Contact: Immediately hold eyes open and flush continuously with running water for at least 15 minutes. Ensure irrigation under eyelids.
Seek medical attention without delay.

Skin Contact: Quickly but gently, wipe material off skin with a dry, clean cloth.
Immediately 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: IMPORTANT: ESTABLISH A FIRST AID PLAN BEFORE WORKING WITH CYANIDES.
ANTIDOTES SHOULD BE AVAILABLE ON SITE.
In all cases of cyanide exposure get medical help urgently after administering first aid.
NOTE: Amyl nitrite is no longer considered to have an antidotal role in the treatment of real or suspected cyanide poisoning. As a first aid measure its disadvantages include: (i) Vasodilatory effects may promote fatal cardiac arrhythmias (particularly if the patient is not really poisoned by cyanide), (ii) Disguise of any arrhythmias or respiratory stimuli used as an indication of true cyanide poisoning, (iii) Its role as a competitive inducer of methemoglobin in the blood-stream is highly variable and, alone, may produce levels of methemoglobin as low as 5% only.(iv) An increase in use of nitrite "poppers" as aphrodisiacs introduces substance-abuse problems.
For cyanide poisonings by any route:
1. Contact Poison Control Center.
2. Seek immediate medical attention.
3. Place casualty in coma position.
4. Give oxygen when available.
5. Consider external cardiac compression, mechanical resuscitation and use of antidote kit.
6. If breathing stops mouth-to-mouth resuscitation may be given only as a last resort. Should such resort prove necessary, first wash the casualty's mouth and lips. A first aid attendant must not inhale the expired air of the casualty.

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

Note to Physicians:
1.Signs & symptoms of acute & cyanide poisoning reflect cellular hypoxia and are often non-specific.
2.Cyanosis may be a late finding.
3.A bradycardia, hypertensive and tachypneic patient suggests poisoning especially if CNS and cardiovascular depression subsequently occurs.
4.Immediate attention should be directed towards assisted ventilation, administration of 100% oxygen, insertion of intravenous lines and institution of cardiac monitoring.
5.Obtain an arterial blood gas immediately and correct any severe metabolic acidosis (pH below 7.15).
6.Mildly symptomatic patients generally require supportive care alone.
Nitrites should not be given indiscriminately - in all cases of moderate to severe poisoning, they should be given in conjunction with thiosulfate.
As a temporizing measure supply amyl nitrite perles (0.2 mL inhaled 30 seconds every minute) until intravenous lines for sodium nitrite are established. 10 mL of a 3% solution is administered over 4 minutes to produce 20% methemoglobin in adults. Follow directly with 50 mL of 25% sodium thiosulfate, at the same rate, IV. If symptoms reappear or persist within 1/2-1 hour, repeat nitrite and thiosulfate at 50% of initial dose.
As the mode of action involves the metabolic conversion of the thiosulfate to thiocyanate, renal failure may enhance thiocyanate toxicity.
7.Methylene blue is not an antidote.

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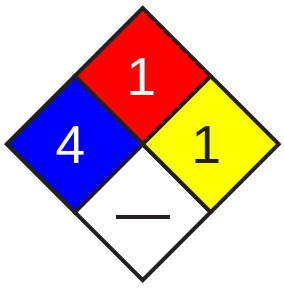
Section 5 - Fire-Fighting Measures

Flash Point: -17.8 °C Closed Cup
Extinguishing Media: Dry chemical powder.
Vaporizing liquid.
Do NOT use carbon dioxide (CO_2) or acidic chemical extinguishers.
General Fire Hazards/Hazardous Combustion Products: Pollutant.
Noncombustible.
Dangerous hazard when exposed to heat or flame.
Contact with acids produces toxic fumes.
Decomposes on heating and produces toxic fumes of hydrogen cyanide, nitrogen oxides (NO_x).
Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
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.
Cool fire-exposed containers with water spray from a protected location.
Fight fire from a safe distance, with adequate cover.

See DOT ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Environmental hazard - contain spillage. Clean up all spills immediately.
Wear protective clothing, gloves, safety glasses and dust respirator.
Use dry clean-up procedures and avoid generating dust.
Sweep up.
Vacuum up or sweep up.
Place in suitable containers for disposal.
Large Spills: Pollutant - contain spillage. 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.
If contamination of drains or waterways occurs, advise emergency services.
Stop leak if safe to do so.
Increase ventilation.
Avoid generating dust.
Recover uncontaminated product in clean, dry, labeled containers.
Collect residues and seal in labeled drums for disposal.
Wash spill area with large quantities of water.
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).

See DOT ERG

Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Use good occupational work practices.
Avoid generating and breathing dust.
Avoid contact with skin and eyes.
Wear personal protective equipment when handling.
When handling, DO NOT eat, drink or smoke.
Avoid contact with incompatible materials.
Avoid sources of heat.
Avoid physical damage to containers.
Use in a well-ventilated area.
Keep containers securely sealed when not in use.
Wash hands with soap and water after handling.
Launder contaminated clothing before reuse.
Recommended Storage Methods: Glass container; plastic container.
Plastic drum.
Polylined drum.
Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Regulatory Requirements: Follow applicable OSHA regulations.

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Section 8 - Exposure Controls / Personal Protection

Engineering Controls: If inhalation risk exists, wear NIOSH-approved respirator.
Local exhaust ventilation usually required.
Personal Protective Clothing/Equipment:
Eyes: Chemical goggles. Full face shield.
Safety glasses with side shields.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Impervious gloves; rubber gloves.
Rubber boots.
Respiratory Protection:
Exposure Range >5 to <25 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 25 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: poor warning properties
Other: Eyewash unit. Overalls. Laboratory coat. Rubber apron.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Information applies to the cynaide ion which is a constituent of a number of cyanide compounds.
Physical State: Divided solid
Vapor Pressure (kPa): Negligible
Formula Weight: 26.02
pH: Not applicable
Boiling Point: Varies
Freezing/Melting Point: Varies
Volatile Component (% Vol): Negligible
Water Solubility: Soluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Contact with acids produces toxic fumes.
Sodium cyanide is deliquescent and is gradually decomposed on exposure to air by reaction with carbon dioxide and moisture forming hydrogen cyanide gas.
Storage Incompatibilities: Avoid reaction with oxidizing agents. Avoid strong acids, bases.
Avoid contamination of water, foodstuffs, feed or seed.

Section 11 - Toxicological Information

Toxicity
Intraperitoneal (mouse) LD_{50}: 3 mg/kg

Irritation
Nil reported

See *RTECS* GS 7175000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Waste solutions can be reacted with ferrous sulfate to form relatively non-toxic ferrocyanide, or reacted with sodium hypochlorite or calcium hypochlorite to form less toxic cyanate.
Caution: Concentrated hypochlorite should not be mixed with concentrated cyanide solutions or solid cyanide because highly toxic cyanogen chloride gas will be released.
Decontaminate empty containers. Puncture containers to prevent reuse.
Bury empty containers at an authorized landfill.

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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: Cyanides, inorganic, solid, n.o.s.
ID: UN1588
Hazard Class: 6.1 - Poisonous materials
Packing Group: I - Great Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB7, IP1, N74, N75
Packaging: **Exceptions:** None **Non-bulk:** 211 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 kg **Cargo aircraft only:** 50 kg
Vessel Stowage: **Location:** A **Other:** 52

Shipping Name and Description: Cyanides, inorganic, solid, n.o.s.
ID: UN1588
Hazard Class: 6.1 - Poisonous materials
Packing Group: II - Medium Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB8, IP2, IP4, N74, N75
Packaging: **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg
Vessel Stowage: **Location:** A **Other:**

Shipping Name and Description: Cyanides, inorganic, solid, n.o.s.
ID: UN1588
Hazard Class: 6.1 - Poisonous materials
Packing Group: III - Minor Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB8, IP3, N74, N75
Packaging: **Exceptions:** 153 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** 100 kg **Cargo aircraft only:** 200 kg
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 43/60

Material Name: Benzo(a)pyrene **CAS Number:** 50-32-8
Chemical Formula: $C_{20}H_{12}$
EINECS Number: 200-028-5
ACX Number: X1002798-4
Synonyms: B(A)P; BAP; BENZO(D,E,F)CHRYSENE; 3,4-BENZOPIRENE; 1,2-BENZOPYRENE; 3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(A)PYRENE; 3,4-BENZPYREN; 3,4-BENZ(A)PYRENE; 3,4-BENZPYRENE; BENZ(A)PYRENE; BENZ[A]PYRENE; 3,4-BENZYLPYRENE; 3,4-BENZYPYRENE; 3,4-BP; BP; COAL TAR PITCH VOLATILES: BENZO(A)PYRENE
Derivation: Synthesized from pyrene and succinic anhydride.
General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo(a)pyrene	50-32-8	ca 100% wt

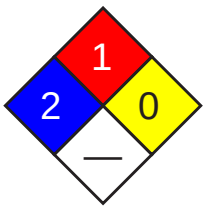
Except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PEL
TWA: 0.2 mg/m^3.

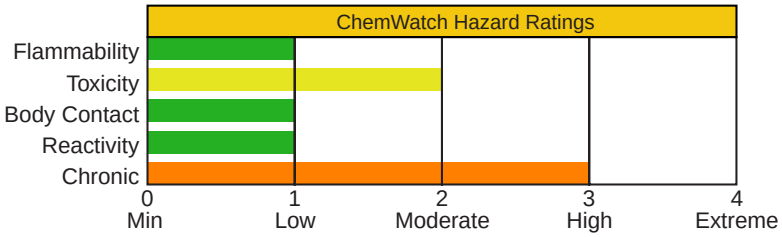
NIOSH REL

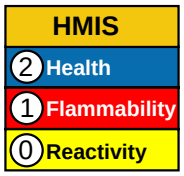
ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Pale yellow, crystalline solid or powder. Irritating to skin, eyes, respiratory tract. Chronic Effects: carcinogen, mutagen. Handle with extreme caution!

Potential Health Effects

Target Organs: Respiratory system, bladder, kidneys, skin.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects
Inhalation: Respiratory tract irritation. Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).

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Eye: Irritation and/or burns on contact.
Skin: Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization).
Ingestion: None reported.
Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.
Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.
Chronic Effects: Inhalation: Cough and bronchitis. Eye: Photosensitivity and irritation. Skin: Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization). Other: Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.

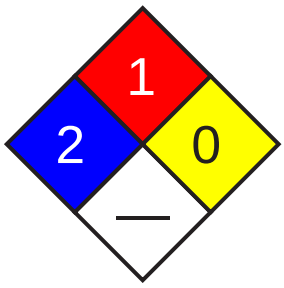
Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.
Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.
Special Precautions/Procedures: Emergency personnel should protect against exposure.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

Flash Point: None reported. Benzo(a)pyrene may burn, but does *not* readily ignite.
Autoignition Temperature: None reported.
LEL: None reported.
UEL: None reported.
Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.
General Fire Hazards/Hazardous Combustion Products: Carbon monoxide and carbon dioxide.
Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.
Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.
Large Spills: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways. *Do not* dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After

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cleanup is complete, thoroughly decontaminate all surfaces. *Do not* reuse contaminated cleaning materials.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.
Recommended Storage Methods: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.
Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV1, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semiannual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.
Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.
Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure- demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.
Other: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Pale yellow monoclinic needles with a faint, aromatic odor.
Physical State: Solid
Vapor Pressure (kPa): >1 mm Hg at 68 °F (20 °C)
Formula Weight: 252.30
Specific Gravity (H_2O=1, at 4 °C): 1.351
Boiling Point: >680 °F (>360 °C); 590 °F (310 °C) at 10 mm Hg
Freezing/Melting Point: 354 °F (179 °C)
Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)

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Other Solubilities: Ether, benzene, toluene, xylene, alcohol, methanol. concentrated hydrosulfuric acid; sparingly soluble in

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone. Hazardous polymerization cannot occur. Avoid heat and ignition sources and incompatibles.

Storage Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Irritation Effects:

Mouse: 14 µg caused mild irritation.

Other Effects:

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Tumorgenicity, mouse, oral: 75 mg/kg administered to the female during the 12- 14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Mouse, inhalation: 200 ng/m^3/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

Human, lung cell: 1 µmol/L caused DNA damage.

Human, liver cell: 100 nmol/L caused DNA damage.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

See *RTECS* DJ3675000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr). It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils. It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.

Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.

BCF: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp*), snails (*Litternia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.

Octanol/Water Partition Coefficient: log K_{ow} = 6.04

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

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Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.
ID: UN3077
Hazard Class: 9 - Miscellaneous hazardous material
Packing Group: III - Minor Danger
Symbols: G - Technical Name Required
Label Codes: 9 - Class 9
Special Provisions: 8, 146, B54, IB8, N20
Packaging: **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U022 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1 lb (0.454 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 51/60

Material Name: Diesel Fuel Oil No. 2-D **CAS Number:** 68334-30-5
Chemical Formula: Un
Structural Chemical Formula: Unspecified; variable
EINECS Number: 269-822-7
ACX Number: X1012054-0
Synonyms: AUTOMOTIVE DIESEL OIL; DIESEL FUEL; DIESEL FUEL OIL NO. 2-D; DIESEL OIL (PETROLEUM); DIESEL OILS; DIESEL TEST FUEL; FUELS,DIESEL; OLEJ NAPEDOWY III; SANTOS MOOMBA DISTILLATE
Derivation: Fuel oil may be a distilled fraction of petroleum, a residuum from refinery operations, a crude petroleum or a blend of two or more of these.
General Use: This medium viscosity residual fuel oil has both light and heavy grades, and is used in furnaces and boilers of utility and industrial power plants, ships, locomotives, and metallurgical operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Diesel fuel oil no. 2-D	68334-30-5	ca 100% vol;

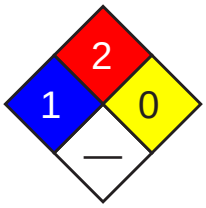
diesel fuels consist primarily of aliphatic (64% vol), aromatic (35% vol), and olefinic (1-2% vol) hydrocarbons.
Trace Impurities: May contain sulfur (< 0.5), benzene (<100 ppm), and additives such as sulfurized esters.

OSHA PEL

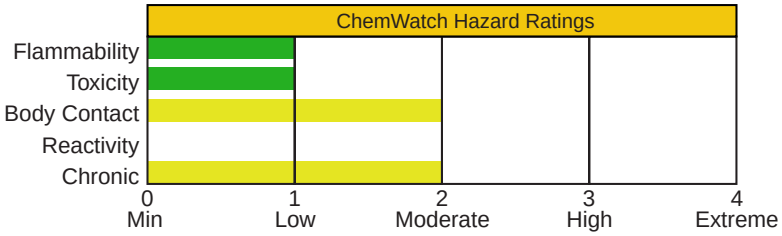
NIOSH REL

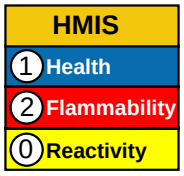
ACGIH TLV
TWA: 100 mg/m^3; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Brown, slightly viscous liquid; kerosene-like odor. Irritating to skin/respiratory tract. Other Acute Effects: headache, nausea, vomiting, diarrhea, CNS depression, tachycardia, cyanosis, pulmonary edema, liver/kidney injury. Flammable.

Potential Health Effects

Target Organs: Skin, CNS, cardiovascular system (CVS), respiratory system, liver, kidneys
Primary Entry Routes: Inhalation, ingestion, skin contact/absorption
Acute Effects
Inhalation: Euphoria, respiratory irritation, cardiac dysrhythmia, increased respiration rates, cyanosis, pulmonary edema, hemoptysis (spitting up blood from the respiratory tract), respiratory arrest, renal (kidney) and liver injury, and CNS toxicity can result from inhalation of diesel fuel oil no. 2-D mist or vapor.
Eye: Contact may result in irritation.
Skin: Contact may cause irritation, systemic effects, and block the sebaceous (oil) glands, resulting in a rash of acne-like pimples and spots, usually on the arms and legs.

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Ingestion: Gastrointestinal irritation, vomiting, diarrhea, and in severe cases, CNS depression progressing to coma and death and other systemic effects can result. Aspiration can result in transient CNS depression or excitement, hypoxia, infection, pneumatocele (abnormal cavities in lungs) formation, and chronic lung dysfunction.

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.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Prolonged or repeated skin contact causes dermatitis and possible systemic toxicity. Prolonged or repeated inhalation can cause CNS and peripheral nervous system damage.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develops.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water followed by washing the exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Have the *conscious and alert* person drink 1 to 2 glasses of water. Contact a poison control center. Because of aspiration risk, *do not* induce vomiting unless the poison control center advises otherwise.

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

Note to Physicians: Gastric lavage is contraindicated due to aspiration risk. Instead, consider administration of charcoal or milk. If ingestion amount is large, gastric emptying in the alert patient can be accomplished through administration of Syrup of Ipecac. Treat overexposure symptomatically and supportively.

Section 5 - Fire-Fighting Measures

See DOT ERG

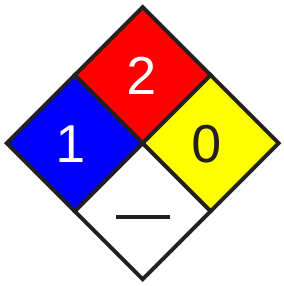
Flash Point: 100.4 °F (38 °C), Closed Cup

Autoignition Temperature: 351-624 °F (177-329 °C)

LEL: 1.3% v/v

UEL: 75% v/v

Flammability Classification: OSHA Class II Combustible Liquid



Fire Diamond

Extinguishing Media: Use dry chemical, carbon dioxide, foam, low velocity water fog or spray. Use a smothering technique to extinguish fire. Water may be ineffective in putting out a fire involving diesel fuel oil no. 2-D, and a solid water stream may spread the flames; however, a water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.

General Fire Hazards/Hazardous Combustion Products: Heating diesel fuel oil no. 2-D to decomposition can produce acrid smoke and irritating vapors. Vapor or mist can form explosive mixtures in air. In still air, the heavier-than-air vapors of diesel fuel oil no. 2-D from a large source may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A fire fighting foam may be used to suppress vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

Small Spills: Absorb diesel fuel oil no. 2-D with vermiculite, earth, sand or similar material.

Large Spills: For large spills, consider downwind evacuation of at least 1000 ft (300 m). Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Ground all equipment. Use non-sparking tools. Spills can be absorbed with materials such as peat, activated carbon, polyurethane foam, or straw. Sinking agents, gelling agents, dispersants, and mechanical systems can also be use to treat oil spills.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves (or use barrier cream), and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers. .
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials. Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations. Also 29 CFR 1910.106 for Class II Combustible Liquid.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Enclose operations and/or provide local exhaust ventilation appropriately designed for flammable mist and vapor at the site of chemical release. Where possible, transfer diesel fuel oil no. 2-D from drums or other storage containers directly to process containers. Minimize sources of ignition in surrounding low-lying areas.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets. Wear protective eyeglasses, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), use an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Brown, slightly viscous; kerosene-like odor.

Physical State: Liquid
Odor Threshold: 0.7 ppm
Vapor Pressure (kPa): < 0.1 mm Hg at 68 °F (20 °C)
Vapor Density (Air=1): > 6
Formula Weight: N/A
Specific Gravity (H_2O=1, at 4 °C): < 0.86
Boiling Point: 340-676 °F (171-358 °C)
Freezing/Melting Point: -29.2 °F (-34 °C)
Viscosity: 1.9-4.1 centistoke at 104 °F (40 °C)
Surface Tension: 23-32 dynes/cm at 68 °F (20 °C)
Water Solubility: Insoluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Diesel fuel oil no. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Exposure to heat and ignition sources.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of diesel fuel oil no. 2-D can produce low molecular weight hydrocarbons, hydrocarbon derivatives, carbon oxides (CO_x), and sulfur oxides (SO_x).

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Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 7500 mg/kg.
Acute Skin Effects:
Rabbit, skin, LD: > 5 mL/kg.
Irritation Effects:
Rabbit, skin, standard Draize test: 500 µL/24 hr, resulted in severe reaction.
Other Effects:
Rat, inhalation: 2 g/m^3/6 hr/3 weeks, intermittently, resulted in changes in blood erythrocyte (RBC) count, and focal fibrosis (pneumonoconiosis) and other changes in the lung, thorax or respiration.
Rat, inhalation: 400 $\mu g/m^3$/16 hr/2.5 years, intermittently, caused other changes in the blood, and biochemical effects - transaminases.
Rabbit, skin: 80 mL/kg/12 days, continuously, resulted in other changes in the liver, kidney, ureter, and bladder, and death.

See *RTECS* HZ1800000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Diesel fuel oil no. 2-D will evaporate from water or soil. In surface water, it may partition from the water column to suspended sediments. Biodegradation may occur in soil and water.
Ecotoxicity: Juvenile American shad, salt water TL_m: 204 mg/L/24 hr; mallard duck, LD_{50}=20 mg/kg.

Section 13 - Disposal Considerations

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

Section 14 - Transport Information

DOT 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: Diesel fuel
ID: NA1993
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols: D - Domestic transportation
Label Codes: None
Special Provisions: 144, B1, IB3, T4, TP1, TP29
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L
Vessel Stowage: **Location:** A **Other:**

Shipping Name and Description: Diesel fuel
ID: UN1202
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols: I - International transportation
Label Codes: 3 - Flammable Liquid
Special Provisions: 144, B1, IB3, T2, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

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Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

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Appendix I

Chemical Hazard Data Table

Chemical Hazard Data Table

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Benzene [71-43-2]	9.24	34-119	Inh Abs Ing Con	Irritates eyes, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone-marrow depression; carcinogenic.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 ppm 0.5 ppm 0.1 ppm	5 ppm 2.5 ppm 1 ppm	PEL TLV REL	Ca 500 ppm
Chlorodiphenyl (42% chlorine) See polychlorinated biphenyls (PCB) [53469-21-9]	ND	ND	Inh Abs Ing Con	Irritated eyes; chloracne; liver damage; carcinogenic.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m^3 (skin) 1 mg/m^3 (skin) 0.001 mg/m^3 Ca		PEL TLV REL	Ca 10 mg/m^3
Chlorodiphenyl (54% chlorine) See polychlorinated biphenyls (PCB) [11097-69-1]	ND	ND	Inh Abs Ing Con	Irritated eyes and skin; acne-form dermatitis; carcinogenic in animals; causes liver damage.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.5 mg/m^3 (skin) 0.5 mg/m^3 (skin) 0.001 mg/m^3 Ca		PEL TLV REL	Ca 5 mg/m^3
Coal tar pitch volatiles [65996-93-2]	ND	ND	Inh Con	Eye sensitivity to light, eye, and skin irritation; dermatitis, bronchitis; carcinogenic.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.2 mg/m^3 0.2 mg/m^3 0.1 mg/m^3* *-cyclohexane extractable fraction		PEL TLV REL	Ca 80 mg/m^3
1,1-Dichloroethane (Ethylidene chloride) [75-34-3]	11.06	NA	Inh Ing Con	Irritated skin; central nervous system depression; liver, kidney, lung damage.	Eye: Irrigate immediately Skin: Soap flush prompt Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm		PEL TLV REL	3,000 ppm
1,2-Dichloroethene [540-59-0]	9.65	17	Inh Ing Con	Irritated eyes and respiratory system; depressed central nervous system.	Eye: Irrigate immediately Skin: Soap wash prompt Breath: Respiratory support Swallow: Immediate medical attention	200 ppm 200 ppm 200 ppm		PEL TLV REL	4,000 ppm
Ethylbenzene [100-41-4]	8.76	NA	Inh Ing Con	Irritated eyes, skin, mucous membranes; headache; dermatitis, narco, coma	Eye: Irrigate immediately Skin: Water flush prompt Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	125 ppm 125 ppm	PEL TLV REL	800 ppm

Chemical Hazard Data Table

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Fuel oil (diesel oil, medium)	ND	ND	Inh Ing Con	Ingestion causes nausea, vomiting, and cramps; depressed central nervous system, headache, coma, death; pulmonary irritation; kidney and liver damage; aspiration causes severe lung irritation, coughing, gagging, dyspnea, substernal stress, pulmonary edema; broncho-pneumonia; excited, then depressed, central nervous system.	Eye: Irrigate immediately Skin: Soap flush prompt Breath: Respiratory support Swallow: Immediate medical attention				
Lead, elemental & inorganic compounds, as Pb [7439-92-1]	NA	NA	Inh Ing Con	Weakness, lassitude, insomnia; facial pallor; eye pallor, anorexia, low body weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremors; wrist and ankle paralysis; brain damage; kidney damage; irritated eyes; hypotension.	Eye: Irrigate immediately Skin: Soap flush prompt Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m^3 0.05 mg/m^3 < 0.1 mg/m^3* * Blood Pb < 0.06 mg/100 g whole blood		PEL TLV REL	100 mg/m^3
Methylene chloride (dichloromethane) [75-09-2]	11.32	NA	Inh Abs Ing Con	Fatigue, weakness, sleepiness, lightheadedness; numbness and tingling in limbs; nausea; irritated eyes and skin.	Eye: Irrigate immediately Skin: Soap wash prompt Breath: Respiratory support Swallow: Immediate medical attention	25 ppm 50 ppm Lowest feasible concentration		PEL TLV REL	Ca 2,300 ppm
Bis(2-ethylhexyl) phthalate	ND	ND	Inh Ing Con	Very low toxicity. Injection may cause escape of fluids into the tissues. Slight eye irritation.	Eye: Irrigate immediately Skin: Water flush Breath: Respiratory support Swallow: Immediate medical attention	NA Rat LD_{50} = 30.6 mg/kg		PEL TLV REL	

Chemical Hazard Data Table

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Polychlorinated biphenyls (PCB) (Aroclor 1242) [53469-21-9] and (Aroclor 1254) [11097-69-1]	ND	ND	Inh Ing Abs Con	Aroclor 1242: irritated eyes; chloracne; acneform dermatitis; mildly toxic by ingestion; poison by subcutaneous route; carcinogenic. Aroclor 1254: irritated eyes and skin; acne-form dermatitis; poison by intravenous route; moderately toxic by ingestion and intraperitoneal routes; carcinogenic.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	Aroclor 1242: 1 mg/m^3 (skin) 1 mg/m^3 (skin) 0.001 mg/m^3 Aroclor 1254: 0.5 mg/m^3 (skin) 0.5 mg/m^3 (skin) 0.001 mg/m^3		PEL TLV REL PEL TLV REL	Ca 10 mg/m^3 Ca 5 mg/m^3
Toluene (Toluol) [108-88-3]	8.82	0.16-37	Inh Abs Ing Con	Fatigue, weakness; confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; nervousness, muscular fatigue, insomnia; paralysis; dermatitis.	Eye: Irrigate immediately Skin: Soap wash prompt Breath: Respiratory support Swallow: Immediate medical attention	200 ppm 50 ppm 100 ppm	C 300 ppm 150 ppm	PEL TLV REL	500 ppm
1,1,1-Trichloroethane (methyl chloroform) [71-55-6]	11.0	390	Inh Ing Con	Headache, lassitude; central nervous system depression, poor equilibrium; irritated eyes; dermatitis; cardiac arrhythmia.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	350 ppm 350 ppm	350 ppm* * - 15 min	PEL TLV REL	700 ppm
Trichloroethene (TCE) [79-01-6]	9.45	21.4	Inh Ing Con	Headache, vertigo; visual disturbance, tremors, somnolence, nausea, vomiting; irritated eyes; dermatitis; cardiac arrhythmia, paresthesia; carcinogenic.	Eye: Irrigate immediately Skin: Soap wash prompt Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 50 ppm 25 ppm	C 200 ppm 100 ppm	PEL TLV REL	Ca 1,000 ppm

Chemical Hazard Data Table

Notes:
a = ionization potential
b = route into body; inh = inhalation, ing = ingestion, abs = absorption, con = contact
c = time-weighted average
d = short-term exposure limit
e = Source for TWA and STEL values.
    PEL = permissible exposure limit (OSHA)
    TLV = threshold limit value (ACGIH)
    REL = recommended exposure limit (NIOSH)
f = immediately dangerous to life and health
ND = Not Detected
NA = Not Applicable

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Appendix J

Job Safety Analyses

Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Construction
Work Type:	Const/Remediation - Excavation of Contaminated Soils
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Hearing Protection
Level D
Protective Gloves - type dependent on job-specific requirements
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Working outdoors and near water	Working outdoors Environmental hazards: sun, heat, cold, insects, hazardous plants; working near water	Environmental hazards: sun, heat, cold, insects, hazardous plants Avoid work in extreme weather conditions, stop work if extreme weather is imminent, inspect area for hazardous plants & insects. Wear appropriate clothes for the area: long sleeves and gloves in overgrown areas, use sunscreen and hat. Monitor for heat and cold stress. Use buddy system when working near river. Avoid slippery terrain.
Pre-shift Safety Inspection	Accidents associated with equipment maintenance and repair	Complete the equipment checklist at the start of each day. Record and report the status of the equipment. Visually inspect equipment (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition?).
Clear excavation locations.	Overhead and underground installations.	Reference Overhead and Underground Utility Checklist. Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. Mark out the proposed excavation locations. Call underground utility locating service for public line location clearance, and get list of utilities being contacted.
Set up necessary traffic control.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	Use buddy system for placing traffic control, place cones around area.
Set up exclusion zone(s), stockpile area and establish work areas.	Struck by vehicle during placement. Vehicle accident as Injury or exposure to other onsite	Implement exclusion zone set-up instructions of HASP. Set up clear walking paths between work stations.

	personnel. Slip/fall hazards. Onsite vehicular accident with heavy equipment.	
Hand dig where necessary to expose and protect underground installations as needed.	Damage to lines (and associated physical hazards or property damage). Back strain. Injury or vehicle damage from falling into holes.	Use hand tools when near buildings possible. Use proper lifting techniques – avoid heavy loads, use two person lifts. Barricade/cover holes until job is complete.
Assist with set up of heavy equipment	Struck by equipment. Damage caused by heavy equipment while accessing set-up location.	Verify clear pathway to excavation and stockpiling locations. Provide as-needed hand signals and guidance to driver to place rig. Maintain eye contact with operator.
Entering and exiting the cab	Physical injuries while climbing in and out of the cab.	Use three points of contact at all times and watch for pinch points. Watch for low overhead clearance.
Operation of Equipment	Injury or damage to personnel or equipment.	Wear seat belts at all times, pay attention to condition of equipment at all times, use emergency break when applicable. Maintain safe working distance from equipment.
Commence excavation	Struck by equipment. Heat or cold exposure. Exposure to chemical hazards. Hitting an underground or overhead utility. trip and fall. Side wall cave in, Equipment failure. Noise.	Monitor weather conditions and take breaks as needed for cold or hot weather. Use proper PPE and air monitoring in accordance with HASP. Review action levels included in HASP. Maintain required excavation set-backs for workers and equipment and monitor condition of side walls and surrounding ground conditions. Keep work area clear of tripping or slipping hazards. Perform periodic visual inspections of heavy equipment and keep it at least 5 ft from excavation edge. Perform necessary characterization by competent person – document inspection on BBL Excavation Inspection Form. Slope/bench walls or shore excavation to prevent cave in. Keep all spoils > 2 ft from excavation edge. Use agreed-upon hand signals with heavy equipment operators. Only enter excavation in compliance with OSHA and associated requirements. Maintain eye contact with equipment operators
Store excavated materials properly in accordance with site-specific requirements.	Exposure to onsite personnel. Traffic hazard or obstruction other onsite operations. Improper storage or disposal	Have proper storage containment and labeling available onsite. Place materials in location designated in work plan. Cover and barricade access to waste in accordance with local regulations. Coordinate proper disposal offsite (where applicable).
Dewater excavation (if necessary)	Exposure to contaminants. Explosion from static electricity. Collapse of side walls. Electrical shock.	Wear PPE in accordance with HASP. Ground dewatering equipment. Maintain safe setback from excavation walls. Use GFCI and inspect cords.
Backfill excavation (if necessary)	Struck by heavy equipment. Side wall collapse. Future damage or accidents resulting from subsidence.	Use agreed-upon hand signals with heavy equipment operators. Only enter excavation in compliance with OSHA and associated requirements. Compact soils to meet specifications. Maintain eye contact with equipment operators.
Clean site/demobilize	Traffic. Safety hazard left on site. Lifting hazards.	Use buddy system as necessary to remove traffic control. Leave site clean of refuse and debris. Notify site personnel of departure. Use proper lifting techniques or use mechanical assistance.

Initial - In Progress - 02/06/2007 09:42 AM EST

Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Environmental Cleaning and Sampling
Work Type:	Environmental - Work Zone Set Up
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Level D
orange traffic safety vest
Personal Flotation Device
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Working outdoors	Environmental hazards: sun, heat, cold, insects, hazardous plants and animals. Slips, trips, and falls. Working near water.	Avoid work in extreme weather conditions and stop work if extreme weather is imminent. Inspect area for hazardous plants, insects, and animals. Wear appropriate clothes for the area: long sleeves in overgrown/thorny areas, use sunscreen and hat when appropriate. Monitor for heat and cold stress. Watch footing and wear appropriate footwear with ankle support. Keep a safe distance from water and use the buddy system.
Clearing and grubbing	Environmental hazards: sun, heat, cold, insects, hazardous plants and animals. Slips, trips, and falls. Electric and equipment hazards	Avoid work in extreme weather conditions and stop work if extreme weather is imminent. Inspect area for hazardous plants, insects, and animals. Wear appropriate clothes for the area: long sleeves in overgrown/thorny areas, use sunscreen and hat when appropriate. Monitor for heat and cold stress. Watch footing and wear appropriate footwear with ankle support. Wear proper safety equipment for working with equipment (saw, chipper, etc.). See the JSA for clearing and grubbing.
Traffic safety	Struck by vehicle, vehicle accident due to improper traffic control	Use safe driving procedures; use buddy system to set up traffic controls; place cones around work areas; wear orange safety vest in high traffic areas.
Set up work areas	Heavy lifting; slips, trips and falls; steep slopes; pinch points	Always use three point mount/dismount. Use correct lifting practices. Use two people to life objects over 50 lbs or in areas that are difficult to navigate. Do not stack objects, and organize materials for easy carrying. Wear appropriate PPE.
Working with heavy equipment	Inspect equipment prior to use; accidents associated with equipment use (falling, muscle tears, head injuries, hot surfaces, pinch points, falling, etc.)	Complete daily inspection; maintain 3-points of contact when entering/exiting equipment; use proper lifting techniques and body positioning; keep hands away from swivel points; wear proper PPE
Remove work zones	Heavy lifting; slips, trips and falls; steep slopes; pinch points	Always use three point mount/dismount. Use correct lifting practices. Use two people to life objects over 50 lbs or in areas that are difficult to navigate. Do not stack objects, and organize materials for easy carrying. Wear appropriate PPE.

Initial - In Progress - 02/06/2007 09:36 AM EST

Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Construction
Work Type:	Const/Remediation - Chain Link Fence Installation
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Hearing Protection
Level D
Protective Gloves - cut-resistant work gloves
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Mobilize equipment to work area.	1. Struck by vehicle; 2. Slips/trips/falls when walking to work areas; 3. Strain from carrying heavy loads/ unloading vehicle.	1. Be alert when moving to work area- watch for traffic and wear safety vest to be more visible to others; 2. Ensure walkways are dry, oil free and free of trip hazards; 3. Do not carry more than can easily be managed. 3. Use a partner to unload heavy loads. 3. Use a wheel barrow to transport awkward or heavy loads.
Cut boards to hold up the fencing.	1. Electrocution; 2. Lacerations; 3. Noise; 4. Wood shavings flying into eye/skin	1. Plug saw into GFCI device; 2. Do not remove guards from saw. 2. Wear protective gloves when operating saw. 2. Keep fingers/hand out of the way of the saw blade. 3. Wear hearing protection when operating saw; 4. Wear safety glasses, long pants and protective gloves to prevent wood shavings from contacting body.
Erect boards for fence support to loading dock.	1. Electrocution; 2. Strain from using incorrect drill bit or screws; 3. Bruise / laceration from clothing getting caught in drill.	1. Inspect drill prior to use- Do not use drill if damaged. 1. Plug drill into GFCI device; 2. Use correct drill bit and screws to prevent unnecessary strain on body when drilling; 3. Do not wear loose fitting clothing to prevent clothes from getting tangled into drill.
Attach snow fencing to boards to complete fence.	1. Pinch points between zip tie and board; 2. Wind blowing snow fencing out of hands; 3. Motorists do not see fence and fall over the loading dock edge.	1. Keep fingers out of the way when attaching snow fencing to boards with zip cords; 2. Use at least two people to hold down snow fencing while attaching snow fencing to boards to ensure the snow fencing does not blow away; 3. Ensure snow fencing a contrasting color to surrounding area to prevent motorists from falling off the loading dock.
Demobilize equipment from work area.	1. Struck by vehicle; 2. Slips/trips/falls when walking to work areas; 3. Strain from carrying heavy loads/ loading vehicle.	1. Be alert when moving from work area- watch for traffic and wear safety vest to be more visible to others; 2. Ensure walkways are dry, oil free and free of trip hazards; 3. Do not carry more than can easily be managed. 3. Use a partner to unload heavy loads. 3. Use a wheel barrow to transport awkward or heavy loads.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Environmental Cleaning and Sampling
Work Type:	Environmental - Decontamination of Large Equipment
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Level D
Protective Gloves - Type dependent on job-specific requirements
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Working outdoors	Environmental hazards: sun, heat, cold, insects, hazardous plants and animals. Slips, trips, and falls.	Avoid working in extreme weather conditions; stop work if extreme weather is imminent; inspect area for hazardous plants, insects, and animals. Wear appropriate clothes for the area; long sleeves in overgrown/thorny areas, use sunscreen and hat. Monitor for heat and cold stress. Watch footing and wear appropriate footwear with ankle support.
Set up decontamination area.	Lifting hazards. Contamination of clean equipment	Use proper lifting techniques. Establish designated 'clean' and 'dirty' equipment staging areas. Review HASP for PPE requirements.
Decontamination procedures will be implemented for all non-disposal equipment (e.g., sampler, hand trowels, splitspoons, etc.).	Inhalation and absorption of decon fluids, slips/trips/falls, hand/eye/foot injuries (cuts), lifting hazards (sprains/strains).	Utilize appropriate PPE. Handle equipment carefully. Use proper decontamination techniques as per the sampling task (soil, surface water, groundwater investigations). Use squirt bottles instead of spray bottles to eliminate mists from solvents. Use caution if walking on wet plastic sheeting and establish decontamination boundaries to keep unauthorized personnel away from area.
Decontamination of large equipment and vehicles.	Inhalation and absorption of wash fluids, slips/trips/falls, hand/eye/foot injuries (cuts), lifting hazards (sprains/strains).	Utilize appropriate PPE with splash shield. Handle equipment carefully. Use proper decontamination techniques as per the sampling task. Caution using high pressure washing equipment and steam cleaners with the hot surfaces and water jet blast of sprayer. Check decon. area for uneven surfaces and keep eye contact with drivers when moving vehicles in and out of the decon. pad. Use caution if walking on wet plastic sheeting and establish decontamination boundaries to keep unauthorized personnel away from area.
Break down of decontamination area	Back strain, inhalation or dermal exposure to chemical hazards, slips, trips, and falls.	Use proper lifting techniques and proper PPE. Dispose of rinsate in accordance with the FSP. Use a face shield if splash hazard is present.

Initial - In Progress - 02/06/2007 10:48 AM EST

Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Environmental Cleaning and Sampling
Work Type:	Environmental - Decontamination of Small Sampling Equipment
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Level D
Long Sleeves
Protective Gloves - nitriles
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Set up decontamination area.	Lifting hazards. Contamination of clean equipment.	Use proper lifting techniques. Establish designated "clean" and "dirty" equipment staging areas. Review HASP and gather necessary PPE.
Working Outdoors	Environmental hazards: sun, heat, cold, insects, hazardous plants and animals. Slips, trips and falls.	Avoid work in extreme weather conditions, stop work if extreme weather is imminent, inspect area for hazardous plants, insects and animals. Wear appropriate clothes for the area: long sleeves in overgrown/thorny areas, use sunscreen and hat. Monitor for heat and cold stress. Watch footing, and wear appropriate footwear with ankle support.
Store cleaning equipment and chemicals.	Contamination of clean equipment. Back strain, inhalation or dermal exposure to chemical hazards, slip and fall.	Keep "dirty" equipment in designated areas. Use proper lifting techniques. Use proper PPE. Keep work area clear of tripping or slipping hazards.
Decontaminate equipment.	Back strain, inhalation or dermal exposure to chemical hazards, repetitive motion, lacerations or abrasions.	Don required PPE. Use appropriate equipment as specified in the FSP. To reduce inhalation or dermal exposure, stand upwind of decon materials/spray. Bend at knees, not waist. COC's are PCBs. Wear protective clothes to help avoid exposure.
Break down decontamination area.	Back strain, inhalation or dermal exposure to chemical hazards, slip and fall.	Use proper lifting techniques. Use proper PPE. Dispose of rinsate in accordance with FSP. Use face shield if splash hazard is present.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Environmental Removals (Equipment)
Work Type:	Const/Remediation - Heavy Equipment Operation
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Ear plugs
Hard Hat
orange traffic safety vest
Protective Gloves - Leather palmed gloves while checking fluids
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Setting up crane and tractor trailer in work area	Traffic concerns, backing heavy equipment	Set up proper work areas, use spotter when locating equipment and tractor trailer, review traffic Control Plan
Site Preparation	Unauthorized personnel in work zone	Set up Exclusion Zone, Barricades with caution Tape. Spotter during overhead lifting
Pre-shift safety inspections	Accidents with maintenance and repair.	Complete the equipment checklist prior to the start of each day. Use three points of contact when entering or exiting equipment. Watch for pinch points, fluids under pressure, and hot surfaces. Record and Report condition of equipment.
Entering and exiting the cab	Injuries climbing into or out of cab	Use three points of contact at all times entering or exiting equipment. Watch for low overhead clearance.
Startup/shutdown	Injury or damage from startup or shutdown of equipment.	Check if emergency brake has been applied. Check for any persons or materials in and around the equipment. Follow the recommendation in operation manual for startup and shutdown procedures.
Operation of Equipment	Injury or damage to personnel and equipment.	Wear seatbelt at all times. Be aware of the current site conditions and surroundings (Conditions may change throughout a shift). Keep a safe working distance between ground equipment, personnel and hazards. When approaching sloped terrain, slow down, down shift, and proceed with caution. Stay inside equipment with emergency brake on when being loaded. Pay attention to the condition of the equipment as mechanical problems could arise during shift operations.
Demobilization	Traffic concerns, backing heavy equipment	Set up proper work areas, use spotter when locating equipment, review traffic Control Plan

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Job Safety Analysis

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Date:	1/8/2007
JSA Type:	Driving and Motor Vehicles
Work Type:	Driving - Passenger Vehicle
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed

Job Steps	Potential Hazard(s)	Critical Action(s)
PRE-TRIP - Review SPSA Card	Worst case outcome of vehicle operation (blowout, breakdown, collision, injury or death).	Assess the potential hazards. Review weather and road conditions/closures before departing. Plan travel route and select alternate routes in case main roads are closed. Notify someone of your departure time/route/and ETA. Pack emergency supplies. Analyze how to reduce the risk. Act to ensure safe operation of the vehicle. Recognize SWA.
Inspect vehicle.	Unfamiliar Vehicle and controls.	Familiarize yourself with the vehicle controls before moving. Properly adjust the mirrors and seats. Assure tires are properly inflated and there is sufficient tread. Assure there are no cuts or bulges in the sidewalls. Assure windshield and window glass is clean. Lift wiper arms and check wiper blades for damage or deterioration. Check behind vehicle for obstructions.
Fasten seat belts.	Increased risk of more serious injury or death in collision.	Assure seat belt is in good condition and fastened. Assure all passenger seat belts are in good condition and fastened.
Lock doors.	Ejection from vehicle in collision. Unwanted intrusion.	Lock all doors to vehicle.
Start engine.	Unexpected movement.	Assure that transmission is in 'Park' and that parking brake is set.
Check gauges and warning lights.	Overheated engine or break-down due to lack of critical fluids.	Assure there is sufficient gas, oil and other critical fluids.
Pull out of parking space.	Collision with other vehicles, pedestrians, or stationary objects.	Check mirrors and over shoulder in all directions prior to pulling out of parking space. Signal if parallel parked along a street. Use spotter if not pulling forward out of spot.
Obey Road Rules.	Speed.	Obey all posted limits. Reduce speed during hazardous conditions (fog, rain, etc.)
Check Mirrors	Accidents due to following too close and spacing	Continually check mirrors. Use the 3 second rule for proper spacing. Regularly scan the area you will be entering in the next 10-12 seconds. Always leave yourself an out during travel. When stopping leave adequate

		space between you and the vehicle ahead of you. Do not tailgate.
Sliding and/or skidding	Skids-sliding of the road	If the vehicle has begun to skid out of control, turn the wheel in the direction of the skid. Reduce speed during hazardous conditions. Use 4 wheel drive, if available, when driving in mud.
Situational Awareness	Automobile accidents due to blind spots	Be familiar with your vehicles blind spots. Adjust mirrors to give maximum viewing area. Use turn signals when changing lanes. Avoid other driver's blind spots.
Avoid distractions	Distractions	Do not use cell phone while driving. Do not read maps while driving.
Backing up.	Collision, injury or death to occupants or other parties.	Make all backing maneuvers slowly and cautiously. Check mirrors and over shoulders. When parking, look for pull-through parking to avoid backing. Use spotter when necessary.
Parking.	Collision, injury or death to occupants or other parties.	Park away from other cars. Back into parking spot when possible and safe. Maintain cushion of safety from fixed objects. Set parking brake. If it is safe to do so, park so the first movement is forward. If parking on road place vehicle as barrier to oncoming traffic and use barricades/warning devices or cones.
POST-TRIP - Report maintenance or mechanical problems upon returning vehicle.	Conditions worsen leading to mechanical failure resulting in accident, injury or death.	Report vehicle problems immediately to company representative or rental car agency. Review JSA again to ensure best practices have been followed.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Environmental Cleaning and Sampling
Work Type:	Const/Remediation - Clearing and Grubbing
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Body Suit - Protective chaps
Hard Hat
Hearing Protection
Level D
Protective Gloves - Gloves with long sleeve shirt
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Pre-Use	Dull/Loose Chain Loose or Disconnected Fuel Lines	Review owners Manual. Check that all fuel lines are connected and not leaking Check that chain is tight to the saw Check that the teeth of the saw are not dull or missing Pull the spark plug prior to maintenance.
Working outdoors	Environmental hazards: sun, heat, cold, insects, hazardous plants and animals. Slips, trips, and falls. Working near water.	Avoid work in extreme weather conditions and stop work if extreme weather is imminent. Inspect area for hazardous plants, insects, and animals. Wear appropriate clothes for the area: long sleeves in overgrown/thorny areas, use sunscreen and hat when appropriate. Monitor for heat and cold stress. Watch footing and wear appropriate footwear with ankle support. Keep a safe distance from water and use the buddy system.
Entering and exiting the work area	Slip, trip, fall Environmental hazards; Sharp or protruding vegetation	Inform laborers of potential hazards. Watch for uneven or slippery terrain, hazardous plants/animals. Wear proper PPE. Be aware of punctures or trips from protruding brush.
Work site Preparation	Electrocution Falling/Tripping/Slipping Traffic	Check that the tree is not near or touching any electrical wires to prevent electrocution Check that the area where you are felling the tree is clear of people and/or objects that could present a hazard if struck Be aware of vines, brush and other plants growing on or around the tree. Check that you are working on a level surface where there is not a risk of losing balance and falling. Clear leaf matter and other debris out from work area to ensure stable footing. If the tree is near a roadway, make sure that approaching cars are warned of work ahead and that workers are also protected from being struck
Starting	Strains, Pulling, Tearing muscles	Consult owners manual for proper starting techniques. Use proper starting techniques. Check manufactures guide for additional methods of starting.
Equipment	Flying Objects Lacerations Burns	Wear listed PPE. Long sleeve shirts and Chaps that are resistant to cutting

Use - cutting	Falling Object Lack of training	should be worn. While cutting make sure that the muffler does not come in contact with any clothing or combustible material Be aware of falling objects, tree limbs and branches, make sure that a hard has is being used to protect the head and neck. Also make sure the chain saw is turned off when it is not in use. Use proper methods of cutting to prevent kickback of the saw during the cutting operation. Remove branches and any interfering brush first. DO NOT CLIMB THE TREE DURING CUTTING OPERATIONS
Refueling equipment	Fires Burns Spills	Make sure that the chain saw is moved a safe distance from the work area and from other people Make sure the chain saw is turned off when refueling is in progress. Wait at least five (5) minutes from the time you stopped cutting to refuel to allow for cooling.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Aquatic Investigations
Work Type:	Aquatic Inv - Surface Water Sampling / River Velocity Profiling
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Level D
Personal Flotation Device
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Mobilizing on dock and starting boat engine	Trips, slips and falls. Falling off dock, tripping while entering boat and falling into river. Engine Operation.	Watch footing on ramp and dock. Carry equipment properly and allow hands to be free if possible to hold ramp handles. Make more than one trip if necessary. Pass equipment from person on dock to person in boat. Make sure footing is steady when starting engine. Confirm that there is enough gas to complete the day's activity. Allow engine to warm up and make sure it is working properly prior to taking the boat off the dock. Always check in with the Site and/or marina before going out on the water
Driving boat	Running into other boats/docks/hazards in area. Possible chance to run into silt curtain and rip silt curtain or the possibility of getting debris stuck in engine. Falling into water. Exceptionally windy weather altering boat driving techniques. Watching where to drive boat especially during high tide.	Before driving the boat, be aware of weather conditions and any other obstacles that maybe be present on that day. Do not operate boat under adverse weather conditions (high winds, lightning). Keep attention to all small craft advisories. Keep boat speed at a reasonable level. Be aware of other boats. Be aware of construction activities. Be aware of water depth and possible shallow areas and avoid those areas. Wear PFD at all times on the boat. If someone falls out of the boat, call for help, then use the life saver attached to the line. Throw to person overboard and drag the overboard person to the shore. In case of an emergency sound fog horn on boat to get the attention the proper authorities/help. All people on the boat should face forward and be aware of the surroundings while boating. Put engine in neutral if encountering a floating obstacle or a place where you want to temporarily tie off the boat. Carry Cell phone for emergency situations with emergency contact info. Always yield to other boat traffic. Be prepared to get out of the way of other vessels. If approached by another vessel, retrieve equipment and get out of the way immediately.
Turbidity readings	Dropping equipment into water. Pinching fingers while lowering/pulling up anchor system Drifting away from monitoring station while in the process of setting up equipment. Possibility of falling into water. Equipment can begin to work improperly. Contaminated water (river)	Wear appropriate PPE (gloves)for handling equipment being placed into river. When working with monitoring equipment, make sure that safety is attached to avoid loosing equipment. Keep important pieces of equipment and paperwork in the on board bucket as to not loose important items overboard. When approaching a monitoring location, tie off to a stationary object nearby to avoid drifting away. When using anchor system, get help when needed to life block over edge and slowly lower equipment into the water to avoid damaging the boat/equipment and to avoid finger pinches or serious injury.

Docking boat and demobilizing	Running into dock or other objects while docking. Splinters while grabbing onto dock to stabilize boat. Tripping on dock and falling into water	Use gloves and care when docking boat. Keep speeds slow. Place equipment on dock or hand off to someone on the dock rather than trying to carry equipment and step out of the boat at the same time. Remove all equipment from the boat and store inside overnight to avoid damage to equipment. Keep PFD on until you are on the land side of the marina gate. MAKE SURE THAT THE BOAT IS TIED ADEQUATELY TO THE DOCK AS TO NOT DRIFT AWAY.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Environmental Cleaning and Sampling
Work Type:	Environmental - Surface Soil Sampling
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Level D
Protective Gloves - Long sleeve shirt as appropriate
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Clear sample locations.	traffic; debris; trips, slips, fall.	Coordinate with property owner to clear potential conflicts. Review proposed locations against work plan. Mark out proposed surface sample locations.
Working outdoors.	Sun, heat, cold, insects, hazardous plants, snakes, uneven footing surfaces.	Avoid work in extreme weather conditions. Stop work if extreme weather is imminent. Inspect area for hazardous plants, insects, etc. Wear appropriate clothing; long sleeves, gloves, thick pants, ankle-high boots, sunscreen, hat. Monitor for heat and cold stress. Clear area to gain firm footing.
Mobilize with proper equipment and supplies for sampling.	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment on site.	Follow safe driving procedures. Obey traffic laws and signs, maintain safe distance, inspect vehicle prior to driving. Use proper lifting techniques - lift with legs, avoid twisting and jerking movements. Review HASP and permit conditions and gather necessary PPE.
Set up traffic control.	Struck by vehicle. Vehicle accident as result of improper placement of traffic control.	Use buddy system for placing traffic control. Place cones around area, park vehicles to block traffic. Check for specific requirements based on HASP. Wear vest in high traffic areas.
Set up exclusion zones and work stations (sample collection and logging).	Struck by vehicle during set up. Slip/fall hazards.	Implement exclusion zone pursuant to HASP. Set up work stations with clear walking paths to and from sampling locations. Place containment materials and decon equipment in exclusion zone.
Collect samples	Cross contamination from previous location. Back strain, heat or cold, eye injury, exposure to chemical hazards, trip and fall, equipment failure. Improper labeling, storage or	Decontaminate sampling equipment. Use proper lifting techniques. Use PPE and air monitoring equipment in accordance with HASP. Keep work area clear of debris and tripping hazards. Keep body contact with contaminated media to a minimum (i.e., don't kneel or sit on contaminated ground surface). Label in accordance with sampling plan - double check prior to storage. Keep samples in appropriate storage

	transport of samples.	container at proper temperature, away from work area, in secure location. Perform air monitoring and be prepared to upgrade PPE based on action levels or stop work.
Site restoration.	Uneven surfaces created by sampling - slip/trip/fall.	Smooth over sampling location using trowel.
Handle investigation derived waste.	Safety hazard if left on site. Uncontrolled chemicals left on site.	Properly contain and dispose of PPE, disposable sampling equipment, decontamination materials, site trash.
Clean site/demob.	Traffic. Hazards left on site. Lifting hazards.	Use buddy system to remove traffic control. Leave site clean of refuse and debris. Clearly mark sample locations. Notify site personnel of departure. Use proper lifting techniques.
Package and deliver samples to lab.	Bottle breakage. Back strain.	Handle and package bottles carefully (bubble wrap bags). Avoid contact with tape cutter. Cut away from body and hand if using a knife. Use proper lifting techniques. Limit weight of each cooler.

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Job Safety Analysis

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Date:	1/8/2007
JSA Type:	Aquatic Investigations
Work Type:	Aquatic Inv - Sediment Sampling
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Level D
Personal Flotation Device
Protective Gloves
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Working outdoors	Environmental hazards: sun, heat, cold, insects, hazardous plants and animals. Slips, trips, and falls. Working near water.	Avoid work in extreme weather conditions and stop work if extreme weather is imminent. Inspect area for hazardous plants, insects, and animals. Wear appropriate clothes for the area: long sleeves in overgrown/thorny areas, use sunscreen and hat when appropriate. Monitor for heat and cold stress. Watch footing and wear appropriate footwear with ankle support. Keep a safe distance from water and use the buddy system.
Boat safety	Running into other boats/docks/hazards in area. Possible chance to run into silt curtain and rip silt curtain or the possibility of getting debris stuck in engine. Falling into water. Exceptionally windy weather altering boat driving techniques. Watching where to drive boat especially during high tide.	Before driving the boat, be aware of weather conditions and any other obstacles that maybe be present on that day. Do not operate boat under adverse weather conditions (high winds, lightning). Keep attention to all small craft advisories. Keep boat speed at a reasonable level. Be aware of other boats. Be aware of construction activities. Be aware of water depth and possible shallow areas and avoid those areas. Wear PFD at all times on the boat. If someone falls out of the boat, call for help, then use the life saver attached to the line. Throw to person overboard and drag the overboard person to the shore. In case of an emergency sound fog horn on boat to get the attention the proper authorities/help. All people on the boat should face forward and be aware of the surroundings while boating. Put engine in neutral if encountering a floating obstacle or a place where you want to temporarily tie off the boat. Carry Cell phone for emergency situations with emergency contact info. Always yield to other boat traffic. Be prepared to get out of the way of other vessels. If approached by another vessel, retrieve equipment and get out of the way immediately. MAKE SURE THAT THE BOAT IS TIED ADEQUATELY TO THE DOCK AS TO NOT DRIFT AWAY.
Set up sampling equipment	Back strain, lifting hazards, inhalation or dermal exposure to chemical hazards, falling into water.	Use proper lifting techniques and proper PPE. Use a face shield if splash hazard is present.
Collect	Cross contamination from	Decontaminate sampling equipment. Use proper lifting techniques. Use PPE

samples	previous location. Back strain, heat or cold, eye injury, exposure to chemical hazards, trip and fall, equipment failure. Improper labeling, storage or transport of samples.	and air monitoring equipment in accordance with HASP. Keep work area clear of debris and tripping hazards. Keep body contact with contaminated media to a minimum (i.e., don't kneel or sit on contaminated ground surface). Label in accordance with sampling plan - double check prior to storage. Keep samples in appropriate storage container at proper temperature, away from work area, in secure location. Perform air monitoring and be prepared to upgrade PPE based on action levels or stop work.
Handle investigation derived waste.	Safety hazard if left on site. Uncontrolled chemicals left on site.	Properly contain and dispose of PPE, disposable sampling equipment, decontamination materials, site trash.
Package and deliver samples to lab.	Bottle breakage. Back strain.	Handle and package bottles carefully (bubble wrap bags). Avoid contact with tape cutter. Cut away from body and hand if using a knife. Use proper lifting techniques. Limit weight of each cooler.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/8/2007
JSA Type:	Air Monitoring
Work Type:	Environmental - Air Monitoring, High Volume
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Level D
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
Working outdoors and near water	Working outdoors Environmental hazards: sun, heat, cold, insects, hazardous plants; working near water	Environmental hazards: sun, heat, cold, insects, hazardous plants Avoid work in extreme weather conditions, stop work if extreme weather is imminent, inspect area for hazardous plants & insects. Wear appropriate clothes for the area: long sleeves and gloves in overgrown areas, use sunscreen and hat. Monitor for heat and cold stress. Use buddy system when working near river. Avoid slippery terrain.
Set up at sample location	-Slip/trip hazard. -Samples canisters cause panic or confusion. -Canister tampering.	-Discuss sample locations with property owner/site contact so placement does not interfere with regular activities. -Place sample canisters in the breathing zone (3-5' above ground surface) in a place where they are not likely to be moved. -Label the sample canister as directed by the laboratory, add an 'ownership' tag with contact information to prevent misunderstanding (canisters may look like an incendiary device). -Chain outdoor samples to a secure object if they will be left in the open or on non-secure property. -Shield canisters if they may be exposed to rain or snow during the sample event (make sure collection point on flow controller is still able to draw air from the environment - not just inside the canister cover).
Remove dust cap, attach flow controller to canister, open canister to initiate sampling	-Wrist/hand strain. -Flow controller - canister incompatibility. -'Bad' canister.	-Use 9/16 wrench to tighten fittings. -Have a spare controller, pair different controllers with different canisters until matches are made if fittings do not seat or tighten properly. -Use cloth or plastic gripper to loosen sample valve if tight. -Check provided gauge, canister should show <28 mmHg vacuum on initiation; otherwise sample may be invalid. Use spare canister if available.
Allow sample to collect over specified interval	-Sample tampering. -'Bad' canister.	-If tampering is possible, locate sample to a less obvious space. Document any observations of possible tampering - sample moved from original placement, dents/dings on canister, etc. -Return to check canister gauge approximately 2-3 hours before sample interval ends. If canister vacuum is at or near zero, close valve and end sampling. Indicate valve closure time in sample log book.
Close valve, remove flow controller, replace dust cap	-Sample invalidation. -Wrist/hand strain.	-Close sample valve before removing flow controller, or sample may be invalidated. -Use 9/16 wrench to loosen fittings.

Ship samples to lab for analysis	-Sample canister damage. -Flow controller gauge damage. -Back strain.	-Use original packaging (foam forms and boxes) from the lab to re-pack sample canisters and flow controllers, to reduce chance of breakage during shipment. -When lifting, bend at the knees and not at the waist. Do not twist or use jerking movements to lift heavy boxes. Get lift assistance or use a dolly to transport heavy boxes or multiple boxes.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/9/2007
JSA Type:	Environmental Cleaning and Sampling
Work Type:	Environmental - Ground Water Sampling
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Level D
Long Sleeves
Protective Gloves - Type dependent on job-specific requirements
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
General: Working Outdoors	-Environmental hazards, including heat/cold stress, sunburn, insect/snake bites, hazardous plants (poison ivy/oak), wild animals.	-Avoid/stop work in extreme weather conditions or if extreme weather is imminent (e.g., lightning, heavy rain). Seek shelter in field vehicles or other site structure. -Take breaks and consume fluids as necessary. -Inspect area for hazardous plants, snakes, wild animals, and insects. Descriptions of potentially hazardous flora/fauna are provided in the HASP. -Monitor behavior of personnel for indications of heat/cold stress. -Use sunscreen and bug spray as appropriate.
Set up necessary traffic control.	-Struck by vehicle during placement. -Vehicle accident as a result of improper traffic control equipment placement.	-Use buddy system for placing traffic control. -Refer to traffic control plan section of HASP for ideal setup.
Set up exclusion zone(s).	-Struck by vehicle. -Slip and fall hazards.	-Face oncoming traffic. -Implement exclusion setup instructions as described in HASP (barricades, caution tape, cones, etc.). -Set up work area free of trip hazards.
Gauge water levels.	-Back strain. -Inhalation or dermal exposure to chemical hazards. -Repetitive motion injury.	-Don PPE as required in HASP. -Initiate air quality monitoring in accordance with the HASP. -Maintain safe distance of face and hands, if possible, from well head. -Bend at knees, not at waist. -Consider using knee padding if kneeling to gauge flush-mount wells.
Purge well(s) and collect purge water.	-Back strain. -Inhalation or dermal exposure to chemical hazards. -Slip and fall hazards. -Spilling/splashing of contaminated water.	-Decontaminate sampling equipment between each sampling location. -Use proper lifting techniques (bend at knees, minimize twisting). -Wear required PPE and use air monitoring equipment in accordance with HASP. -Clear area of tripping or slipping hazards. -Store water in appropriate containers, label containers. -When using a displacement pump, secure all tubing/hoses.
Collect samples in	-Back strain. -Inhalation or dermal	-Decontaminate sampling equipment, unless disposable. -Use proper

accordance with sampling plan.	exposure to chemical hazards. -Slip and fall hazards. -Improper labeling or storage. -Injury from broken sample bottles (cuts or acid burns).	lifting techniques (bend at knees, not waist, reduce twisting motions). -Wear required PPE in accordance with HASP. -Label samples in accordance with sampling plan. -Keep samples stored in proper containers, at correct temperature, and away from work area. -Handle bottles carefully, do not overtighten bottle caps.
Store purge/decon water onsite.	-Back strain. -Exposure to contaminants. -Improper storage or disposal could result in release of purge/decon water.	-Use equipment to transport/contain water (pump, drums, dollies, etc.). -Wear PPE in accordance with HASP. -Label storage containers properly. -Coordinate offsite disposal, if necessary.
Clean site/demobilize.	-Safety hazard left on site. -Lifting hazard. Struck by vehicle during traffic control removal.	-Use buddy system as necessary to remove traffic control. -Leave site clean of refuse and debris. -Notify site personnel of departure and any purge water left onsite. -Use two people to lift heavy or awkward objects, minimize bending and twisting during lifting.
Package and deliver/ship samples to lab.	-Bottle breakage, cuts/acid burns. -Back strain.	-Handle and pack bottles carefully (bubble wrap is helpful). -Use two people to lift heavy sample coolers, bend at the knees (not the waist) when lifting.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/9/2007
JSA Type:	Oversight
Work Type:	Const/Remediation - Oversight
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Hard Hat
Hearing Protection
Level D
orange traffic safety vest
Safety Glasses
Safety Shoes

Job Steps	Potential Hazard(s)	Critical Action(s)
General: Working Outdoors	Weather Conditions (heat exhaustion, heat stress, lightning, rain, sunburn). Insects/animals (snakes, spiders, wild animals, etc.), poison ivy and oak.	Have and drink plenty of fluids, especially water. Stay in the shade, out of the sun, as much as possible. Wear clothing appropriate to weather (e.g., lighter clothes on warm days). All personnel are to wear sunscreen on exposed skin at all times. Take shelter in nearest building/structure in the event of lightning or heavy rain. Stop work if hazardous weather conditions arise. Wear bug spray when biting bugs are present. Scan the area for poisonous plants and wild animals/snakes. If present, stop work and report to site supervisor for alternate work plans. Maintain first aid kit. Perform SPSA procedures when entering new work areas. Review HASP regularly for emergency procedures and location of nearest hospital.
Locate work area	Slip, trip, and falls from wet or uneven terrain. Onsite vehicular accident with heavy equipment. Falling into the excavation area. Engulfment and drowning in viscous fluid.	Designate equipment area within work area. Keep all equipment organized. Identify and remove trip hazard if possible. Watch footing in wet areas to be sure not to slip and/or fall. Maintain safe distance from excavation area.
Traffic Safety	Injuries from moving vehicles.	Personnel should be cautious around roadways and look for oncoming vehicles before proceeding. Personnel should be aware that articulated trucks move at a high speed and should maintain a safe distance from these trucks.
Visually clear proposed excavation locations	Underground and overhead utilities/obstructions	Visually identify and potential hazards due to utilities or large objects located in the work area.
Mobilize with proper	Vehicle accidents. Delayed	Follow safe driving practices. Do not start work unless the proper

equipment/tools/supplies for construction	or improper/unsafe performance of work due to improper equipment/tools/supplies onsite	equipment/tools/supplies are on hand.
Excavation of soil and sediment.	Injuries (e.g., sprains, strains, cuts, bruises) from excavation equipment. Slips/trips/falls. Shock or injury from subsurface utilities. Fire, spills, contact and/or inhalation of unknown constituents in soil.	Identify & avoid pinch points and sharp edges. Excavator operator must perform a preoperation inspection prior to starting work. A 'competent person' must be onsite for all excavation activities. Maintain 6' clearance from excavation area, and maintain 15' clearance from back hoe. Oversight personnel should only be within the 15' clearance when absolutely necessary (i.e. instructing depth, etc). If this occurs, make sure operator is aware of the presence of oversight personnel. In order to maintain a safe area for oversight personnel, the excavator should load trucks in the same location at all times (i.e., only swing one way). Oversight personnel should maintain line-of-sight with equipment operators at all times. Oversight personnel should maintain communication with equipment operators at all times, either verbally or through hand signals. Hand signals should be consistent with the signals shown on the following site: http://www.cdc.gov/elcosh/docs/d0100/d000068/d000068.pdf Stay clear of the excavator bucket. Stay away from fall hazards (open excavation, pits, etc.). Verify good housekeeping practices are followed: tools picked up, minimize soil buildup. Verify that all equipment/hoses are inspected daily. STOP WORK IMMEDIATELY if conditions change or if subsurface utilities are suspected. Maintain spill kit, first aid kit and fire extinguisher. Refer to the HASP for emergency procedures.

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Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	1/9/2007
JSA Type:	Geophysical Survey
Work Type:	Aquatic Inv - Bathymetric Survey
Project No.:	64530 - SEGMENT 15 C FORMER PLA (LYONDELL CHEMICAL CO.,)

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Hritsuk, Eric J.			Bowman, Matthew M.		

Personal Protective Equipment (PPE) needed
Harness & Lifeline
Level D
orange traffic safety vest
Protective Gloves - Mimimum PPE is Level D. Additional PPE may be required in the Health & Safety Plan (HASP)
Safety Glasses

Job Steps	Potential Hazard(s)	Critical Action(s)
Working outdoors	Environmental hazards: sun, heat, cold, insects, hazardous plants and animals. Slips, trips, and falls. Working near water.	Avoid work in extreme weather conditions and stop work if extreme weather is imminent. Inspect area for hazardous plants, insects, and animals. Wear appropriate clothes for the area: long sleeves in overgrown/thorny areas, use sunscreen and hat when appropriate. Monitor for heat and cold stress. Watch footing and wear appropriate footwear with ankle support. Keep a safe distance from water and use the buddy system.
Mobilize with proper geophysical equipment/supplies.	Vehicle accident. Lifting hazards. Delay or improper/unsafe performance of work due to improper equipment on site.	Follow safe driving procedures. Use proper lifting techniques. Review work plan to determine equipment/supply needs. Review HASP and gather necessary PPE. Additional PPE may be required in the HASP. Also refer to the HASP for required traffic control, air monitoring, and emergency procedures.
Set up necessary traffic control, if needed (i.e., working in traffic area).	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	Use buddy system for placing traffic control. Reference traffic control plan section of HASP (may include specific requirements based on encroachment permit).
Set up Survey Grid and control.	Struck by vehicle. Slip and fall hazards.	Face incoming station traffic. Implement exclusion zone set-up instructions of HASP (barricades, caution tape, cones, etc.). Set up work area free of trip hazards.
Calibrate geophysical equipment in background area.	Back strain, slips, trips and fall hazards.	Use proper lifting procedures. Watch for uneven ground, debris, and trip hazards. If possible clear area of trip hazards. Use buddy system to spot for uneven ground while surveying.
Begin geophysical survey of target area using survey grid or other methods (GPS).	Back strain. Slip and fall hazards. Scrape and cut hazards. Plant and insect hazards. When surveying on steep slopes or with in structures	Use proper lifting procedures. Watch for uneven ground, debris, and trip hazards. If possible clear area of trip hazards. Wear long sleeve shirt and tuck pants into boots and apply bug repellant if needed. Wear gloves and heavy denim work pants to avoid cuts

	(reservoirs, treatment lagoons, or facility buildings) extra safety actions must be taken based on the conditions encountered. Steep slopes, confined spaces, overhead and at grade structures must be evaluated and the potential hazards considered on a case by case basis.	when working in heavy brush/briers. Use buddy system to spot for uneven ground while surveying. If special hazards are present in the survey area (e.g., steep slopes) then additional safety actions (e.g., safety harness and ropes/equipment will be used. Air monitoring will be completed in all potential confined spaces. Hard hats will be used in areas with overhead piping or structures. A third health and safety person may be needed to assist with equipment or air monitoring when working on steep slopes or within structures or buildings. Potential confined spaces must be identified and treated accordingly and personnel working in these areas must have confined space training.
Review data for each area surveyed and determine if anomalies are identified and defined or if additional data is needed.	Working with data loggers and laptop computers.	Do not operated vehicles while downloading or reviewing data. If possible perform data review in secure area (field office/trailer) or vehicle.
Download and store data on secure media, make backup copy of data for office review and data processing.	Working with data loggers and laptop computers.	Do not operate vehicles while downloading or reviewing data. If possible perform data review in secure area (field office/trailer) or vehicle.
Clean site/demobilize.	Traffic. Safety hazard left on site. Lifting hazard.	Use buddy system as necessary to remove traffic control. Leave site clean of refuse and debris. Notify station personnel of departure, and any equipment/PPE left on site. Use proper lifting technique. Follow safe driving procedures.
Package and deliver/ship equipment to office/rental agent.	Package breakage, back strain.	Handle and pack equipment carefully (bubble wrap bags are helpful). Use proper lifting techniques.

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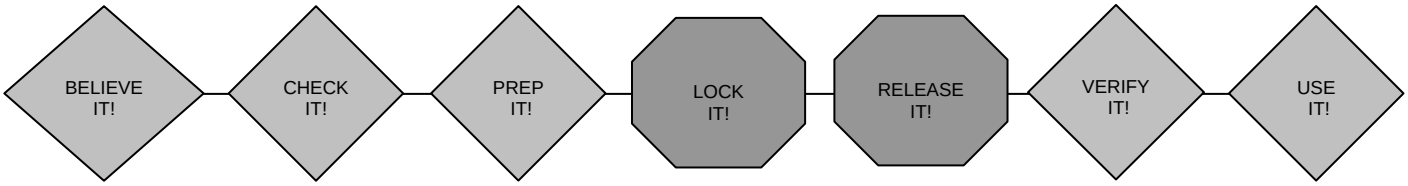
Appendix K

Lockout/Tagout Equipment-
Specific Energy Control Procedure

Lockout / Tagout Equipment-Specific Energy Control Procedure



Equipment Identification:

_____

_____

Hazardous Energy Source		Isolation Device			Verifying Lockout Means of Verification of Lockout
Type and Magnitude	Function	Type	Location	I.D. No.	
Electrical 120v					
Pneumatic					
Hydraulic					
Mechanical					
Potential					
Gravity					
Other					
Other					
Other					
Area:		**Date of Last Review:**			**Authorized by:**

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Appendix L

Site Hot Work Permit

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Site Hot Work Permit

Permit #:	**ALL COPIES OF PERMIT MUST REMAIN AT JOB SITE UNTIL THE WORK IS COMPLETE**
Project:	

Location and Description of Hot Work:

Checklist	Yes	No	N/A	Comment
Is there any alternate procedure to use instead of hot work?	☐	☐	☐	
Is it possible to move the hot work to a designated hot work area?	☐	☐	☐	
Is it possible to move all fire hazards at least 35 feet away?	☐	☐	☐	
If all fire hazards cannot be removed, can guards, barriers, or screens be used to confine any heat, sparks, or slag, and to protect the immovable fire hazards?	☐	☐	☐	
Are there any flammable or combustible liquid storage areas within 50 feet?	☐	☐	☐	
Is the area where the work is to be performed free of combustible material to heat, sparks, flying sparks, or slag?	☐	☐	☐	
Are combustible materials adjacent to the opposite side of partitions, walls, or ceilings protected by guards or moved 35 feet away from the surface?	☐	☐	☐	
Is everything moved or protected that could be damaged by sparks or water?	☐	☐	☐	
Is suitable fire extinguishing equipment on hand and ready for immediate use?	☐	☐	☐	
Is the sprinkler system in the area operational?	☐	☐	☐	
Are the surrounding employees in an area where flying sparks and slag may injure them?	☐	☐	☐	
When working with compressed gas cylinders and torches, has the worker verified that all connections are tight?	☐	☐	☐	
Have precautions been implemented to prevent injury to employees?	☐	☐	☐	
Has the area supervisor been notified?	☐	☐	☐	
Is a fire watch in place? When using compressed gases, is the fire watch located in a position to cut off the flow of gas if needed?	☐	☐	☐	
Is hot work to be conducted in a confined space?	☐	☐	☐	
Is appropriate personal protective equipment and respiratory protection being used?	☐	☐	☐	

The area where hot work is being conducted must remain attended for at least 30 minutes after completion of the work.

Monitoring Frequency: ☐ **Continuous** ☐ **Every 30 min.** ☐ **Other**

Monitor's Name:

Time of Reading	Hot Work Air Monitoring Parameters		
	% Oxygen>19.5%	% LEL <10%	Other

Air Monitor _____
Print Name

Signature Date Time

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Appendix M

Confined Space Entry Checklist and Permit

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Confined Space Entry Checklist

Permit #:

Project:

ALL COPIES OF PERMIT MUST REMAIN AT JOB SITE UNTIL THE ENTRY IS COMPLETE

Location and Description of Confined Space:

Checklist	Yes	No	N/A	Comment
Are all lines to and from confined space blanked, capped, or isolated?	☐	☐	☐	
Electrical service locked out (entrant with key)?	☐	☐	☐	
Are mechanical devices / systems restrained and locked out?	☐	☐	☐	
Is explosion-proof electrical equipment in use?	☐	☐	☐	
Are ladders secured at top?	☐	☐	☐	
Is the GFCI checked and functioning?	☐	☐	☐	
Are all ignition sources identified and isolated?	☐	☐	☐	
Are respirators and air supply equipment in proper condition?	☐	☐	☐	
Are safety harnesses and lifelines in proper condition?	☐	☐	☐	
Is required PPE being used?	☐	☐	☐	
Is monitoring equipment calibrated and functioning properly?	☐	☐	☐	
Is atmospheric testing completed?	☐	☐	☐	
Is a trained attendant on standby?	☐	☐	☐	
Is emergency equipment ready for use?	☐	☐	☐	
Are rescue provisions in place?	☐	☐	☐	
Are warning signs posted?	☐	☐	☐	
Is ventilation equipment functioning properly?	☐	☐	☐	
Is the retrieval system functioning properly?	☐	☐	☐	
Communication device for entrance and attendants?	☐	☐	☐	
Is the area secured to eliminate unauthorized entry?	☐	☐	☐	
Are entry personnel trained for confined space entry?	☐	☐	☐	
Is the confined space entry permit completed and posted?	☐	☐	☐	
Are the permanent ladder rungs in safe condition?	☐	☐	☐	

Monitoring Frequency: ☐ **Continuous** ☐ **5 min.** ☐ **10 min.** ☐ **30 min.**

Monitor's Name: _____

Time of Reading	Confined Space Air Monitoring Parameters			
	% Oxygen>19.5%	% LEL <10%	CO <20 ppm	Other
Pre-Entry				

Entry Supervisor _____
Print Name

_____
Signature Date Time

Air Monitor _____
Print Name

_____
Signature Date Time

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Confined Space Entry Permit

Project Name:	**Date / Time:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**
Location and Description of Confined Space:	
Rescue Contact and Phone Number:	
Entry Objectives:	
Equipment / Materials Required for Entry:	
Time of Entry:	Expiration of Entry:
Required Respirator for Entry:	
Required Protective Clothing for Entry:	

Monitoring Interval: ☐ **Continuous** ☐ **5 min.** ☐ **10 min.** ☐ **15 min.** ☐ **30 min.**

Air Monitoring Requirements

Monitor For	Monitoring Equipment	Calibrated	
		Date / Time	By
% O_2			
% of LEL			
H_2S			
CO			
Other:			
Other:			

Entrants and Attendants

Number of Entrants:	Number of Attendants:
Names of Entrants	**Names of Attendants**

Entry Supervisor Authorizing Confined Space Entry Permit

Print:	Date:	Time:
Signature:		

Entry Supervisor Canceling Confined Space Entry Permit

Print:	Date:	Time:
Signature:		

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Appendix N

Float Plan

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Float Plan

Before going boating, complete this page and leave it with a reliable person who can be depended upon to notify the Coast Guard or other rescue organization, should you not return as scheduled. **Do not** file this plan with the Coast Guard.

Name of person reporting and telephone number:	Name:	Phone:	
Description of boat:	Type:	Color:	
	Registration No.:	Length:	
	Name:	Make:	
	Other information:		
Description of engine:	Type:	H.P.:	
	No. of engines:	Fuel capacity:	
Survival equipment (check as appropriate:	☐ PFDs	☐ Flares	☐ Mirror
	☐ Smoke Signals	☐ Flashlight	☐ Food
	☐ Paddles	☐ Water	☐ Others
	☐ Anchor	☐ Raft or Dinghy	☐ EPIRB
Radio:	☐ Yes ☐ No	Type:	Frequency:
Automobile:	License:	Make/Model:	
	Color:	Trailer License:	
	Where parked:		
Persons aboard:	**Name**	**Age**	**Address / Phone**
	Do any of these persons have a medical problem? ☐ Yes ☐ No		
	If yes, describe:		
Trip expectations:	Departure time / location:		
	Going to:		
	Expected return time:		
	Return no later than:		
	If not returned by latest time listed, call the COAST GUARD, or (local autority):		
	Coast Guard #:	Local Authority #:	
Other pertinent information:			
Telephone Numbers:			

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Appendix O

Daily Boat Inspection List

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Daily Boat Inspection List

Date:			
Boat:			
Operator:			
Checklist Before Departure	**OK**	**Need Repair**	**Comments**
Documentation and Training			
Boat has current registration on board.	☐	☐	
Boat operator has appropriate training (United States Coast Guard [USCG] Boating Safety Course or equivalent).	☐	☐	
Acquaint all passengers with use and location of safety equipment, radio, plans for day, etc.	☐	☐	
Float plan filed.	☐	☐	
Personal Flotation Devices (PFDs)			
One USCG approved device per passenger.	☐	☐	
Inspect all PFDs for tears/holes, discolored or weakened material, insecure straps, zippers, buckles or labels that are no longer readable.	☐	☐	
Throw ring on vessel.	☐	☐	
Explain the location and use of all PFDs to passengers and crew that may be new to the vessel.	☐	☐	
If sampling on or near water below 50°F, cold water immersion suit for affected personnel.	☐	☐	
Sound Producing Devices			
Must have a horn capable of producing 4-second blast audible for at least ½ mile. If a portable air horn, have a spare can of air or an alternate device.	☐	☐	
Lights, Navigation, Distress Signals			
All navigation lights, as required, in working order. Instrumental lights working.	☐	☐	
Accessible flares, day signals, etc. stored in a dry location and available at all times.	☐	☐	
Inform crew members and passengers of their location and use.	☐	☐	
Tools and Spares			
Plug in bottom of boat.	☐	☐	
Oars or paddles in boat.	☐	☐	
Basic tool box onboard and a bucket for bailing.	☐	☐	
Box of spares aboard (e.g., fuel filter, through hull plugs, etc.).	☐	☐	
Fire Extinguishers and First Aid			
Accessible fire extinguisher located on boat and operational.	☐	☐	
Mounts are secure and functional.	☐	☐	
First-aid kit present and stocked.	☐	☐	
Spill kit.	☐	☐	

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Daily Boat Inspection List

Fuel, Oil, and Battery			
Tanks topped-off; if not adequate fuel for boat usage.	☐	☐	
Check engine oil level.	☐	☐	
If dual charging system, is selector switch in proper position and power on to vessel.	☐	☐	
Spare batteries for accessories (e.g., radio, flashlight).	☐	☐	
If batteries are rechargeable, are they charged.	☐	☐	
Weather Forecast			
Check weather forecasts.	☐	☐	
Weather band radio present and operational.	☐	☐	
Docking and Anchoring			
At least one anchor setup and bent-on to anchor line.	☐	☐	
Two to three extra docklines in case of unusual conditions dockside.	☐	☐	
Visually inspect lines.	☐	☐	
Communication			
Cell phones available.	☐	☐	
Marine radio present and operational.	☐	☐	
Trailer Checks			
Check tire pressure and wheel bearings.	☐	☐	
Make sure hitch is secure and safety chains attached/functional.	☐	☐	
Make sure boat is tied down properly.	☐	☐	
Check all lights and signals.	☐	☐	
Look before backing up.	☐	☐	

Notes:

1. Checklist should be completed each day prior to use of boat(s).
2. Portion of checklist obtained from Nautical Know How, Inc. 1998.

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Appendix P

Air Monitoring Log

Air Monitoring Log

Project:
Monitoring Instruments:
Air Monitor:
Level of Protection:

Date:
Activity:

Time	Location	Instrument Reading	Comments

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Appendix Q

Health and Safety Inspection Form

ARCADIS BBL
Infrastructure, environment, facilities

Health and Safety Inspection Form

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**
Auditor:	**HSS On Site:**

General	Yes	No	N/A	Comments
Is the HASP on site?	☐	☐	☐	
Is the HASP finalized and approved?	☐	☐	☐	
Is the OSHA poster displayed?	☐	☐	☐	
Are emergency telephone numbers posted?	☐	☐	☐	
Is emergency eyewash immediately available?	☐	☐	☐	
Is an emergency shower immediately available?	☐	☐	☐	
Are emergency notification means available (radio, telephone)?	☐	☐	☐	
Is a first-aid kit immediately available?	☐	☐	☐	
Is the first-aid kit adequately stocked?	☐	☐	☐	
Is there a proper sanitation facility on site?	☐	☐	☐	

Documentation and Recordkeeping	Yes	No	N/A	Comments
Are only personnel listed and approved in the HASP on site?	☐	☐	☐	
Are all personnel properly trained? (Check company-issued wallet cards.)	☐	☐	☐	
Is the daily field log kept by the Site Manager?	☐	☐	☐	
Are levels of PPE recorded?	☐	☐	☐	
Are contaminant levels recorded?	☐	☐	☐	
Are site surveillance records kept by HSS?	☐	☐	☐	
Are copies of current fit test records on site?	☐	☐	☐	
Are calibration records maintained for air monitoring equipment?	☐	☐	☐	
Are accident / incident forms on site?	☐	☐	☐	
Are field team review sheets signed?	☐	☐	☐	
Are additional hospital route directions available?	☐	☐	☐	
Is the visitors' logbook being accurately maintained?	☐	☐	☐	
Are MSDSs available for all chemicals on site?	☐	☐	☐	
Are HASP revisions recorded?	☐	☐	☐	
Is the first-aid kit inspected weekly?	☐	☐	☐	
Are daily safety meetings held?	☐	☐	☐	
Are emergency procedures discussed during safety meetings?	☐	☐	☐	

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Health and Safety Inspection Form

Emergency Responses	Yes	No	N/A	Comments
Is a vehicle available on site for transportation to the hospital?	☐	☐	☐	
Are fire extinguishers on site and immediately available at designated work areas?	☐	☐	☐	
Is at least one person trained in CPR and first aid on site at all times during work activities?	☐	☐	☐	
Do all personnel know who is trained in CPR / first aid?	☐	☐	☐	
Personal Protective Equipment (PPE)	**Yes**	**No**	**N/A**	**Comments**
Is proper PPE being worn as specified in HASP?	☐	☐	☐	
Level of PPE being worn.				
Is PPE adequate for work conditions?	☐	☐	☐	
If not, give reason.				
Upgrade / downgrade to PPE level.	☐	☐	☐	
Does any employee have facial hair that would interfere with respirator fit?	☐	☐	☐	
If yes, willing to shave, as necessary?	☐	☐	☐	
Fit-tested within the last year? (Documentation present)	☐	☐	☐	
If Level B, is a back-up / emergency person suited up (except for air)?	☐	☐	☐	
Does the HSS periodically inspect PPE and equipment?	☐	☐	☐	
Is the PPE not in use properly stored?	☐	☐	☐	
Is all equipment required in the HASP on site?	☐	☐	☐	
Properly calibrated?	☐	☐	☐	
In good condition?	☐	☐	☐	
Used properly?	☐	☐	☐	
Other equipment needed?	☐	☐	☐	
List.				
Is monitoring equipment covered with plastic to minimize contamination?	☐	☐	☐	
Personnel and Equipment Decontamination	**Yes**	**No**	**N/A**	**Comments**
Is the decontamination area properly designated?	☐	☐	☐	
Is appropriate cleaning fluid used for known or suspected contaminants?	☐	☐	☐	
Are appropriate decontamination procedures used?	☐	☐	☐	
Are decontamination personnel wearing proper PPE?	☐	☐	☐	
Is the equipment decontaminated?	☐	☐	☐	
Are sample containers decontaminated?	☐	☐	☐	
Are disposable items replaced as required?	☐	☐	☐	

ARCADIS BBL
Infrastructure, environment, facilities

Health and Safety Inspection Form

Work Practices	Yes	No	N/A	Comments
Was proper collection and disposal of potentially contaminated PPE performed?	☐	☐	☐	
Was proper collection and disposal of decontamination fluid performed?	☐	☐	☐	
Is water available for decontamination?	☐	☐	☐	
Is the buddy system used?	☐	☐	☐	
Is equipment kept off drums and the ground?	☐	☐	☐	
Is kneeling or sitting on drums or the ground prohibited?	☐	☐	☐	
Do personnel avoid standing or walking through puddles or stained soil?	☐	☐	☐	
Are work zones established?	☐	☐	☐	
If night work is conducted, is there adequate illumination?	☐	☐	☐	
Is smoking, eating, or drinking in the exclusion zone or CRZ prohibited?	☐	☐	☐	
To the extent feasible, are contaminated materials handled remotely?	☐	☐	☐	
Is contact lenses use prohibited on site?	☐	☐	☐	
Is entry into excavations not allowed unless properly shored or sloped?	☐	☐	☐	
Is a competent person on site during excavation?	☐	☐	☐	
Are all unusual situations on site listed in HASP?	☐	☐	☐	
If not, when?				
Action taken?				
HASP revised?				
Confined Space Entry	**Yes**	**No**	**N/A**	**Comments**
Are employees trained according to 1910.146 – Confined Space Entry?	☐	☐	☐	
Are all confined spaces identified? If not, list:	☐	☐	☐	
Is all appropriate equipment available and in good working order?	☐	☐	☐	
Is equipment properly calibrated?	☐	☐	☐	
Are confined space permits used?	☐	☐	☐	
Are confined space permits completely and correctly filled out?	☐	☐	☐	

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Appendix R

Safety Meeting Log

Safety Meeting Log

Project:	**Location:**
Date / Time:	**Activity:**

1. Work Summary

2. Physical / Chemical Hazards: Has JSA been reviewed / modified to address changing conditions?

3. Protective Equipment / Procedures

4. Emergency Procedures

Is there anyone with any medical conditions that they would like the team to know about? For example: Medic Alert, allergic to bee stings, nitro for chest pains, etc.

Location of medical equipment: fire extinguishers, first aid kit, route to hospital, auto-injectors, etc.

5. Signatures of Attendees

Health and Safety Plan Acknowledgment

I have read the Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents and I agree to abide by its requirements.

Name (Print)	Signature	Representing	Date

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Infrastructure, environment, facilities

Imagine the result

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Multi-Area Health and Safety Plan Addendum 1: Working in Proximity of Crane Operations

Kalamazoo River Study Group

October 2007

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Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Supplemental Remedial Investigations/ Feasibility Studies

CERCLA Docket No. V-W-07-C-864

Multi-Area Health and Safety Plan: Addendum 1, Working in Proximity to Crane Operations

Kalamazoo River Study Group

September 2007

ARCADIS BBL

Michael J. Erickson, P.E.
SRI/FS Project Coordinator

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Health and Safety Manager

Multi-Area Health and Safety Plan: Addendum 1, Working in Proximity to Crane Operations

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Supplemental Remedial Investigations/Feasibility Studies

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Kalamazoo River Study Group

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1. Working in Proximity to Crane Operations

At the former Plainwell Impoundment Time-Critical Removal Action work site, ARCADIS BBL personnel will work in the area of a crane as it hoists and installs sheet pile near the Plainwell Dam.

The subcontractor must implement a crane safety program to maintain compliance with applicable requirements, and must meet numerous specific regulatory standards relative to crane design. The following key requirements must be met in addition to regulatory standards and the manufacturer's recommendations:

- The subcontractor must adhere to manufacturer's specifications and limitations.
- Rated load capacities, recommended operating speeds, special hazard warnings, and instruction shall be conspicuously posted on all equipment.
- Instructions or warnings must be in the cab and visible to the crane operator while the operator is at the control station.

Although the safety of the crane operation itself is the responsibility of the subcontractor, ARCADIS BBL personnel must be aware of basic crane safety procedures and precautions. The following information is presented to familiarize ARCADIS BBL personnel with these basic requirements.

1.1 Hazards

The primary physical hazards for crane operations are associated with overhead hoisting. Tools and equipment, such as booms, cables and slings have the potential for striking, pinning or cutting personnel, and loads may swing and strike personnel or equipment.

1.1.1 Overhead Hazard

Equipment being hoisted poses a hazard to personnel underneath the raised load.

1.1.2 Electrical Hazards

The following minimum distance from electrical lines will be maintained, or appropriate controls measures will be implemented (shielding, power isolation, etc.), during crane operations:

Table 1-1 Minimum Overhead Electrical Clearances

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

1.1.3 Slings, Hooks and Cable-related Hazards

Worn slings, hooks or cables present the hazard of a dropped load. Wire rope presents a laceration hazard if loose wires protrude from the main bundle.

1.1.4 Working Surface Hazards

Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. Uneven or sloped surfaces can present an unstable platform for safe crane operations.

1.1.5 Load Lifting Hazards

The most common type of accident is the “caught between” situation when a load is being handled and a finger or toe gets caught between two objects.

1.1.6 Over-water Hazards

Some activities at the Plainwell Dam may require the use of a barge-based crane or hoist. Such equipment poses hazards in addition to those related to working over water. Accidents can occur as a result of failing to adequately secure the crane to the barge prior to the start of operations. Large waves may make the entire platform unstable and cause equipment or loads to strike persons or other equipment.

1.2 Controls

Hazards are controlled by establishing clear roles and responsibilities, identifying and following appropriate procedures, and meeting appropriate requirements. When working in proximity to crane operations, hazards are controlled by: Identifying crane operator responsibilities and duties; ensuring the crane and its equipment are suitable for the work; working safely in the operating environment; meeting rigging safety requirements; rigging a load properly; moving a load safely; using appropriate hand signals; avoiding overloading the crane; inspecting, maintaining, and testing the crane and equipment; and testing the load capacity of the crane.

1.2.1 Crane Operator Responsibilities and Duties

Only qualified individuals will be permitted to operate cranes. The operator is responsible for the control and safe operation of the crane and adherence to the requirements of this HASP. The crane operator must be fully qualified to operate the particular crane in use. The operator must verify that all safety equipment is in proper condition and is properly used. The crane operator must participate in the Daily Safety Meetings and be aware of all emergency procedures. The operator must operate the hoisting equipment safely, conduct functional tests prior to using the equipment, and select and use rigging equipment appropriately.

At the start of each work shift, the operator will complete the following steps before making lifts:

1. Test the upper-limit switch. Slowly raise the unloaded hook block until the limit switch trips.

2. Visually inspect the hook, load lines, and derrick.

3. Test all direction and speed controls.

4. Test all limit switches and the emergency stop.

5. Test the hoist brake to verify there is no drift without a load.

6. Lock out and tag for repair any crane or hoist that fails any of the above tests.

The crane operator will:

- Not engage in any practice that will divert their attention while operating the crane.
- Respond to signals only from the person who is directing the lift, or any appointed signal person.
- Obey a stop signal at all times, no matter who gives it.
- Not move a load over people.
- Ensure that the rated load capacity of a crane's bridge, individual hoist, or any sling or fitting is not exceeded.
- Check that all controls are in the OFF position before closing the main-line disconnect switch.
- Avoid side pulls. These can cause the hoist rope to slip out of the drum groove, damaging the rope or destabilizing the crane or hoist.
- Prevent shock loading and avoid sudden stops or starts. Shock loading can occur when a suspended load is accelerated or decelerated, and can overload the crane or hoist. When completing an upward or downward motion, ease the load slowly to a stop.

1.2.2 Crane and Equipment

- The design of the crane or hoist will comply with the requirements of ASME/ANSI B30 standards and the Crane Manufacturer's Association of America standards.
- Crane and hoist hooks will have safety latches.
- Crane pendants shall have an electrical disconnect switch or button.
- Cranes and hoists shall have a main electrical disconnect switch. This switch shall be in a separate box that is labeled with lockout capability.
- Crane must be labeled on both sides with the maximum capacity.

- Each hoist hook block shall be labeled with the maximum hook capacity.
- Tag lines must be used to stabilize loads during lifts.

1.2.3 Operating Environment

- Crane lifts will not be made when the operator judges that the sea state or ground condition precludes safe operation.
- All personnel in the vicinity of the crane will wear hard hats, safety-toe shoes, and safety glasses.
- Personnel must remain away from overhead loads.

1.2.4 Rigging Safety Requirements

- Rigging equipment must be maintained in good condition. Rigging equipment must be inspected at least annually; defective equipment is to be removed from service and destroyed to prevent reuse.
- Nylon slings must be inspected and removed from service if they exhibit abnormal wear, torn stitching, broken or cut fibers, or discoloration or deterioration.
- Wire rope slings must be removed from service if they exhibit kinking, crushing, bird-caging, or other distortions; evidence of heat damage; cracks; deformation; worn end attachments; or six randomly broken wires in a single rope lay, or three broken wires in one strand of rope.
- Hooks must be removed from service if they are opened more than 15% at the throat or twisted sideways more than 10 degrees from the plane of the unbent hook.
- Alloy steel chain slings must be removed from service if they exhibit cracked hooks or cracked, bent, or elongated links or components.

1.2.5 Rigging a Load

When rigging a load the operator must:

- Determine the weight of the load.
- Determine the proper size for slings and components.
- Verify that shackle pins and shouldered eye bolts are installed in accordance with the manufacturer's recommendations.
- Verify that ordinary (shoulderless) eye bolts are threaded in at least 1.5 times the bolt diameter.
- Use safety hoist rings (swivel eyes) as a preferred substitute for eye bolts wherever possible.
- Pad sharp edges to protect slings.
- Avoid using slings, eye bolts, shackles, or hooks that have been cut, welded, or brazed.
- Install wire rope clips with the base on the live end only and the U-bolt on the dead end only.
- Determine the center of gravity of the load and balance the load before moving it.
- Initially lift the load only a few inches to test the rigging and balance.

1.2.6 Moving a Load

When moving a load the operator must:

- Check the travel path in order to avoid personnel and obstructions.
- Center the hook over the load to keep the cables from slipping, and to prevent the load from swinging when it is lifted.

- Use a tag line when loads require precise control or when the sea state dictates.
- Lift the load only high enough to clear the tallest obstruction in the travel path.
- Start and stop slowly.
- Choose a safe landing and land the load when the move is finished.
- Never leave suspended loads unattended.

1.2.7 Hand Signals

Signals to the operator shall be made in accordance with the standard hand signals unless voice or radio communication is used. Signals shall be discernable (that is, either visible or audible) at all times. If special signals are established, they will be agreed upon and thoroughly understood by both the person giving the signals and the operator. Special signals cannot be in conflict with the standard signals.

1.2.8 Crane Overloading

Cranes or hoists shall not be loaded beyond their rated capacity for normal operations. Any crane or hoist suspected of having been overloaded shall be removed from service by locking open and tagging the main disconnect switch. Additionally, overloaded cranes shall be inspected, repaired, load tested, and approved for use before being returned to service.

1.2.9 Inspection, Maintenance, and Testing

All tests and inspections shall be conducted in accordance with the manufacturer's recommendations.

All in-service cranes and hoists shall be inspected monthly and the results documented. Defective cranes and hoists shall be locked and tagged "out of service" until all defects are corrected. The inspector shall initiate corrective action by notifying the facility manager or building coordinator.

Annual inspection records must be available. Annual tests and inspections must include:

- Hoisting and lowering mechanisms.
- Limit switches and locking and safety devices.
- Structural members.
- Bolts or rivets.
- Sheaves and drums.
- Parts such as pins, bearings, shafts, gears, rollers, locking devices, and clamping devices.
- Brake system parts, linings, pawls, and ratchets.
- Load, wind, and other indicators over their full range.
- Gasoline, diesel, electric, or other power plants.
- Chain drive sprockets.
- Crane and hoist hooks.
- Electrical apparatus such as controller contactors, limit switches, and push button stations.
- Wire rope.
- Hoist chains.

1.2.10 Load Testing

Newly-installed cranes and hoists shall be load tested at 125% of the rated capacity by designated personnel.

Slings shall have appropriate test data when purchased. It is the responsibility of the purchaser to verify that the appropriate test data are obtained and maintained.

Cranes or hoists that have had major modifications or repair shall be load tested to 125% of the rated capacity. Cranes and hoists that have been overloaded shall be inspected prior to being returned to service.

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Attachment 1

Job Safety Analysis (JSA)

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Job Safety Analysis -

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, and lightning).

Date:	8/20/07
JSA Type:	Const/Remediation
Work Type:	Crane Operations
Work Site:	Plainwell TCRA
Organization:	ARCADIS BBL

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Dave Herweyer		☑			
Rich Klaynick					
Joseph Willoughby					

Personal Protective Equipment (PPE) needed:
Hard Hat
Safety Glasses
Steel Toed Boots
Level D
Hearing Protection (If deemed necessary)
High Visibility Clothing

No	Job Steps	Potential Hazard(s)	Critical Action(s)
1	Working Outdoors And Near Water	1. Environmental Hazards: Sun, heat, cold, thunder/lightning, insects, hazardous plants, snakes, animals 2. working Near water	1. Avoid work in extreme weather condition, stop work in extreme weather conditions, stop work if extreme weather is imminent. If lightning or thunder is present, utilize the 30/30 rule. Inspect area for hazardous plants and insects. Wear appropriate clothes for the area: long sleeves and gloves in overgrown areas, use sunscreen. Monitor for cold and heat stress. Use buddy system 2. Avoid slippery terrain when working near water.
2	Pre-shift Safety Inspection	1. Accidents associated with equipment maintenance and repair 2. Slips, trips, falls	1. Complete the equipment inspection checklist at the start of each day. Record and report the status of the equipment. Visually inspect equipment (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition). 2. Wear proper footwear. Three points of contact whenever climbing on or off a piece of equipment

3	Operation of Crane	1. Personnel in work zone 2. Uneven ground 3. Crane lifting weight limitations 4. Personnel guiding material using hand signals/guide wire. Wrapping hands around tagline 5. Slips, trips, falls	1. Keep all personnel away from the crane while in operation. Maintain constant communication with signal person. 2. Ensure proper use of outriggers while on uneven ground. Use blocking when on soft surfaces. The crane must be level whenever a load is picked up. 3. The operator must be aware of the boom angle and boom length weight limitations. At no time should the operator exceed these limits. Properly use the crane outriggers 4. Ensure use of proper PPE. Make sure signal person knows all hand signals required to safely complete job. Never wrap hands around tagline. Always be in a position to release it if load becomes unstable. 5. Wear proper footwear and always maintain a clean work zone. Use 3 points of contact.
4	Shut Down Procedures	1. Not conducting equipment inspection 2. Poor placement of crane 3. Slips, trips , Falls	1. Ensure a proper equipment inspection is completed. Look for any equipment damage or leaks and note it on the checklist 2. Ensure that the crane is properly stored for the night by lowering the boom and placing crane on even ground. Lock the cab if possible 3. Wear proper footwear. Use 3 points of contact at all times

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Addendum 2

Change to the Acceptable Types of PFDs

ARCADIS

Michael J. Erickson, P.E.
SRI/FS Project Coordinator

Stephen Garbaciak Jr., P.E.
TCRA Project Coordinator

Charles P. Webster, CSP
Health and Safety Manager

Revision to Section 4.22.2 Boat and Equipment Inspections on Page 4-41: PFD Types I or II must be worn at all times when working on or adjacent to the water. No other type of PFD is authorized.

Multi-Area Health and Safety Plan: Addendum 2, Change to the Acceptable Types of PFDs

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Supplemental Remedial Investigations/Feasibility Studies

Prepared for:
Kalamazoo River Study Group

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October 25, 2007

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Addendum 3

Change to Thermal – Protective Clothing Requirement

ARCADIS

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SRI/FS Project Coordinator

Stephen Garbaciak Jr., P.E.
TCRA Project Coordinator

Charles P. Webster, CSP
Health and Safety Manager

Revision to Section 4.22.3 Proper Clothing for Water-Based Operations on Page 4-42: Thermal-Protective Clothing and Equipment – In addition to PFDs, personnel who are working in boats over water when water temperatures are below 50°F must be equipped with thermal-protective clothing and equipment (wet suits, dry suits, etc.). The Heath and Safety Site Manager and Supervisor can limit and modify this requirement if other health and safety considerations (e.g., heat-related injury) could potentially outweigh the necessity of immersion protection. The thermal-protective clothing must be adequate to protect personnel from hypothermic effects of immersion in water at the temperatures encountered.

Multi-Area Health and Safety Plan: Addendum 3, Change to Thermal – Protective Clothing Requirement

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Supplemental Remedial Investigations/Feasibility Studies

Prepared for
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Multi-Area Health and Safety Plan (Rev. 1) Addendum 4: Diving Operations at Plainwell Dam Project

Kalamazoo River Study Group

April 2008

ARCADIS
Infrastructure, environment, facilities

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Supplemental Remedial Investigations/ Feasibility Studies

CERCLA Docket No. V-W-07-C-864

Multi-Area Health and Safety Plan (Rev. 1) : Addendum 4, Diving Operations at Plainwell Dam Project

Kalamazoo River Study Group

April 2008

ARCADIS

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Multi-Area Health and Safety Plan (Rev. 1): Addendum 4, Diving Operations at Plainwell Dam Project

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

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April 21, 2008

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Attachments

1 King Co. Dive Plan

Purpose: Locate two underground gas lines in the Kalamazoo River

1. Dive Plan

The work will be conducted from April 22 – April 23, 2008 by King Co. (King). King has prepared a Dive Plan that covers the proposed work. The plan specifies the required training, experience, equipment, and procedures necessary to safely complete the planned work. King is responsible for the safe conduct of dive activities and compliance with the Dive Plan.

Dives will be conducted from a workboat or a steel platform. Maximum water depth is 10 feet. All dives are no-decompression; work will be performed using SCUBA. At 500 pounds per square (psi) divers will terminate work and surface. Currents may reach 3.0 feet per second (fps). King estimates that two dives will be completed per location. All divers will monitor depth and time with dive computers. A tender will be available with fully dressed safety diver. Weighted line (ends and center) will be used to provide the divers with guideline for support. The divers may elect to tether to guideline based on their assessment of conditions. The divers will use a magnetometer to locate pipeline and will mark with weighted buoys (See Attachment 1, King Co. Dive Plan).

2. Personal Protective and Support Equipment

2.1 Commercial Divers

The decision to use neoprene wetsuits, neoprene or vulcanized rubber drysuits and any associated undergarments will vary depending upon water temperature, comfort level, and/or contact with known concentrations of contaminants and will be at the discretion of the subcontracting commercial diver. Diving hats (Kirby-Morgan models or similar), gloves, and boots will be worn at all times unless conditions warrant SCUBA. King will supply their own personal protective equipment (PPE) and be responsible for the safe operation, inspection, and certification (if required) of all equipment. Communication between diver and surface (although standard with hats), is strongly encouraged for all other operations where visibility with the diver (or divers) is restricted, or where other hazardous conditions are present.

Ultimately, the decision to use protective equipment that is appropriate for the diving hazards that are present at the site is at the discretion of King Co.

2.2 Diver Support Staff (Tender or Operator)

Level D with a United States Coast Guard (USCG)-approved Type I or Type II Personal Floatation Device (PFD) must be worn for all diver support staff. When water temperatures drop below 50°F, USCG-approved insulated exposure suits (i.e., Mustang suit, survival suit) must be worn. Prior to and after each use, the PFD must be inspected for defects that would alter strength and/or buoyancy. PPE upgrades, depending upon the specific activity, may include: safety glasses or goggles, ANSI approved steel-toed safety shoes, hard hat, hearing protection (based on task), and gloves (type dependent on job-specific requirements).

3. ARCADIS's Role in Commercial Diving Operations

ARCADIS field staff that are acting as Task Leaders or field support for commercial diving operations, must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting with the commercial diving firm must be performed and the topics of the meeting documented in field notebooks. A float plan will be filled out and posted in a common work place (i.e., field trailer) for all water vessels used to support diving operations. Contact numbers or monitored marine channel frequencies must be posted on the float plan. Weather conditions (heat, cold, rain, and lightning) must also be considered and plans for rapid demobilization from the water body discussed with all members of the field crew and subcontracting diving firm at the tailgate safety meeting.

ARCADIS's role in commercial diving operations is to coordinate with the commercial dive organization to support them in performing the scope of work. It is ARCADIS's job to inform the commercial dive team supervisor about the potential hazards and risks associated with the site although these hazards or risks may, or may not be, diving related. ***ARCADIS cannot identify potential hazards that are specifically related to commercial diving operations or recommend that changes be made to any diving operation procedure****; that is the role of the commercial dive team supervisor. However, ARCADIS will participate in discussions with the commercial dive team and document any equipment or procedural changes that are made towards continually improving site safety.*

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Attachment 1

King Co. Dive Plan

DIVE PLAN AND EMERGENCY PLAN

Week of April 21, 2008
Plainwell Dam Project
The King Co., Inc.
ARCADIS – BBL

Project Manager – Dive Coordinator:
David Herweyer, P.E., The King Co., Inc. (616) 836-6551
Coordinate all aspects of dive. Main POC for operations and safety.

Dive Team Members:
Rich Klaynik – Superintendent (616) 836-1056
Main contact located on shore/on work platform.

Jim Box – Workboat operator, Dive Tender 2

Scott Barnes – Lead Diver 1
Responsible for operations/coordination of divers and underwater activities. Primary safety instructor for dive activities.

Adam Czarnopys – Diver 2
Back-up diver/tender

Scope of Work:
The primary purpose of the dive is to locate two underground steel gas lines located under the Kalamazoo River. While the general location of the utility lines are known, the intent to the accurately locate the horizontal position of the lines. An underwater, hand-held magnetometer will be used to locate the underground utilities.

Area of Operations:
Kalamazoo River, Upstream of Plainwell Dam
Diving operations are scheduled from April 22 – April 23, 2008, dependent upon weather and river conditions.

Dive Plan:
Dives will be conducted from a King Co. steel workboat/platform and from the west shoreline. The maximum water depth in the river is anticipated to be 10-feet. All dives will be no-decompression dives conducted within U.S. Navy Dive Charts. Due to expected high currents and difficult river conditions, divers will switch out after an air tank reaches 500 psi. Divers will terminate the dive and begin to surface when tank pressure reach 500 psi. Two dives are expected for each utility locate. All divers will monitor depth and time with dive computers. Tender 1 and Diver 2 will be located either on shore or on the workboat to assist the diver located in the water. Communication equipment will be available on-site in the event that it is required.

The river conditions are expected to be difficult with high currents approaching 3 fps. A rope with weights at either end and in the middle will be deployed to assist the diver in crossing the river and locating the utility. The diver will mark the utility with weighted buoys at 50-foot intervals. The diver will elect whether it is appropriate to be tethered to the weighted line.

Anticipated Hazards:
Adverse weather conditions and/or currents.
River traffic

Emergency Procedures:
Prior to diving operations, all dive personnel will conduct a pre-dive safety meeting to discuss conditions, the work plan, emergency procedures and other information.
Each diver, tender and boat operator will be familiar with these procedures. In the event that conditions do not permit the safe performance of the work plan, the dive will be terminated and re-scheduled when conditions permit.

EMERGENCY ASSISTANCE
King Co. Workboat

Emergency Telephone Numbers

Divers Alert Network (DAN)
919.684.8111

IDENTIFY AS A SCUBA DIVING EMERGENY

In the event of an EMERGECY the King Co. workboat will transport the diver to shore where the severity of the condition will be evaluated.

(a) Evaluate medical problem;
(b) Decide on transportation to medical facility either land, sea or air.
Medical Facilities:

Plainwell – Borgess PIPP Hospital
411 Naomi St.
Plainwell, MI 49080
(269) 685-0700

Hyperbaric Chamber Location
Bronson Hospital – Kalamazoo
(616) 341-7654

DIVE SAFETY AND PLANNING

The Dive Safety and Planning Pre-Dive and Post-Dive Checklists are to be completed by the assigned Dive Coordinator prior to and following dive operations. Each item is to be reviewed and discussed. All personnel must be present and initial each page.

PRE-DIVE CHECKLIST

1. Mission Safety
   - Dive operations are planned in accordance with OSHA/NOAA Diving Regulations.
   - Safety of the dive team and personnel is of utmost importance.
   - An Experienced Dive Coordinator is in charge of the diving operations.
   - All divers are on active dive status with the ADC.
   - Conduct a pre-dive briefing. Dive mission, objectives and goals are defined, reviewed and understood by the dive team and support personnel.
   - The Dive Plan is posted, coordinated and reviewed (i.e., chamber availability, evacuation route, etc.), and all personnel are informed of their duties.

2. Evaluate and Prepare for Potential Hazards
   - Identify dive, site entry procedures and exit access point(s).
   - Define depth and bottom time limits for the planned dive.
   - Define next deeper depth and next longer bottom time limits in case planned limits are exceeded.
   - Evaluate and discuss potential for entrapment, entanglement, or other physical or mechanical hazards.
   - Evaluate and discuss potential for bottom obstructions or dangerous bottom conditions.
   - Evaluate and discuss potential for encountering dangerous marine life.
   - Evaluate and discuss potential for contamination or exposure to pollution (i.e., petroleum products, biological or chemical hazards).
   - Divers are outfitted in proper exposure equipment for environmental or other conditions.
   - Evaluate and discuss surface and subsurface conditions and potential for strong current, low visibility, cold water, thermo clines, surge, swell, fog, etc.
   - Evaluate and discuss local marine traffic hazards (notify vessel traffic systems about diving operations).
   - Complete Dive Safe Ship Operations (NOAA Form 64-3), if applicable.
   - Ensure that Material Safety Data Sheets (MSDS) are available and reviewed prior to use of any hazardous chemicals.

3. Diving and Support Personnel

- Ensure that all divers are authorized to perform tasks assigned according to their experience and certification levels (i.e., Working Diver, Scientific Diver, Trainee Diver, or Observational Diver).
- Ensure that dive physicals are available for each diver in case of an emergency.
- Ensure that all divers are qualified, have received proper training and have appropriate experience, to complete assigned underwater tasks safely.
- Verify that all divers are physically and mentally fit to conduct the diving required.
- Ensure that all divers are properly hydrated and rested before the diving operations.
- Support personnel understand all diver hand signals, emergency recall signals and can offer immediate assistance in case of an emergency.
- Thoroughly evaluate repetitive dive designations if a previous dive was made within 12 hours.
- Brief the dive team and support personnel.

4. Equipment

- "Dive platform is stable, seaworthy and outfitted with appropriate safety equipment.
- All support equipment (i.e., boats, compressor, oxygen kit, underwater tools, etc.) is operated by trained and competent personnel.
- All tools used are appropriate for the task.
- All dive techniques to be used are safe and appropriate and authorized.
- All required dive gear is on-hand, inspected and found fully functional prior to the divers departing for the dive.
- All emergency and support equipment are available, inspected and found fully functional prior to commencing dive operations:
- Drinking water is available.
- Means of communication (i.e., cellular telephone, landline telephone, NAVSAT etc.).
- Complete diving first aid kit, first aid handbook, oxygen resuscitator and backboard.
- Divemaster kit on site, including a complete set of 1999 U.S. Navy Dive Tables, 1999 NOAA Nitrox Tables and other require dive tables.
- Rigid replicas of appropriate dive flags (sport and/or alpha) are prominently displayed during diving operations.

POST-DIVE CHECKLIST

- Notify watch on the vessel's bridge when operations are completed.
- Strike the dive flags.
- Dive team buddies have remained together for a minimum of 30 minutes after each dive and have monitored each other's condition during that time.
- Recover and stow all support equipment.
- Ensure that all personal dive equipment and support equipment is thoroughly cleaned and properly stowed. Perform required preventative maintenance.
- Tag all damaged or malfunctioning equipment and remove from use.
- Refill all scuba cylinders.
- Log all dives and topside activities.
- If necessary, discuss procedures for flying after diving.
- Provide contact numbers for nearest chamber, UDS and Divemaster.
- Monitor divers for signs and symptoms of pressure-related illnesses or injuries for a minimum of 2 hours after each dive.
- Conduct a dive debrief and critique operations.
- File a final dive report.

The Dive Plan will be followed and executed as described above. The lead diver onsite will conduct a Site-specific safety analysis to ensure proper steps have been taken to minimize all hazards. This may require a modification to the original Dive Plan to ensure the safety of all affected personnel.

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Multi-Area Health and Safety Plan (Rev. 1) Addendum 5: Plainwell No. 2 Dam Area Time-Critical Removal Action

Kalamazoo River Study Group

March 2010

ARCADIS
Infrastructure, environment, buildings

Allied Paper, Inc./Portage Creek/
Kalamazoo River Superfund Site

Multi-Area Health and Safety Plan (Rev. 1) Addendum 5: Plainwell No. 2 Dam Area Time-Critical Removal Action (Rev. 1)

Georgia-Pacific LLC

March 2010

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Multi-Area Health and Safety Plan (Rev 1) Addendum 5: Plainwell No. 2 Dam Area Time-Critical Removal Action

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1. Introduction

1.1 General

On February 21, 2007 the Kalamazoo River Study Group, or KRSG, voluntarily entered into an Administrative Settlement Agreement and Order on Consent (AOC) with the U.S. Environmental Protection Agency (USEPA). This agreement, which described a series of supplemental remedial investigations and feasibility studies (SRIs/FSs) to be carried out at the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site or Superfund Site), is referred to as the SRI/FS AOC (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. V-W-07-C-864). The SRI/FS work conducted to date has been focused in Area 1 of the Site – defined as the reach of the Kalamazoo River between Morrow Dam and the Plainwell Dam and a stretch of Portage Creek – as described in the USEPA-approved *Supplemental Remedial Investigation/Feasibility Study Work Plan – Morrow Dam to Plainwell Dam* (Area 1 SRI/FS Work Plan; ARCADIS BBL 2007a).

After reviewing the results of sampling and investigation work in the Plainwell No. 2 Dam Area completed pursuant to the Area 1 SRI/FS Work Plan (ARCADIS BBL 2007a), USEPA determined that a Time-Critical Removal Action (TCRA) was necessary in the Plainwell No. 2 Dam Area to address potential sources of polychlorinated biphenyls (PCBs) to the river. Locations targeted for excavation in the Plainwell No. 2 Dam Area include bank soils, sediments in a portion of a historical oxbow channel, and soils in a floodplain area adjacent to the oxbow.

In June 2009, USEPA and Georgia-Pacific LLC (Georgia-Pacific) signed an AOC that formalized the agreement to complete a TCRA (Plainwell No. 2 TCRA AOC; CERCLA Docket No. V-W-09-C-925). The Plainwell No. 2 Dam Area TCRA AOC requires development and submission of a Health and Safety Plan (HSP) designed to protect on-site personnel and area residents from physical, chemical, and hazards posed by the TCRA. USEPA agreed that Georgia-Pacific could submit an addendum to the *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan* (Rev. 1) (Multi-Area HSP, ARCADIS BBL 2007b) to satisfy this requirement. This revision to Addendum 5 to the *Multi-Area HSP* (Addendum) – which describes the health and safety risk analysis for the proposed activities, a description of required environmental monitoring and personal protective equipment (PPE), required medical monitoring, work area controls (i.e., decontamination and contaminant control), and contingency and emergency planning – has been developed to meet the requirements of the activities to be performed under the Plainwell No. 2 Dam TCRA AOC.

This revision to the July 2009 version of the Addendum was developed to document changes to the staging areas that will be used during the 2010 construction season (see Figure 1-1) and update the name and contact information for USEPA's On-Scene Coordinator (see Table 2-1).

1.2 Objective

The objective of this Addendum is to provide a mechanism for establishing safe working practices while conducting the TCRA activities. The safety organization, procedures, and PPE have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incidents. Table 1-1 (located at the end of this addendum) presents an activity hazard summary table for the Plainwell No. 2 Dam Area.

1.2.1 Time-Critical Removal Action Activities

As identified above, USEPA determined that a TCRA was necessary in the Plainwell No. 2 Dam Area to accomplish the specific removal action objectives for the project. These removal actions are identified in the *Plainwell No. 2 Dam Area Time-Critical Removal Action Draft Design Report* (TCRA Design Report, ARCADIS 2009), which was approved by USEPA in July 2009. Work activities commenced in August 2009. An area site plan is illustrated in Figure 1-1.

The following field activities have been/will be conducted:

- Pre-design investigation and site reconnaissance
- Surveying activities
- Mobilization (including site preparation activities, clearing and grubbing, and access road construction)
- Sediment and soil excavation operations
- Material transport and disposal at an offsite location
- Personnel and equipment decontamination
- Environmental monitoring
- Construction oversight

- Site restoration and demobilization

1.3 Applicability of the Multi-Area HSP

The Plainwell No. 2 Dam Area TCRA is being performed using similar construction techniques as the Former Plainwell Impoundment TCRA, completed between 2007 and 2009. The Former Plainwell Impoundment TCRA was conducted under the Multi-Area HSP (ARCADIS BBL 2007b) and associated Addenda 1 through 4. Over 200,000 man hours of work were performed at the Former Plainwell Impoundment with one recordable incident. The Plainwell No. 2 Dam Area TCRA is being performed following the health and safety guidelines established in the Multi-Area HSP and associated addenda. To date, approximately 14,700 man hours of work have been performed at the Plainwell No. 2 Dam Area TCRA with no recordable incidents.

1.4 Policy Statement

The policy of ARCADIS is to provide a safe and healthy work environment. No aspect of operations is of greater importance than the prevention of injury and illness. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS takes every reasonable step to eliminate or control hazards to minimize the possibility of injury, illness, or incident.

This Addendum prescribes the procedures that must be followed during activities conducted as part of the TCRA at the Plainwell No. 2 Dam Area. Operational changes that could affect the health and safety of personnel, the community, or the environment are not made without the prior approval of the Project Coordinator (PC) and the Health and Safety Manager (HSM). Any changes in site conditions and/or the scope of work covered under the Plainwell No. 2 Dam TCRA AOC require the review and modification (if necessary) of this Addendum – such changes will be completed in the form of a revision to this Addendum.

The provisions of this plan are mandatory for all ARCADIS personnel assigned to the Plainwell No. 2 Dam Area TCRA. All visitors to ARCADIS work areas at the Plainwell No. 2 Dam Area TCRA must read and abide by the requirements of this plan. Subcontractors prepare their own site-specific/project-specific HSP that must meet the basic requirements of the Multi-Area HSP and associated addenda.

2. Roles and Responsibilities

2.1 All ARCADIS Personnel

All ARCADIS personnel must adhere to the procedures outlined in the Multi-Area HSP (ARCADIS BBL 2007b) and relevant addenda during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner conflicting with these procedures. The PC has the authority to dismiss any person from the Plainwell No. 2 Dam Area who violates the procedures identified in this Addendum and the Multi-Area HSP.

All ARCADIS personnel receive training in accordance with applicable regulations, and are familiar with the requirements and procedures contained in the Multi-Area HSP and relevant addenda prior to initiating Plainwell No. 2 Dam Area activities. In addition, all onsite personnel attend an initial hazard briefing prior to beginning work at the Plainwell No. 2 Dam Area.

The roles of ARCADIS personnel are outlined in the following subsections. A summary table for key project personnel and contacts is provided below.

Table 2-1 – Key Personnel

Role	Name	Address/Telephone No.
ARCADIS Personnel		
Principal in Charge (PIC)	Michael J. Erickson, P.E.	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1924 Cell: 734.604.7044
Plainwell No. 2 Dam Area Project Coordinator (PC)	Stephen Garbaciak Jr., P.E.	30 W. Monroe St. Suite 1710 Chicago, IL 60604 Phone: 312.332.4937 ext.12 Cell: 708-203-0566
Health and Safety Officer (HSO)	Jay D. Keough, CIH	8 South River Road Cranbury, NJ 08512 Phone: 609.860.0590 ext. 101 Cell: 908.492.5674

Role	Name	Address/Telephone No.
Health and Safety Manager (HSM)	Charles P. Webster, CSP	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
Health and Safety Supervisor	Ben Lawrence	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.229.8594 Cell: 734.732.0586
Site Supervisor (SS)	EJ Suardini	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1955 Cell: 734.276.2566
Georgia-Pacific Personnel		
Technical Lead	Garry Griffith, P.E..	951 County Street Milan, MI 48160-9610 Phone: 734.439.1205 Cell: 734.735.0780
USEPA Region 5 Personnel		
On-Scene Coordinator (OSC)	Sam Borries	77 W. Jackson Blvd (SR-6J) Chicago, IL 60604 Phone: 312.353.8360 Cell: 312.802.5336

2.2 ARCADIS Personnel

2.2.1 Principal in Charge and Project Coordinator

The Principal in Charge (PIC) is responsible for promoting health and safety in all aspects of the project and empowering the PC to implement the requirements of this Addendum.

The PC is responsible for verifying that activities are completed in accordance with the requirements of this Addendum. It is also the responsibility of the PC to perform the following duties:

- Consult with the HSM on Plainwell No. 2 Dam Area health and safety issues.
- Review Loss Prevention Observation reports (Appendix A of the Multi-Area HSP).
- Verify that all incidents and near-misses are thoroughly investigated and reported to Georgia-Pacific within 24 hours of notification.
- Approve, in writing, addenda or modifications to this Addendum.
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

In addition, the PC is responsible for confirming that the Site Supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this Addendum.

2.2.2 Other ARCADIS Personnel

All other personnel roles are outlined in Sections 2.2.2 to 2.2.5 of the Multi-Area HSP (ARCADIS BBL 2007b).

2.3 Other Roles and Responsibilities

Further information on Contractor Qualified Safety Personnel, Stop Work Authority, Short-Service Employee Program, Visitors, and the ARCADIS Near-Loss Reporting Hotline can be found in Sections 2.3 to 2.8 of the Multi-Area HSP(ARCADIS BBL 2007b).

3. Project Hazards and Control Measures

3.1 Field Activities, Hazards, and Control Procedures

The scope of work for the Plainwell No. 2 Dam Area TCRA includes the activities outlined in Section 1.2.1. The activity hazards at the Plainwell No. 2 Dam Area, provided below and in Table 1-1, identify potential health, safety, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, the SS must continually inspect the Plainwell No. 2 Dam Area to identify hazards that may affect onsite personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PC whenever these changes impact employee health, safety, the environment, or performance of the project. The SS keeps onsite personnel informed of the changing conditions, and the PC writes and/or approves addenda or revisions to this Addendum as necessary.

Many of the field activities, hazards, and control procedures are similar to those outlined in the Multi-Area HSP (ARCADIS BBL 2007b). The Multi-Area HSP has therefore been referenced where applicable.

3.1.1 Pre-Design Investigation

3.1.1.1 Site Reconnaissance

Site reconnaissance activities were completed during the pre-construction phases of the project and generally involved walking or driving across the Plainwell No. 2 Dam Area to evaluate existing conditions. Hazards associated with the terrain of the Plainwell No. 2 Dam Area and environmental conditions were identified.

Hazards – Walking surfaces may involve slip, trip, or fall hazards. Slippery walking surfaces can increase the possibility of slips and falls. The immediate proximity of the Plainwell No. 2 Dam Area to the Kalamazoo River increases the possibility of slipping and falling into the river itself and drowning. Several areas around the Plainwell No. 2 Dam Area are also low-lying and prone to flooding, which increases the risk of drowning or injury due to a rapidly rising river level and slippery walking surfaces. Also, debris carried by the river during flooding conditions could strike people or equipment.

Environmental hazards may include plants such as poison ivy and poison oak; aggressive fauna such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather conditions such as lightning, rain, tornados, snow, sleet, frost, and ice; weather-related effects such as

sunburn, windburn, frostbite, and other heat or cold-related illnesses; and pathogens such as rabies, Lyme disease, and blood-borne pathogens.

Control – Prior to the start of any field activity, the Plainwell No. 2 Dam Area conditions are discussed with all affected employees. Potential hazards are identified, and protective measures are explained and implemented. Personnel should not visit the Plainwell No. 2 Dam Area during periods of heavy rainfall, when the river is more prone to flooding. If flooding or other extreme weather events occur, personnel consult with the SS before visiting the area to verify that conditions are safe.

3.1.2 Mobilization

Refer to Section 3.2.1 of the Multi-Area HSP for a discussion of the potential hazards associated with mobilization including heavy equipment operations, increased traffic, working near the river, and other physical and environmental hazards. As detailed in Section 3.2.1 of the Multi-Area HSP, mobilization activities are assumed to include site preparation activities, clearing and grubbing, and access road construction.

3.1.3 Surveying Activities

Refer to Section 3.2.2 of the Multi-Area HSP for a discussion of the potential hazards associated with surveying including working near the river, and other physical and environmental hazards.

3.1.4 Sediment and Soil Excavation Operations

3.1.4.1 Excavation activities

Refer to Section 3.3.3 of the Multi-Area HSP for a discussion of the potential hazards associated with sediment and soil removal operations including heavy equipment operations, materials handling, working near the river, exposure to Plainwell No. 2 Dam Area contaminants, and other physical and environmental hazards.

3.1.4.2 Backfilling Activities

Refer to Section 3.3.3.6 of the Multi-Area HSP for a discussion of the potential hazards associated with backfilling activities including heavy equipment operations, materials handling, working near the river, and other physical and environmental hazards.

3.1.5 Material Dewatering and Transport to an Offsite Facility

Following excavation activities, the excavated material is moved away from the river, staged and dewatered, if necessary, and then transported to an off-site licensed disposal facility. Sections 3.3.3.7 and 3.3.4 of the Multi-Area HSP discusses the potential hazards and controls pertaining to this work including working surfaces, heavy equipment operations, materials handling, exposure to Plainwell No. 2 Dam Area contaminants, material dewatering, and increased traffic.

3.1.6 Personnel and Equipment Decontamination

Refer to Section 3.2.3 of the Multi-Area HSP for a discussion of decontamination of non-disposable equipment and the primary potential hazard – release of hazardous materials.

3.1.7 Site Restoration and Demobilization

Refer to Section 3.2.4 of the Multi-Area HSP for a discussion of the potential hazards associated with restoration and demobilization including heavy equipment operation, materials handling, working near the river, and other environmental and physical hazards.

3.1.8 Environmental Monitoring

Refer to Sections 3.3.5.1, 3.3.5.2, and 3.3.5.4 of the Multi-Area HSP for a discussion of the potential hazards associated with air sampling, soil and sediment confirmation sampling, and surface water monitoring including hazards associated with the sample collection methods, sampling equipment, and the environment in which the samples are collected (e.g., sampling near the river).

3.1.9 Construction Oversight

Refer to Section 3.2.5 of the Multi-Area HSP for a discussion of the potential physical and health hazards associated with construction oversight including working around heavy equipment, material handling, and environmental hazards.

3.2 Chemical Hazards

Refer to Section 3.4 of the Multi-Area HSP for a discussion of the potential chemical hazards related to inhalation, ingestion, and skin or eye contact with materials that are impacted by PCBs.

4. Sections of Multi-Area HSP Applicable to the Plainwell No. 2 Dam Area TCRA

Compliance with the following sections of the Multi-Area HSP is required for the Plainwell No. 2 Dam Area TCRA:

- General Safety Practices – Outlined in Section 4 of the Multi-Area HSP
- Personal Protective Equipment – Outlined in Section 5 of the Multi-Area HSP
- Air Monitoring – Outlined in Section 6 of the Multi-Area HSP
- Work Zones and Decontamination – Outlined in Section 7 of the Multi-Area HSP
- Training and Medical Surveillance – Outlined in Section 8 of the Multi-Area HSP
- Emergency Procedures – Outlined in Section 9 of the Multi-Area HSP. Figure 4-1 of this Addendum identifies routes to the hospital from the Plainwell No. 2 Dam Area project site.
- Addendum 2 to the Multi-Area HSP: Changes to the Acceptable Types of PFD (ARCADIS 2008a)
- Addendum 3 to the Multi-Area HSP: Immersion Suits (ARCADIS 2008b)
- Addendum 4 to the Multi-Area HSP: Diving Operations at the Plainwell Dam Project (ARCADIS 2008c)

5. ARCADIS Policies/Procedures

ARCADIS Health and Safety Procedures applicable to this project are listed below. These procedures should be reviewed by the project manager, task manager, and site personnel. The Client Health and Safety Resource should be contacted with any questions concerning the procedures. In the event that there is conflicting information between the policies and information provided in this addendum or the Multi-Area HSP, the rules that provide the most protection to the worker will be followed.

- ARC HSCS005 – Excavation and Trenching
- ARC HSFS019 – Utility Location
- ARC HSGE007 – Hazard Communication
- ARC HSGE024 – Motor Vehicle
- ARC HSIS008 – Hearing Conservation
- ARC HSGE004 – First Aid / Cardiopulmonary Resuscitation (CPR)
- ARC HSMS010 – Incident Reporting and Investigation
- ARC HSGE015 – Personal Protective Equipment (PPE)

6. ARCADIS Field Health and Safety Handbook

The Field Health and Safety Handbook is an ARCADIS document containing information about topic-specific health and safety requirements for the field. This handbook contains relevant general topics and is used as part of the overall health and safety program. Where applicable, the information provided in the handbook is used as an informational source in conjunction with this Addendum and the Multi-Area HSP. Field Health and Safety Handbook sections applicable to this project include:

II. Health and Safety Administration

A. ARCADIS Responsibilities
B. Employee Responsibilities
C. Visitors
D. Communications
E. HARC Process (ARCHSMS002)
F. Incident Investigation (ARCHSMS010)
G. Near-miss Reporting
H. Stop Work Authority
I. Short-service Employee Program
J. Workplace Violence and Harassment
K. Drug and Alcohol Awareness
L. Emergency Action Plan
M. WorkCare
N. Subcontractors
O. Regulatory Inspections (ARCHSG013)
P. Recordkeeping and Postings

III. General Field Health and Safety Requirements

A. Daily Safety Meetings/Tailgates
B. Department of Transportation – HAZMAT Transportation/Dangerous Goods (ARCHSGED02)
C. First-aid/CPR
D. Blood-borne Pathogens (ARCHSIH005)
E. General Health and Safety Rules and Safe Work Permits
F. General Housekeeping, Personal Hygiene and Field Sanitation
G. Site Security, Work Zone and Decontamination for HAZWOPER Sites
H. Personal Safety and Other Unique Site Conditions
I. Severe Weather
J. Fire Prevention
K. Hazard Communication
L. Noise
M. Heat and Cold Stress
N. Biological Hazards
P. Medical Surveillance (ARCHSGE010)
R. Personal Protective Equipment (ARCHSGE015)

S. Travel Safety-Domestic and International (ARCHSGE022)
T. Vehicle Safety Inspection
U. Driving
V. Trailer Safety
CC. Hand and Power Tools
DD. Vegetation Management
EE. Ergonomics
FF. Site Storage of Hazardous Chemicals, Gases and Solvents
GG. HAZWOPER and HAZMAT Response (ARCHSSF012)
II. Drum and Other Material Handling
JJ. Ladders (Portable/Fixed)
KK. Signs, Signals and Barricades
LL. Traffic Control (ARCHSFS017)
MM. Utility Location (ARCHSF019)
NN. Backing Safety

IV. General Field Construction Health and Safety Best Management Practices

A. Elevated Work Surfaces
D. Excavation/Trenching (ARCHSCS005)
E. Heavy Equipment (ARCHSCS006)
F. Hoisting and Rigging, Cranes and Derricks
L. Temporary Working Surfaces
O. Rollover and Overhead Protection
Q. Permit to Work

V. Specific Work Areas, Hazards and Activities

F. Roadway
G. Water Operations Work
I. Industrial Hygiene and Monitoring Equipment
J. Scientific Scuba Diving

7. References

ARCADIS BBL. 2007a. *Supplemental Remedial Investigation/Feasibility Study Work Plan – Morrow Dam to Plainwell Dam*. Prepared for the Kalamazoo River Study Group by ARCADIS BBL U.S., Inc. February 2007.

ARCADIS BBL. 2007b. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan (Rev. 1).* Prepared for the Kalamazoo River Study Group by ARCADIS BBL U.S., Inc. May 2007.

ARCADIS. 2008a. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan (Rev. 1) – Addendum 2, Change to the Acceptable Types of PFDs.* February 2008.

ARCADIS. 2008b. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan (Rev. 1) – Addendum 3, Change to Thermal Protective Clothing Requirement.* April 2008.

ARCADIS. 2008c. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan (Rev. 1) – Addendum 4, Diving Operations at the Plainwell Dam Project.* May 2008.

ARCADIS. 2009. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Plainwell No. 2 Dam Area Time-Critical Removal Action Design Report.* Prepared for the Kalamazoo River Study Group by ARCADIS. July 2009.

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Tables

Kalamazoo River Study Group
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Multi-Area Health and Safety Plan (Rev. 1) - Addendum 5 (Rev. 1):
Plainwell No. 2 Dam Area Time-Critical Removal Action

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.1.1	Site Reconnaissance	Slip, trip, and fall/unstable soil	Personnel wear proper foot protection and avoid dangerous terrain.
		Environmental hazards	Personnel wear proper clothing and avoid reaching into dark spaces.
		Water related incidents, drowning, submersion	Personnel wear a MiOSHA-approved PFD whenever working on or near the water. Personnel avoid site visits during periods of heavy rain.
3.1.2	Mobilization	Refer to Table 1-1, section reference 3.2.1, of the Multi-Area HSP	
3.1.3	Surveying Activities	Refer to Table 1-1, section reference 3.2.2, of the Multi-Area HSP	
3.1.4.1	Sediment and Soil Removal Operations	Refer to Table 1-1, section reference 3.3.3, of the Multi-Area HSP	
3.1.9	Personnel and Equipment Decontamination	Refer to Table 1-1, section reference 3.2.3, of the Multi-Area HSP	
3.1.10	Site Restoration and Demobilization	Refer to Table 1-1, section reference 3.2.4, of the Multi-Area HSP	
3.1.11	Environmental Monitoring	Refer to Table 1-1, section references 3.3.5.1, 3.3.5.2, and 3.3.5.4, of the Multi-Area HSP	
3.1.12	Construction Oversight	Refer to Table 1-1, section reference 3.2.5, of the Multi-Area HSP	

Notes:
1. PFD – personal flotation device
2. MiOSHA – Michigan Office of Health and Safety Administration

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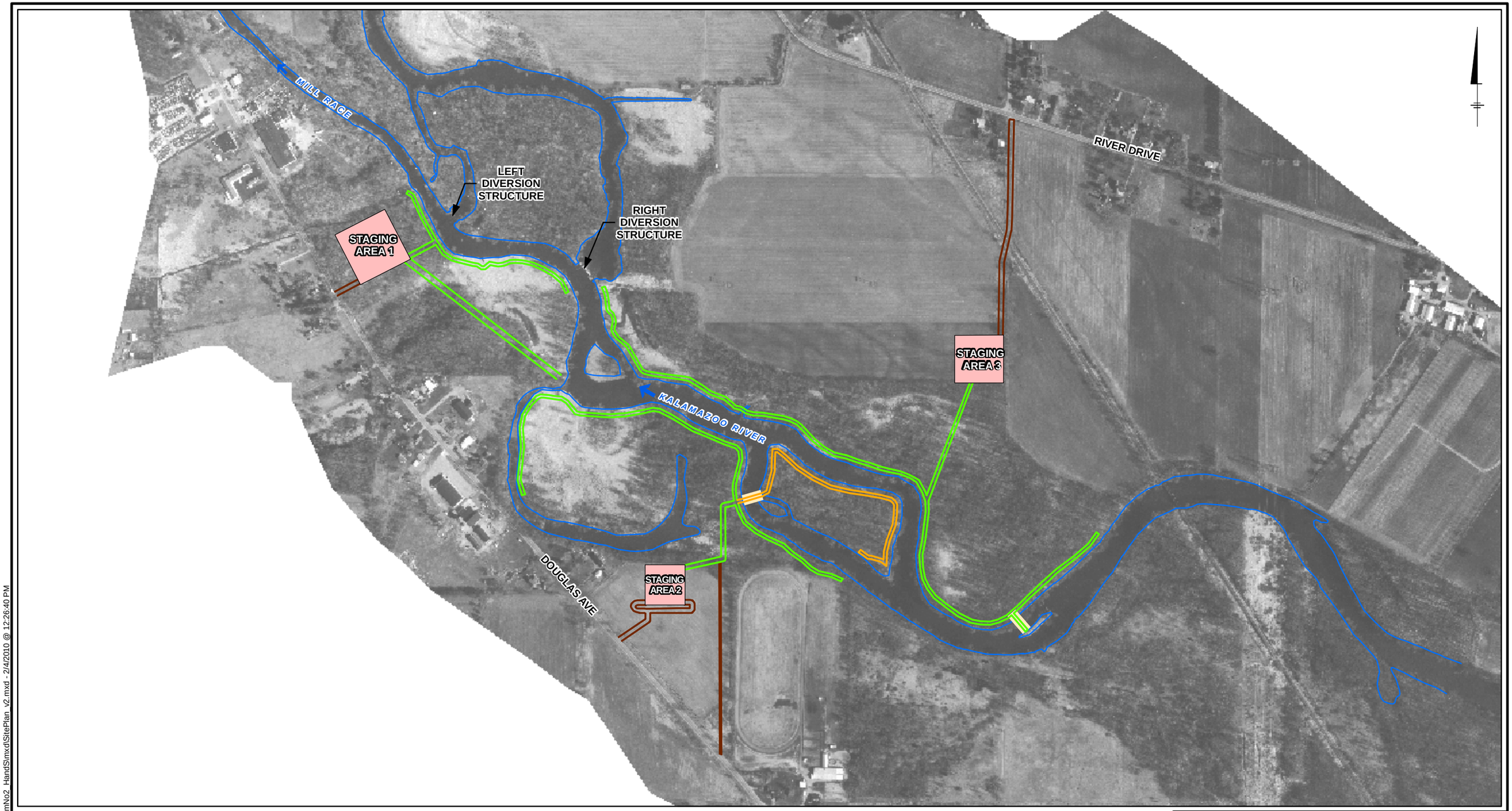
Figures



LEGEND:

- GRAVEL TRAIN HAUL ROAD
- HEAVY EQUIPMENT HAUL ROAD
- LIGHT DUTY EQUIPMENT HAUL ROAD
- MEDIAN WATER LINE (APPROXIMATE)
- POTENTIAL TEMPORARY BRIDGE
- POTENTIAL STAGING AREA

0 600 1,200 Feet

GRAPHIC SCALE

NOTE:

1. REVISED IN FEBRUARY 2010 TO INCLUDE UPDATES TO STAGING AREA LOCATIONS.

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

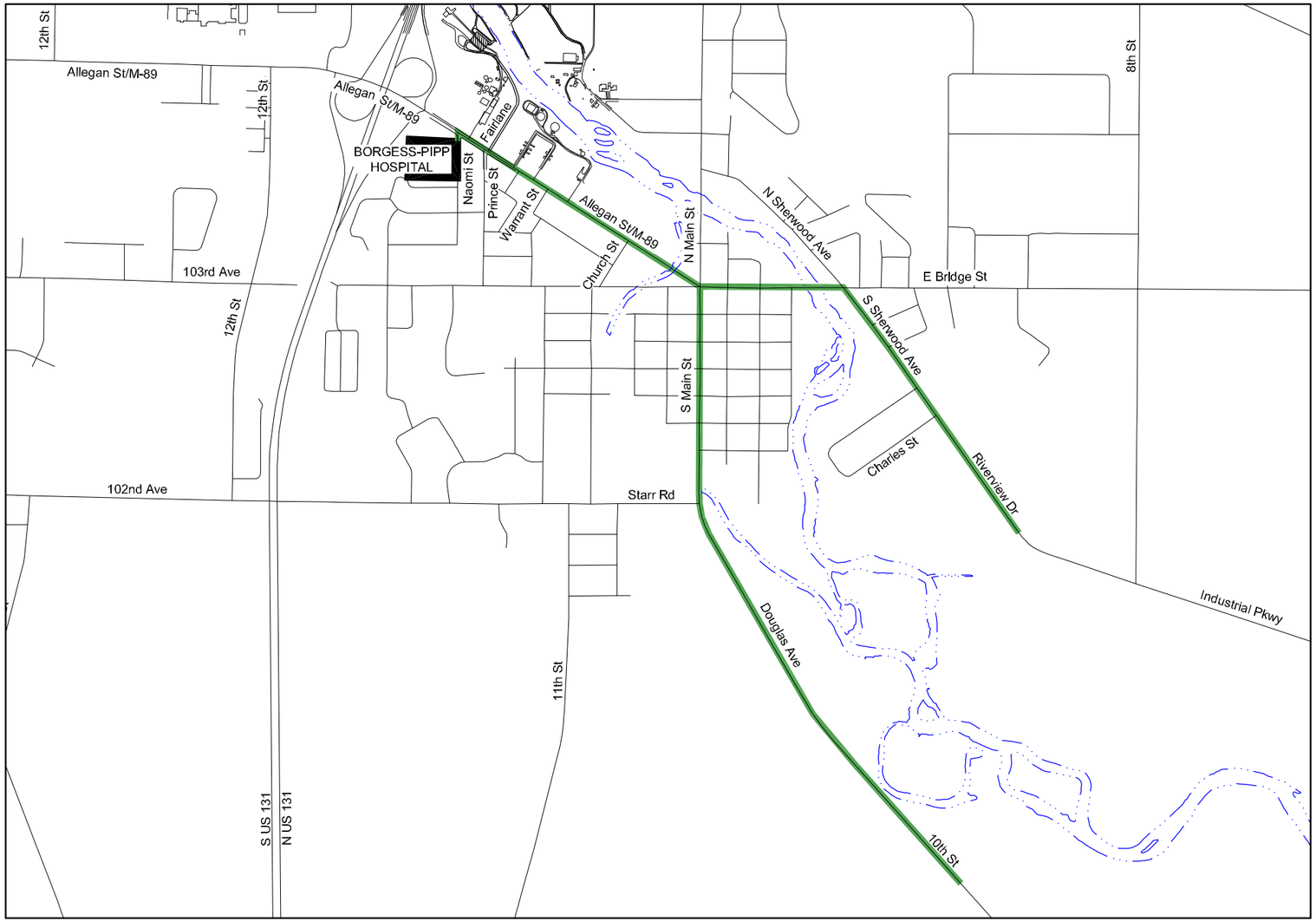
MULTI-AREA HEALTH AND SAFETY PLAN ADDENDUM 5

PLAINWELL NO. 2 DAM AREA SITE PLAN

ARCADIS

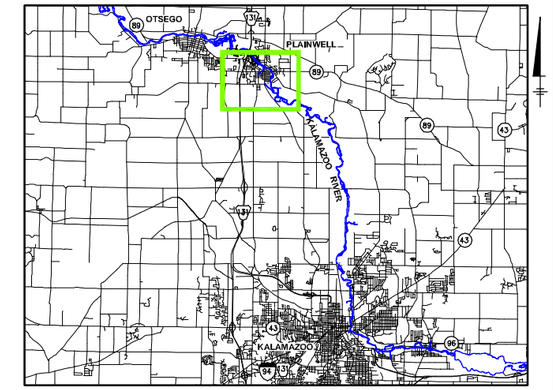
FIGURE **1-1**

SYR-90 MTK JCR KEW JCR
KRSG (B0064539.0000.00670)
Q:\KRSG\MorrowDamToPlainwellDam\SRI_DamNo2_HandSmxd\SitePlan_v2.mxd - 2/4/2010 @ 12:26:40 PM



RIVERVIEW DRIVE AND 10TH STREET TO BORGESS-PIPP HOSPITAL

0 800' 1600'
SCALE: 1"=800'



OVERVIEW MAP

0 3 6
SCALE: 1"=3 MILES

DIRECTIONS TO BORGESS-PIPP HOSPITAL FROM RIVERVIEW DRIVE	
Head northwest on Riverview Dr toward Charles St	0.4 miles
Continue on S. Sherwood Ave	0.3 miles
Turn left on E Bridge St./M-89	1.0 miles
Turn left on Naomi St.	0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	

DIRECTIONS TO BORGESS-PIPP HOSPITAL FROM 10TH STREET	
Head northwest on 10th St toward Starr Rd	0.8 miles
Continue on S. Main St	0.5 miles
Turn left on Allegan St./M-89	0.7 miles
Turn left on Naomi St.	0.1 miles
Arrive at 411 Naomi Street, Plainwell, MI	

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
MULTI-AREA HEALTH AND SAFETY PLAN
ADDENDUM 5

PLAINWELL NO. 2 DAM AREA - ROUTES TO THE HOSPITAL

ARCADIS

FIGURE
4-1

CITY: SYRACUSE DIV/GROUP: 141/ENV DB: A. SAMIOS PM: S. GARBACIAK LYRON="OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0064539\0000\00670\DWG\HASP\64539G01.dwg LAYOUT: 4-1 SAVED: 6/9/2009 3:25 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 6/9/2009 3:26 PM BY: SAMIOS, ALEX
XREFS: 64539X00 64539X01 64539X02 64539X03 IMAGES: PROJECTNAME: ----

ARCADIS
Infrastructure, environment, buildings

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Multi-Area Health and Safety Plan (Rev. 1) Addendum 6: Willow Boulevard/A-Site Landfill Operable Unit

Kalamazoo River Study Group

March 2010

ARCADIS
Infrastructure, environment, buildings

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Multi-Area Health and Safety Plan (Rev. 1) Addendum 6: Willow Boulevard/A-Site Landfill Operable Unit

Georgia-Pacific LLC

March 2010

ARCADIS

Michael J. Erickson, P.E.
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Multi-Area Health and Safety Plan (Rev. 1) Addendum 6: Willow Boulevard/A-Site Landfill Operable Unit

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

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B0064581 and B0064582

Date:
March 2010

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1. Introduction

1.1 General

On September 30, 2009 Georgia-Pacific LLC (Georgia-Pacific) entered into an agreement with the U.S. Environmental Protection Agency (USEPA) that will govern the next phase of work at the Willow Boulevard/A-Site Landfill Operable Unit (WB/A-Site OU) (Figure 1-1). The WB/A-Site OU is Operable Unit 2 of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site), located in Kalamazoo and Allegan Counties, Michigan.

A Statement of Work (SOW), included as an attachment to the Consent Decree for the Design of Certain Response Actions at Operable Unit 2 of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, describes the proposed design and remedial action work at the WB/A-Site OU. The Remedial Action is estimated to begin in the Spring of 2011, and removal activities and initial planting of vegetation are estimated to be completed by the end of 2012.

The Consent Decree requires development and submission of a Health and Safety Plan (HSP) designed to protect onsite personnel and area residents from physical, chemical, and hazards posed by the Remedial Action. . USEPA agreed that Georgia-Pacific could submit an addendum to the *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan* (Multi-Area HSP; ARCADIS BBL 2007) to satisfy this requirement. This *Multi-Area Health and Safety Plan – Addendum 6* (Addendum) – which describes the health and safety risk analysis for the proposed activities, provides a description of required environmental monitoring and personal protective equipment (PPE), required medical monitoring, work area controls (i.e., decontamination and contaminant control), and contingency and emergency planning – has been developed to meet the requirements of the activities to be performed under the above referenced Consent Decree.

1.2 Objective

The objective of this Addendum is to provide a mechanism for establishing safe working practices while conducting the Remedial Action activities. The safety organization, procedures, and PPE have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incidents. Table 1-1 (located at the end of this Addendum) presents an activity hazard summary table for the WB-A/Site OU.

1.2.1 Remedial Action Activities

As described in the Consent Decree, the objectives of the WB/A-Site OU Remedial Action are to protect public health and the environment at the WB/A-Site OU by the design and implementation of remedial actions at the site. The following field activities are anticipated:

- Pre-Design Investigation
  - Site reconnaissance
  - Installation of borings
- Surveying Activities
- Mobilization
- Sediment and Soil Excavation Operations
  - Confirmation sampling
  - Mitigation activities
- Material Transport and Consolidation at WB/A-Site OU
- Installation of Cover System
  - Part 115 cap
  - Groundwater monitoring network
  - Landfill gas monitoring system and cutoff trench
  - Permanent Erosion and sedimentation controls
- Fencing
- Sheet Pile Wall Removal

- Personnel and Equipment Decontamination
- Site Restoration and Demobilization
- Environmental Monitoring
- Construction Oversight

1.3 Applicability of the Multi-Area HSP

The Willow Boulevard and A-Site landfills served as disposal sites for paper residuals from the King Highway Landfill until 1975 and 1987, respectively. The presence of polychlorinated biphenyls (PCBs) in soils within the WB/A-Site OU as a result of the disposal operations is the primary impetus for the Remedial Action.

The Remedial Action at the WB/A-Site OU will be performed using similar construction techniques as the Former Plainwell Impoundment Time Critical Removal Action (TCRA), completed between 2007 and 2009. The Former Plainwell Impoundment TCRA was conducted under the Multi-Area HSP and associated Addenda 1 through 4. Over 200,000 man hours of work were performed at the Former Plainwell Impoundment with one recordable incident. The Remedial Action at the WB/A-Site OU will be performed following the health and safety guidelines established in the Multi-Area HSP and associated addenda.

1.4 Policy Statement

The policy of ARCADIS is to provide a safe and healthy work environment. No aspect of operations is of greater importance than the prevention of injury and illness. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS will take every reasonable step to eliminate or control hazards to minimize the possibility of injury, illness, or incident.

This Addendum prescribes the procedures that must be followed during activities conducted as part of the Remedial Action at the WB/A-Site OU. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Coordinator (PC) and the Health and Safety Manager (HSM). This Addendum will be reviewed periodically to ensure that it is current and technically correct. Any changes in WB/A-Site OU conditions and/or the scope of work covered under the Consent Decree will require the review and modification (if necessary) of this Addendum - such changes will be completed in the form of a revision to this Addendum.

The provisions of this plan are mandatory for all ARCADIS personnel assigned to the WB/A-Site OU. Subcontractors will prepare their own site-specific/project-specific HSP that must meet the basic requirements of the Multi-Area HSP. All visitors to ARCADIS work areas at the WB/A-Site OU must read and abide by the requirements of this plan.

2. Roles and Responsibilities

2.1 All ARCADIS Personnel

All ARCADIS personnel must adhere to the procedures outlined in the Multi-Area HSP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner conflicting with these procedures. The PC has the authority to dismiss any person from the WB/A-Site OU who violates the procedures identified in this Addendum and the Multi-Area HSP.

All ARCADIS personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in the Multi-Area HSP prior to initiating WB/A-Site OU activities. In addition, all onsite personnel will attend an initial hazard briefing prior to beginning work at the WB/A-Site OU.

The roles of ARCADIS personnel are outlined in the following subsections. A summary table for key project personnel and contacts is provided in Table 2-1 below.

Table 2-1 – Key Personnel

Role	Name	Address/Telephone No.
ARCADIS Personnel		
Principal in Charge (PIC)	Michael J. Erickson, P.E.	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1924 Cell: 734.604.7044
WB/A-Site OU Project Coordinator (PC)	Patrick N. McGuire	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
Engineer of Record (ER)	William Rankin, P.E.	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
Health and Safety Officer (HSO)	Jay D. Keough, CIH	8 South River Road Cranbury, NJ 08512 Phone: 609.860.0590 ext. 101 Cell: 908.492.5674

Role	Name	Address/Telephone No.
Health and Safety Manager (HSM)	Charles P. Webster, CSP	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 Phone: 315.671.9297 Cell: 315.247.5971
Health and Safety Supervisor	Ben Lawrence	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.229.8594 Cell: 734.732.0586
Site Supervisor (SS)	EJ Suardini	10559 Citation Drive Suite 100 Brighton, MI 48116 Phone: 810.225.1955 Cell: 734.276.2566
Client Personnel		
Georgia-Pacific LLC	Garry Griffith, P.E..	951 County Street Milan, MI 48160-9610 Phone: 734.439.1205 Cell: 734.735.0780
USEPA Region 5 Personnel		
Remedial Project Manager (PM)	Michael Berkoff	77 W. Jackson Blvd (SR-6J) Chicago, IL 60604 Phone: 312.353.8983
Michigan Department of Natural Resources and Environment (MDNRE) Personnel[1]		
MDNRE PM	Paul T. Bucholtz	Remediation Division 525 W. Allegan St., 3rd Floor South Lansing, MI 48933 Phone; 517.373.8174

[1] The Michigan Departments of Environmental Quality and Natural Resources (MDEQ and MDNR, respectively) merged on January 17, 2010 into the new Michigan Department of Natural Resources and Environment (MDNRE).

2.2 ARCADIS Personnel

2.2.1 Principal in Charge, Project Coordinator, and Engineer of Record

The Principal in Charge (PIC) is responsible for promoting health and safety in all aspects of the project and empowering the PC and Engineer of Record (ER) to implement the requirements of this Addendum.

The PC and ER are responsible for verifying that activities are completed in accordance with the requirements of this Addendum. It is also the responsibility of the PC and ER to perform the following duties:

- Consult with the HSO on WB/A-Site OU health and safety issues
- Review Loss Prevention Observation reports (Appendix A of the Multi-Area HSP)
- Verify that all incidents and near-misses are thoroughly investigated and reported to Georgia-Pacific within 24 hours of notification
- Approve, in writing, addenda or modifications to this Addendum
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance

In addition, the PC is responsible for confirming that the Site Supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this Addendum.

2.2.2 Other ARCADIS Personnel

All other personnel roles are outlined in Sections 2.2.2 to 2.2.5 of the Multi-Area HSP document.

2.3 Other Roles and Responsibilities

Further information on Contractor Qualified Safety Personnel, Stop Work Authority, Short-Service Employee Program, Visitors, and the ARCADIS Near-Miss Reporting Hotline can be found in Sections 2.3 to 2.8 of the Multi-Area HSP document.

3. Project Hazards and Control Measures

3.1 Field Activities, Hazards, and Control Procedures

The scope of work for the WB/A-Site OU Remedial Action includes the activities outlined in Section 1.2.1. The activity hazards at the WB/A-Site OU, provided below and in Table 1-1, identify potential health, safety, and environmental hazards associated with each type of field activity. Job Loss Analyses (JLAs) (formerly known as Job Safety Analyses [JSAs][2], and additional to those provided in the Multi-Area HSP) are also provided in Appendix A. It is intended that these JLAs will be updated as necessary prior to construction, when the full project design is known and understood. Because of the complex and changing nature of field projects, the SS must continually inspect the WB/A-Site OU to identify hazards that may affect onsite personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PC whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep onsite personnel informed of the changing conditions, and the PC will write and/or approve addenda or revisions to this Addendum as necessary.

Many of the field activities, hazards, and control procedures are similar to those outlined in the Multi-Area HSP main text. The Multi-Area HSP has therefore been referenced where applicable.

3.1.1 Pre-Design Investigation

3.1.1.1 Site Reconnaissance

Site reconnaissance activities are likely to occur during the pre-design phases of the project and will generally involve walking or driving across the WB/A-Site OU to evaluate existing conditions. Hazards may be associated with the terrain of the WB/A-Site OU and environmental conditions.

Hazards – Walking surfaces may involve slip, trip, or fall hazards. Slippery walking surfaces can increase the possibility of slips and falls. The immediate proximity of the WB/A-Site OU to the Kalamazoo River and Davis Creek increases the possibility of slipping and falling into the

[2] Updates to the ARCADIS Health and Safety system in September 2009 resulted in changes to several terms used throughout the Multi-Area HSP (ARCADIS BBL 2007). Job Safety Analyses (JSAs) are now referred to as Job Loss Analyses (JLAs), and Near Misses are now referred to as Near Losses. Only the terms have been updated -- the definition and purpose of each element of the health and safety program remain unchanged.

river itself and drowning. Several areas around the WB/A-Site OU are also low-lying and prone to flooding, which again increases the risk of drowning by falling into bodies of water. The paper residuals create potentially large desiccation cracks and produce uneven walking surfaces increasing the possibility of tripping and falling.

Environmental hazards may include flora and fauna such as poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues such as sunburn, lightning, rain, tornados, and heat or cold-related illnesses; and pathogens such as rabies, Lyme disease, and blood-borne pathogens.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel should take extra care during periods of heavy rainfall, when the river is more prone to flooding, possibly avoiding visiting the WB/A-Site altogether.

3.1.1.2 Installation of borings

A subsurface investigation (i.e., a drilling program) will be completed to evaluate soil conditions in order to perform a slope stability analysis for the final build-out berm slope geometry of the WB/A-Site OU and to delineate waste limits throughout the WB/A-Site OU for grading and cap construction. Soil sampling activities will consist of collecting samples for field analysis using a drill rig with hollow-stem auger and/or geoprobe units. The physical hazards from sampling are associated with the heavy equipment used to collect the samples, and the environment in which the samples are collected.

Refer to Section 3.2.6.2 of the Multi-Area HSP for a discussion of the potential hazards associated with land-based drilling that include heavy equipment operations, working near underground and overhead utility lines, and use of specialized tools and equipment. As detailed in Section 3.2.6.2 of the Multi-Area HSP, the driller is responsible for safe operation of the drill rig and must follow all hazard and control procedures, including procedures for equipment decontamination. Additional hazards related to handling of soil samples are outlined below.

Hazards –The environmental conditions under which the sampling is conducted may present chemical hazards including contact with soil containing PCBs and contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection/probing, potential hazards associated with working near water are a concern. A number of samples will be collected from the shoreline - the primary hazard of working near the river is drowning. A number of borings will be located near to the sheet pile wall along the north side of the A-Site, which may lead to the hazards of falling from height into the river and drowning.

The flora and fauna of the WB/A-Site OU may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may exacerbate these hazards by causing wet, muddy, slick walking surfaces, and unstable soil.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods. To control dermal exposure during soil sampling/probing activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders. It is also anticipated that a temporary guardrail will be installed along the length of the sheet pile wall on the north side of the A-Site to prevent falls into the river.

3.1.1.3 Pre-Design Soil Sampling

Pre-design soil sampling will be conducted throughout the WB/A-Site OU to verify the extent of PCB contamination. Soil sampling activities consist of collecting samples for field and laboratory analysis using hand-augering techniques. The physical hazards from sampling are associated with the sample collection methods, the equipment used to collect the samples, and the environment in which the samples are collected.

Hazards – The primary physical hazards associated with soil sampling include muscle strains, sprains, and eye injuries. The environmental conditions under which the sampling is conducted may present chemical hazards including contact with soil containing PCBs and contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection, potential hazards associated with working near water will be a concern. A number of samples will be collected from the shoreline and in the area east of Davis Creek - the primary hazard of working near water is drowning.

The flora and fauna of the WB/A-Site OU may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may exacerbate these hazards by causing wet, muddy, slick walking surfaces, and unstable soil.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods. To control dermal exposure during soil sampling activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders.

3.1.2 Surveying Activities

Surveying activities for the WB/A-Site OU will include survey of boring and monitoring well locations from the pre-design investigation, as well as survey of the site subsequent to the Remedial Action. Surveying involves the transportation, set up, and use of survey equipment (e.g., Global Positioning System [GPS] unit, survey rod).

Hazards – The primary physical hazards associated with these specific procedures include muscle strains, sprains, and potential eye hazards along with water hazards (through working in close proximity to water) such as immersion in cold water or drowning. The conditions under which the procedures are conducted may present chemical and physical hazards. Slips, trips and falls can occur at any time based upon the terrain covered. Potential chemical hazards may include contact with media containing PCBs and potential contact with chemicals used for equipment decontamination.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – To control dermal exposure during surveying activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment. Prior to initiating each activity, the Site conditions will be discussed with

onsite personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in Section 4, General Safety Practices, and in task-specific sections of the Multi-Area HSP. Specifically, Section 4.22 contains information on water hazards and safety practices including mandatory use of floatation equipment. Air monitoring information is included in Section 6, Air Monitoring. As detailed in 3.1.1.2, it is also anticipated that a temporary guardrail will be installed along the length of the sheet pile wall on the north side of the A-Site to prevent falls into the river.

3.1.3 Mobilization

Refer to Section 3.2.1 of the Multi-Area HSP for a discussion of the potential hazards associated with mobilization including heavy equipment operations, increased traffic, working near the river, and other physical and environmental hazards.

3.1.4 Sediment and Soil Excavation Operations

3.1.4.1 Excavation activities

Refer to Section 3.3.3 of the Multi-Area HSP for a discussion of the potential hazards associated with sediment and soil removal operations including heavy equipment operations, materials handling, working near the river, exposure to WB/A-Site OU contaminants, and other physical and environmental hazards.

3.1.4.2 Confirmation Sampling

Confirmation soil and sediment sampling will be conducted throughout the WB/A-Site OU to verify that PCBs have been removed to the site-specific cleanup criteria. Soil sampling activities consist of collecting samples for field and laboratory analysis using Lexan® tubing, driven until refusal, or hand-augering techniques. The physical hazards from sampling are associated with the sample collection methods, the equipment used to collect the samples, and the environment in which the samples are collected.

Hazards – The primary physical hazards associated with soil and sediment sampling include muscle strains, sprains, and eye injuries. The environmental conditions under which the sampling is conducted may present chemical hazards including contact with soil containing PCBs and contact with chemicals used for equipment decontamination.

In addition to the safety hazards specific to sample collection, potential hazards associated with working near water will be a concern. A number of samples will be collected from the shoreline and in the area east of Davis Creek - the primary hazard of working near water is drowning.

The flora and fauna of the WB/A-Site OU may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may exacerbate these hazards by causing wet, muddy, slick walking surfaces, and unstable soil.

Control – Prior to the start of any field activity, the WB/A-Site OU conditions will be discussed with all affected employees. Potential hazards will be identified, and protective measures will be explained and implemented. Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods. To control dermal exposure during sediment soil/probing activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders.

3.1.4.3 Mitigation Activities

Refer to Section 3.3.3.6 of the Multi-Area HSP for a discussion of the potential hazards associated with mitigation activities including heavy equipment operations, materials handling, working near the river, and other physical and environmental hazards.

3.1.5 Material Transport and Consolidation at WB/A-Site OU

Following excavation activities, the excavated material will be staged and dewatered, if necessary, and then moved away from the river, where it will be consolidated prior to capping. The majority of excavated materials will be transported fully within the site; however, some materials will be excavated from areas away from the site that will require transportation via public roads (including the area around monitoring well AMW-3). Section 3.3.4 of the Multi-Area HSP discusses the potential hazards and controls pertaining to this work including working surfaces, heavy equipment operations, materials handling, exposure to WB/A-Site OU contaminants, and increased traffic.

3.1.6 Installation of Cover System

3.1.6.1 Part 115 Cap Installation

Capping activities will involve import of clean materials which will be placed over the consolidated contaminated material. Hazards and Controls are similar to those discussed in Section 3.1.5 Material Transport and Consolidation.

3.1.6.2 Groundwater Monitoring Network

Monitoring wells will be analyzed periodically to evaluate groundwater elevations throughout the site. The hazards and safety procedures for groundwater sampling are included in the following sections. The physical hazards of this operation are primarily associated with the methods and procedures for monitoring the wells and sample locations.

Hazards – The primary hazards associated with determining groundwater elevations are not potentially serious; however, the conditions under which the wells are monitored may present physical hazards. The hazards directly associated with monitoring wells are generally limited to strains/sprains and potential eye hazards. Potential chemical hazards may include contact with media containing PCBs and potential contact with chemicals used for equipment decontamination. In addition to the safety hazards specific to sample collection, hazards associated with working on, in, or near water, will be a concern.

The flora and fauna of the Site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Controls – To control dermal exposure during sampling activities, a minimum of Modified Level D PPE will be worn. A description of each level of PPE is included in Section 5, Personal Protective Equipment of the Multi-Area HSP. Section 4.22 of the Multi-Area HSP, Water and Boating Precautions, provides general safety procedures for working on or near the river including proper clothing precautions such as personal floatation devices and waders.

3.1.6.3 Landfill Gas Monitoring System and Cutoff Trench

A landfill gas monitoring system and cutoff trench will be installed to determine the extent of gas generation and migration at each landfill cap. The hazards and safety procedures for installation of this system are included in the following sections. The physical hazards are

primarily associated with the potentially explosive conditions created by confinement of methane gas in concentrations above the lower explosive limit.

Hazards – The primary hazards associated with installation of a landfill gas monitoring system and cutoff trench are primarily associated with the exposure of personnel to a potentially difficult breathing environment and potentially explosive conditions due to the build-up of methane gases, materials handling, and hand-labor activities. Unstable trenches could collapse, resulting in possible injury and death. Materials handling and hand-labor activities may cause blisters, sore muscles, joint and skeletal injuries, and contusion and laceration hazards. The work area itself presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. In addition, rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces. A falling-from-height hazard is introduced due to excavation of the trench. A drowning hazard is associated with working on or near the River.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating gas monitoring system and trench installation activities, the operation will be reviewed with all onsite personnel. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Restrictions will be placed on performing hot work at the site (welding, torch cutting, etc.), using sparking tools, and smoking will be forbidden on site. The use of air quality meters will be employed to identify potentially hazardous breathing or explosive environments during excavation/trenching activities. Trenches must be inspected regularly and following rain or other such weather event that could affect the integrity of the excavation. Inspections must be performed by a Competent Person as defined in the ARCADIS Excavation and Trenching Procedure (ARC HSCS005). It is not anticipated that there will be a need for personnel to enter any trenches; however, if necessary, personnel should not enter into trenches that have not been inspected and approved as safe by the designated Competent Person. Soil piles and materials will be kept a minimum of two feet from the edge. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods or performing work in the trench for long periods. Mechanical assistance should be provided for large lifting tasks. Personnel should maintain a safe walking distance from the edge; at least two feet. Any excavations left open and unattended will be marked and protected by the contractor.

3.1.6.4 Permanent Erosion and Sedimentation Controls

After complete removal of contaminated materials, erosion control measures will be implemented to include topsoil placement, seeding, and erosion control matting as required.

Hazards – The hazards of this phase of activity are primarily associated with materials handling and unloading, and hand-labor activities. Materials handling and hand-labor activities may cause blisters, sore muscles, joint and skeletal injuries, and contusion and laceration hazards. The work area itself presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. In addition, rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces. A drowning hazard is associated with working on or near the River.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating erosion control installation activities, the operation will be reviewed with all onsite personnel. Hazards will be identified, and protective measures, including the appropriate level of PPE, will be explained and implemented. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Mechanical assistance should be provided for large lifting tasks.

3.1.7 Sheet Pile Wall Removal

The sheet pile wall that runs along the northern bank of the A-Site is anticipated to be cut off at the median river water level and the cut sections removed from the project area. Sheet pile removal activities may involve exposure to physical and health hazards.

Hazards – The hazards of this phase of activity are associated with manual materials handling, overhead work (sheet pile removal and lifting), hot work (removal of sheet pile by torch cutting), excavation hazards, and drowning hazards. Manual materials handling and project area preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. Removal of the sheet pile wall may expose personnel to hot work activities, underground and overhead utilities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from

scattered debris, irregular walking surfaces, or elevated work. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Working in and around the River also presents a drowning hazard.

Environmental hazards include plants, such as poison ivy and poison oak; water-based hazards, such as drowning; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather issues, such as sunburn, lightning, rain, tornados, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and other blood-borne pathogens.

Control – Prior to initiating each activity, the Site conditions and JLAs will be discussed with onsite personnel. Hazards will be identified and protective measures will be explained and implemented. Control procedures for these hazards are discussed in the Multi-Area HSP in Section 4, General Safety Practices, and in task-specific sections. Decisions regarding PPE and air monitoring will be based on the potential chemical and physical hazards at the Site, and measurements and observations made prior to and during work activities. Equipment will be inspected and in proper working condition. Mechanical assistance will be provided for large lifting tasks. Avoidance of biological hazards, as discussed in Section 4, General Safety Practices, of the Multi-Area HSP will be implemented. Personnel conducting observation activities will do so from a safe distance. Any required hot work will be performed using the appropriate PPE equipment, including gloves and face shields. Additionally, no hot work will be conducted on any surface covered with a protective coating whose flammability is not known. Noise may also present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 A-weighted decibels (dBA), requiring the use of hearing protection.

3.1.8 Personnel and Equipment Decontamination

Refer to Section 3.2.3 of the Multi-Area HSP for a discussion of decontamination of non-disposable equipment and the primary potential hazard - release of hazardous materials.

3.1.9 Site Restoration and Demobilization

Refer to Section 3.2.4 of the Multi-Area HSP for a discussion of the potential hazards associated with restoration and demobilization including heavy equipment operation, materials handling, working near the river, and other environmental and physical hazards.

3.1.10 Environmental Monitoring

Refer to Sections 3.3.5.1, 3.3.5.3, and 3.3.5.4 of the Multi-Area HSP for a discussion of the potential hazards associated with air, groundwater, and surface water monitoring including hazards associated with the sample collection methods, sampling equipment, and the environment in which the samples are collected (e.g., sampling near the river).

3.1.11 Construction Oversight

Refer to Section 3.2.5 of the Multi-Area HSP for a discussion of the potential physical and health hazards associated with construction oversight including working around heavy equipment, material handling, and environmental hazards.

3.2 Chemical Hazards

Refer to Section 3.4 of the Multi-Area HSP for a discussion of the potential chemical hazards related to inhalation, ingestion, and skin or eye contact with materials that are impacted by PCBs.

Table 3-1 provides supplemental information to that of the Chemical Hazard Table provided in the Multi-Area HSP, which includes data on methane. A Material Data Sheet is also included in Appendix B.

4. Sections of Multi-Area HSP Applicable to WB/A-Site OU Remedial Action

Compliance with the following sections of the Multi-Area HSP is required for the WB/A-Site OU Remedial Action:

- General Safety Practices – Outlined in Section 4 of the Multi-Area HSP
- Personal Protective Equipment – Outlined in Section 5 of the Multi-Area HSP
- Air Monitoring – Outlined in Section 6 of the Multi-Area HSP
- Work Zones and Decontamination – Outlined in Section 7 of the Multi-Area HSP
- Training and Medical Surveillance – Outlined in Section 8 of the Multi-Area HSP
- Emergency Procedures – Outlined in Section 9 of the Multi-Area HSP. Figure 9-2 in the Multi-Area HSP identifies a route to the hospital (Borgess Emergency and Trauma Center [north of the site]) that would be applicable for the WB/A-Site OU.

5. ARCADIS Policies/Procedures

ARCADIS Health and Safety Procedures applicable to this project are listed below. These procedures should be reviewed by the project manager, task manager and site personnel. The Health and Safety Officer should be contacted with any questions concerning the procedures. In the event that there is conflicting information between the policies and information provided in this addendum or the Multi-Area HSP, the rules that provide the most protection to the worker will be followed.

- ARC HSCS005 – Excavation and Trenching
- ARC HSFS019 – Utility Location
- ARC HSGE007 – Hazard Communication
- ARC HSGE024 – Motor Vehicle
- ARC HSIS008 – Hearing Conservation
- ARC HSGE004 – First Aid / Cardiopulmonary Resuscitation (CPR)
- ARC HSMS010 – Incident Reporting and Investigation
- ARC HSGE015 – Personal Protective Equipment (PPE)

6. ARCADIS Field Health & Safety Handbook

The Field Health and Safety Handbook is an ARCADIS document containing information about topic-specific health and safety requirements for the field. This handbook contains relevant general topics and is used as part of the overall health and safety program. Where applicable, the information provided in the handbook will be used as an informational source in conjunction with the Multi-Area HSP. Field Health and Safety Handbook sections applicable to this project include:

II. Health and Safety Administration

A. ARCADIS Responsibilities
B. Employee Responsibilities
C. Visitors
D. Communications
E. HARC Process (ARCHSMS002)
F. Incident Investigation (ARCHSMS010)
G. Near-miss Reporting
H. Stop Work Authority
I. Short-service Employee Program
J. Workplace Violence and Harassment
K. Drug and Alcohol Awareness
L. Emergency Action Plan
M. WorkCare
N. Subcontractors
O. Regulatory Inspections (ARCHSG013)
P. Recordkeeping and Postings

III. General Field Health & Safety Requirements

A. Daily Safety Meetings/Tailgates
B. Department of Transportation – HAZMAT Transportation/Dangerous Goods (ARCHSGED02)
C. First-aid/CPR
D. Blood-borne Pathogens (ARCHSIH005)
E. General Health and Safety Rules and Safe Work Permits
F. General Housekeeping, Personal Hygiene and Field Sanitation
G. Site Security, Work Zone and Decontamination for HAZWOPER Sites
H. Personal Safety and Other Unique Site Conditions
I. Severe Weather
J. Fire Prevention
K. Hazard Communication
L. Noise
M. Heat and Cold Stress
N. Biological Hazards
P. Medical Surveillance (ARCHSGE010)
R. Personal Protective Equipment (ARCHSGE015)

S. Travel Safety-Domestic and International (ARCHSGE022)
T. Vehicle Safety Inspection
U. Driving
V. Trailer Safety
Y. Confined Spaces (ARCHSSF003)
BB. Fall Protection (ARCHSFS007)
CC. Hand and Power Tools
DD. Vegetation Management
EE. Ergonomics
FF. Site Storage of Hazardous Chemicals, Gases and Solvents
GG. HAZWOPER and HAZMAT Response (ARCHSSF012)
II. Drum and Other Material Handling
JJ. Ladders (Portable/Fixed)
KK. Signs, Signals and Barricades
LL. Traffic Control (ARCHSFS017)
MM. Utility Location (ARCHSF019)
NN. Backing Safety

IV. General Field Construction Health and Safety Best Management Practices

A. Elevated Work Surfaces
D. Excavation/Trenching (ARCHSCS005)
E. Heavy Equipment (ARCHSCS006)
F. Hoisting and Rigging, Cranes and Derricks
K Welding and Cutting (ARCHSC011)
L. Temporary Working Surfaces
O. Rollover and Overhead Protection
Q. Permit to Work

V. Specific Work Areas, Hazards and Activities

F. Roadway
G. Water Operations Work
I. Industrial Hygiene and Monitoring Equipment
J. Scientific Scuba Diving

7. References

ARCADIS BBL. 2007. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Multi-Area Health and Safety Plan – Revision 1.* Prepared for the Kalamazoo River Study Group by ARCADIS BBL U.S., Inc. May 2007.

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Tables

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.1.1	Site Reconnaissance	Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces.
		Water-related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
3.1.1.2	Installation of borings	Refer to Table 1-1, section reference 3.2.6.2, of the Multi-Area HSP for hazards related to land-based drilling	
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain. A guardrail will be installed along the extent of the sheet pile wall on the north side of the A-Site
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.1.3	Pre-Design Soil Sampling	Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.2	Surveying Activities	Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain. A guardrail will be installed along the extent of the sheet pile wall on the north side of the A-Site
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.3	Mobilization	Refer to Table 1-1, section reference 3.2.1, of the Multi-Area HSP	
3.1.4.1	Sediment and Soil Removal Operations	Refer to Table 1-1, section reference 3.3.3, of the Multi-Area HSP	

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.4.2	Confirmation Sampling	Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.4.3	Mitigation Activities	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		Electrical (overhead and underground utilities)	Maintain proper distance from utility lines (as defined in Section MM of the ARCADIS Employee Field Health and Safety Handbook; Use lockout/tagout
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain
3.1.5	Material Transport and Consolidation at WB/A-Site OU	Refer to Table 1-1, section reference 3.3.4, of the Multi-Area HSP	

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.6.1	Part 115 Cap Installation	Refer to Table 1-1, section reference 3.3.4, of the Multi-Area HSP for details of material transport and consolidation.	
		Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Slip, trip, and fall/unstable soil	Proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain
3.1.6.2	Groundwater Monitoring Network	Strains/sprains and potential eye hazards.	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Chemical hazards	Personnel will wear a minimum of Modified Level D PPE.
		Working on, in, or near water.	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards.	Personnel will wear proper clothing and avoid reaching into dark spaces

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.6.3	Landfill Gas Monitoring System and Cutoff Trench	Difficult breathing conditions	Air quality meters will be employed in certain confined areas to identify potentially difficult breathing environments. Work will be scheduled to reduce the likelihood of personnel being in confined spaces for long periods. The ARCADIS Confined Space Procedure will be followed if confined space entry is required.
		Explosion (due to methane gases)	Restrictions will be placed on hot working (welding, torch cutting, etc) and the use of sparking tools. Smoking will be forbidden at the site. Air quality meters will be employed in any area where intrusive activities are being performed to identify potentially explosive environments (where gas levels exceed the Lower Explosive Limit as defined on material data sheets).
		Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Falling from height	All elevated work will be performed in a safe manner and in compliance with all regulations governing such work (including 29 CFR 1926). All personnel exposed to fall hazards shall be trained regarding the nature of the hazards of elevated work prior to assignment.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards.	Personnel will wear proper clothing and avoid reaching into dark spaces

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
3.1.6.4	Permanent Erosion and Sedimentation Controls	Physical hazards (e.g., muscle strains, sprains, eye injuries)	Personnel will be trained to operate equipment properly and work will be scheduled to reduce the likelihood of performing repetitive tasks for long periods.
		Slip, trip, and fall/unstable soil	Personnel will wear proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain.
		Water related incidents, drowning, submersion	All personnel must wear a USCG-approved Type 1 or Type 2 PFD whenever working on or near the water per 29 CFR 1926. Personnel will avoid site visits during periods of heavy rain, when determined to be unsafe by the SS or PC.
		Environmental hazards.	Personnel will wear proper clothing and avoid reaching into dark spaces
3.1.7	Sheet pile wall removal	Manual materials handling/site preparation (lifting, blisters, sore muscles, skeletal injuries, eye contusion, laceration)	Proper lifting techniques, avoid repetitive motions
		Heavy Equipment (fractures, contusions, lacerations)	Stay clear of heavy equipment, outfit equipment with warning signals
		Excavation Hazards (access and egress, surface stability, vehicular traffic, falling loads, hazardous atmospheres, water accumulation)	Maintain ladders at regular intervals, brace sidewalls, follow traffic safety, do not stand under falling loads, air monitoring, use of sumps and water control structure). Have a competent person (as defined in the ARCADIS Excavation and Trenching Procedure [ARC HSCS005]) inspect daily.
		High Noise	Hearing protection for noises that exceed 85 dBA
		Electrical (overhead and underground utilities)	Maintain proper distance from utility lines (as defined in Section MM of the ARCADIS Employee Field Health and Safety Handbook; Use lockout/tagout
		Hot work activities	Use lockout/tagout and appropriate PPE, including gloves and face shields.

Table 1-1 – Activity Hazard Summary Table

Section Reference	Activity	Hazards	Controls
		Slip, trip, and fall/unstable soil	Proper foot protection (ASTM F2412 and F2413 approved footwear with lugged soles) and avoid dangerous terrain
		Truck Traffic	Designate truck routes, outfit equipment with warning signals
		River Work	Boating safety and personal flotation devices
		Environmental Hazards	Wear proper clothing; avoid reaching into dark spaces
		Overhead work (sheet pile installation and lifting materials)	Use ladder and aerial lift safety. Do not stand under elevated loads.
		Observation safety	Observe from a safe distance
3.1.8	Personnel and Equipment Decontamination	Refer to Table 1-1, section reference 3.2.3, of the Multi-Area HSP	
3.1.9	Site Restoration and Demobilization	Refer to Table 1-1, section reference 3.2.4, of the Multi-Area HSP	
3.1.10	Environmental Monitoring	Refer to Table 1-1, section references 3.3.5.1, 3.3.5.3, and 3.3.5.4, of the Multi-Area HSP	
3.1.11	Construction Oversight	Refer to Table 1-1, section reference 3.2.5, of the Multi-Area HSP	

Notes:
1. PFD – personal flotation device
2. PPE – personal protective equipment
3. USCG – United States Coast Guard

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Multi-Area Health and Safety Plan

Table 3-1 – Chemical Hazard Data Table

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Methane [74-82-8]	12.48	NA	Inh	Simple asphyxiant by displacing air necessary for life. Symptoms include rapid respiration, muscular incoordination, fatigue, dizziness, nausea, vomiting, unconsciousness, death	Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.	NA 1000 ppm NA	NA NA NA	PEL TLV REL	NE

Notes:

1. Table supplements data in Multi-Area HSP Chemical Hazard Table.
2. a = ionization potential
   b = route into body; inh = inhalation, ing = ingestion, abs = absorption, con = contact
   c = time-weighted average
   d = short-term exposure limit
   e = Source for TWA and STEL values.
      PEL = permissible exposure limit (OSHA)
      TLV = threshold limit value (ACGIH)
      REL = recommended exposure limit (NIOSH)
   f = immediately dangerous to life and health
3. ND = Not Detected
4. NA = Not Applicable
5. NE = Not Evaluated

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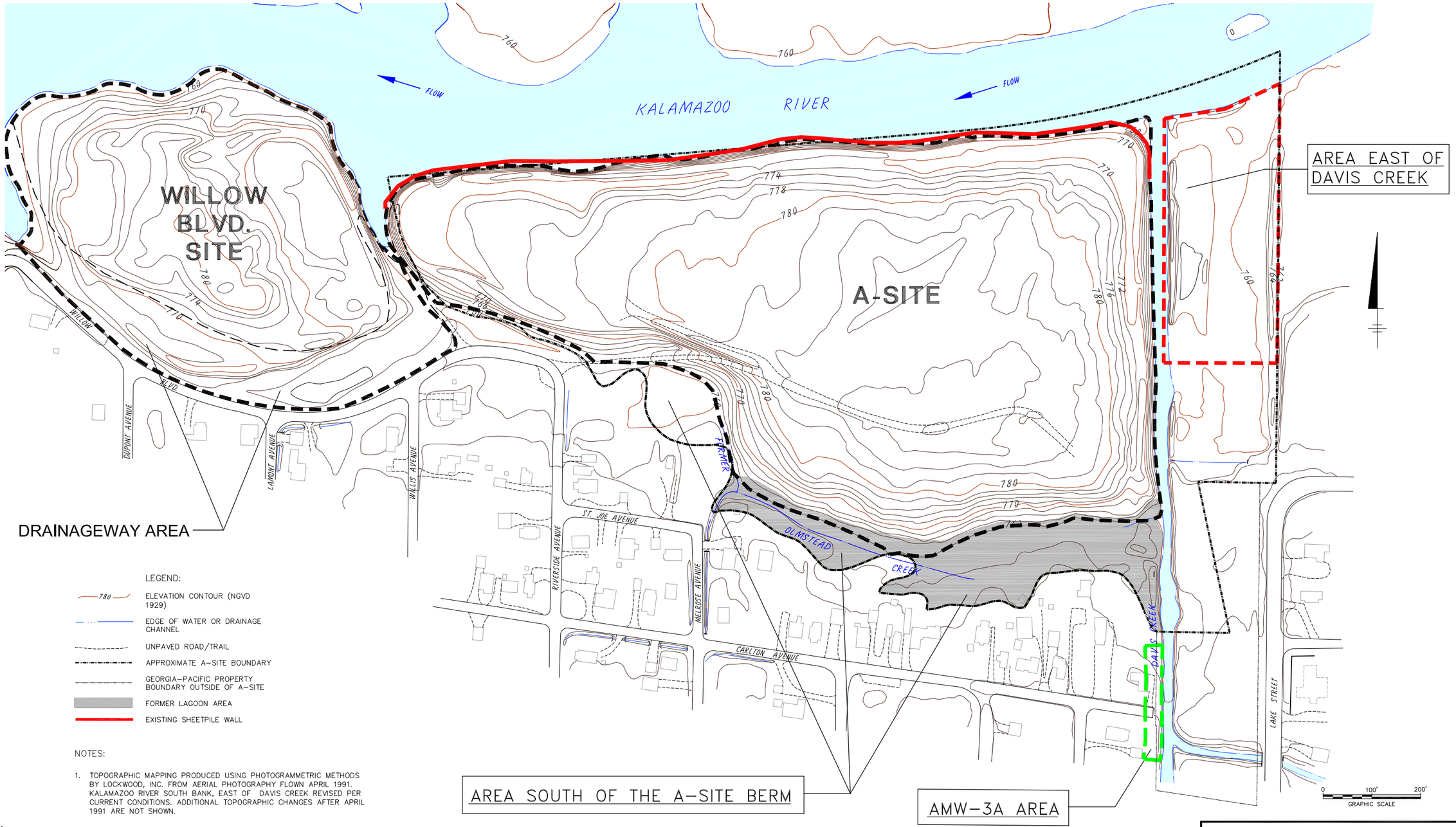
Figures



LEGEND:

- 780 — ELEVATION CONTOUR (NGVD 1929)
- EDGE OF WATER OR DRAINAGE CHANNEL
- UNPAVED ROAD/TRAIL
- APPROXIMATE A-SITE BOUNDARY
- GEORGIA-PACIFIC PROPERTY BOUNDARY OUTSIDE OF A-SITE
- FORMER LAGOON AREA
- EXISTING SHEETPILE WALL

NOTES:

1. TOPOGRAPHIC MAPPING PRODUCED USING PHOTOGRAMMETRIC METHODS BY LOCKWOOD, INC. FROM AERIAL PHOTOGRAPHY FLOWN APRIL 1991. KALAMAZOO RIVER SOUTH BANK, EAST OF DAVIS CREEK REVISED PER CURRENT CONDITIONS. ADDITIONAL TOPOGRAPHIC CHANGES AFTER APRIL 1991 ARE NOT SHOWN.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
MULTI-AREA HEALTH AND SAFETY PLAN - ADDENDUM 6

WILLOW BOULEVARD/A-SITE AND ANCILLARY AREAS

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FIGURE
1-1

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: RLP GMS KMD LD: (Opt) PIC: (Opt) PM: (Reqd) TM: D. AMBER LYR: ON=*;OFF=*REF* PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 10/8/2009 4:36 PM BY: RITSCHEL, TIMOTHY
G:\ENVCAD\SYRACUSE\ACT\B0064581\0000\00670\DWG\64581G01.dwg LAYOUT: 1-1 SAVED: 6/9/2009 3:41 PM ACADVER: 17.0S (LMS TECH)
XREFS: 64581X03 IMAGES: PROJECTNAME: ----

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Appendix A

Job Loss Analysis Sheets

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	526
Job Name	Environmental-Other
Task Description	Erosion and Sediment Control Installation
Project Number	B00645810000
Project Name	A-SITE
PIC Name	ERICKSON, MICHAEL
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Creation Date	6/29/2009 07:35:31 PM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer	Suardini, E.J.	10/23/2009	10/23/2009		Bowman, Matthew	True
HASP Reviewer	Webster, Charles	10/23/2009	10/23/2009		Lynch, Edward	True
Reviewer	Mcguire, Patrick	10/23/2009	10/23/2009		Romagnoli, Robert	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Working Outdoors and near water	1	Environmental hazards: sun, heat, cold, thunder/lightning, insects, hazardous plants, snakes, and animals	Avoid work in extreme weather conditions. Stop work if extremem weather is imminent. If lightning or thunder is present, utilize the 30/30 rule. Inspect area for hazardous plants and insects. Wear appropriate clothes for the area and weather. Use sunscreen, if necessary. Monitor for heat and cold stress. Use buddy system.	
		2	Working near water	Avoid slippery terrain when working near water. Wear PFD when working in/near water.	
2	Work zone set up	1	Not informing anyone in your work area what your intentions are.	Communicate your intentions to all affected personnel. Use high visibility cones if necessary.	
		2	Slips, trips, falls	Choose the safest path on which to walk. Continue to scan for any slip, trip, fall hazards.	
		3	Pulled muscles/back strain	Use proper lifting/pulling/pushing techniques when bending over. Use a buddy lift if something is too heavy to lift by one person.	
3	Installation of silt curtain	1	Pinch points/flying debris	Always wear gloves and safety glasses. Never put your hand in a position to be struck by a hammer.	
		2	Muscle strain	Use proper liftinng techniques.	
		3	Being hit by equipment entering work zone	Maintain a visual of your work area. Continue to communicate with anyone in your work zone.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)	Leather or mechanics	Required
Eye Protection	Safety glasses		Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required
Miscellaneous PPE	personal flotation device	For any work over water	Required

Supplies

Type	Supply	Description	Required
Personal	insect repellant		Recommended
Personal	sunscreen		Recommended
Miscellaneous	first aid kit		Recommended

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	503
Job Name	Environmental-Other
Task Description	Gas monitoring System Installation
Project Number	B00645810000
Project Name	A-SITE
PIC Name	DESHIELDS, BRIDGETTE
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Creation Date	6/23/2009 08:56:53 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	7/14/2009			Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	7/14/2009			Erickson, Michael	True
Developer	Amber, Danielle	7/14/2009			Erickson, Michael	True
Developer	Batten, Philip	7/14/2009			Rankin, William	True
HASP Reviewer	Webster, Charles				Lynch, Edward	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Excavation of trench	1	Contact, caught by machinery	Personnel shall remain at least 20 feet away from moving or rotating parts (i.e. excavator bucket, equipment tracks/wheels, vehicle drive shaft, etc.). If required to approach or work in the vicinity of moving equipment, obtain eye contact with equipment operator by using hand signals.	
		2	3rd Party Inhallation Hazard	Monitor air in work area(s) for elevated vapors during excavation activities. Complete (if required) an air monitoring log in addition to air monitoring required for Work Permit.	
		3	Area contamination	Excavated soils should be properly stored on-site. Excavated soils shall be sorted on and covered with polyethylene tarps.	
		4	Trench collapse	Soils and equipment shall remain at least two feet away from the edge of the excavation/trench.	
		5	Fall from height	Personnel should maintain a safe walking distance (at least two feet) from the edge of the excavation/trench. Excavations left open and unattended shall be properly marked and protected.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
2	Installation of monitoring system	1	Exposure to hazardous gases/chemicals	a. Operations shall be described to personnel prior to commencement of work. b. Wear Level D PPE. c. Restrictions shall be placed on performing hot work activities and smoking will be forbidden at the site. d. Air quality meters shall be used to identify potentially hazardous breathing or explosive environments.	
3	Routine monitoring of system	1	Exposure to hazardous gases/chemicals	a. Operations shall be described to personnel prior to commencement of work. b. Wear Level D PPE. c. Restrictions shall be placed on performing hot work activities and smoking will be forbidden at the site. d. Air quality meters shall be used to identify potentially hazardous breathing or explosive environments.	

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)		Required
Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Recommended
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	first aid kit		Recommended

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	504
Job Name	Environmental-Other
Task Description	Methane monitoring in excavations
Project Number	B00645810000
Project Name	A-SITE
PIC Name	ERICKSON, MICHAEL
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Cretaion Date	6/23/2009 09:38:17 AM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
HASP Reviewer	Webster, Charles	10/23/2009	10/23/2009		Lynch, Edward	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Setup of monitoring equipment	1	Exposure to hazardous breathing or explosive environments	Air quality meters will be used to identify potentially hazardous breathing or explosive environments during excavation/trenching activities.	
		2	Injuries associated with materials handling and hand-labor activities	Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods or performing work in the excavation/trench for long periods.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Dermal Protection	Long sleeve shirt/pants		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)		Required
Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Required

Supplies

Type	Supply	Description	Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
Miscellaneous	First aid kit		Recommended
Communication Device	Mobile phone		Recommended
Personal	eye wash (specify type)		Required

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	525
Job Name	Construction-Heavy equipment operation
Task Description	Sheet pile removal
Project Number	B00645810000
Project Name	A-SITE
PIC Name	ERICKSON, MICHAEL
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Cretaion Date	6/29/2009 06:57:24 PM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	10/23/2009	10/23/2009		Erickson, Michael	True
Developer	Suardini, E.J.	10/23/2009	10/23/2009		Bowman, Matthew	True
HASP Reviewer	Webster, Charles	10/23/2009	10/23/2009		Lynch, Edward	True

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Loading and Unloading Equipment from transport vehicles.	1	Stake or impact hazards from moving equipment	Stand clear of equipment loading or unloading form transport vehicles	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		2	Equipment damage from improper removal or placement on vehicle	Ensure any ramps used are rated for weight and properly placed and secure prior to moving equipment across, ensure trailers being loaded or unloaded are properly secured against movement.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		3	Overhead utility contact for equipment with booms or extensions	Plan position of transport vehicle to maintain safe distance (>20 ft) from all overhead lines and structures, Use spotters since operator focus may be on vehicle alignment with ramps or other ground level distractions.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)
		4	Ascending/Descending equipment cab.	Do not hurry through task, wear footwear with good tread and ankle support, maintain 3 points of contact while accessing or egress equipment, no jumping off trailers or truck beds.	FHSHB Section IV (E); ARCHSF019, FHSHB Section III(MM)

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
2	Pre-operation inspection	1	Pinch hazards to hands	Wear gloves appropriate for hazard while maintaining dexterity. Keep hand in field of vision and watch for and keep hands clear of obvious hazards like door or cover closures. Do not hurry during the removal or placement of covers or equipment components.	
		2	Head injury from striking equipment covers or components	Wear hard hat, stay focused on surroundings, avoid standing or raising up suddenly especially if door cover is overhead.	
		3	Exposure to engine fluids or lubricants	Wear protective gloves, ensure MSDS is available for engine fluids and lubricants, promptly wash exposed skin, contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Awkward body positions and twisting	Plan inspection activity and do not hurry through task, stretch before crawling or squatting. Avoid overreaching.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, ensure equipment is not operational (LOTO if necessary) when accessing engine compartment if intrusion required.	
3	Equipment operation	1	Strike or impact hazards with other workers, equipment or structures.	Keep eyes moving and watch for unanticipated worker movement. Keep workers 15 ft from any extendable area of the equipment, Maintain 360 degrees of awareness and ensure adequate communication method with other workers. All workers to know emergency STOP hand signals. all back up alarms to be functional.	
		2	Utility contact (subsurface or above ground)	Follow utility clearance procedure prior to any intrusive work with equipment. Immediately stop work if any unusual or unanticipated condition encountered.	
		3	Rollovers on slopes or from improper usage	Follow equipment manufacturer instructions for use on slopes or load capacities, wear seatbelt at all times, Ensure all outriggers, if equipped are properly deployed on stable surface.	
		4	Noise from engine or work activity	Wear hearing protection as required, keep equipment well maintained.	
		5	Slips and falls from accessing or egress from equipment	Maintain 3 points of contact when access or egress equipment, keep any ladder or steps on equipment clean and dry to extent practical, ensure equipment doors, if present, are in good working order.	
		6	Exposure to tools and metal edges and damaged metal resulting in cuts lacerations to hands during maintenance	Wear protective gloves that allow for good dexterity. Mitigate sharp surfaces to extent practical.	
		7	Pinch/crush hazards to hands from doors or covers	wear gloves appropriate for hazard while maintaining dexterity, Watch for and keep hands clear of obvious hazards like door or cover closures. Do not hurry during the removal or placement of covers or equipment components.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
		8	Contact stress to knees and hands	Use padding or knee pads if kneeling on hard surfaces for an extended period of time. Avoid placing weight on hands for extended periods of time.	
		9	Load failure from impact with other equipment or objects	All site workers will be educated in the Emergency Stop Hand Signal. Standard hand signals will be reviewed prior to hoisting activities for all workers involved in the lift. Lifts to be performed in a smooth methodical manner and overseen by a Competent Person. All loads to be adequately contained and/or secure to prevent being knocked off and falling to ground	
		10	Worker struck by hazard from spinning or swinging load	tagline required for all loads lifted over knee height to prevent sudden spinning or swinging, number of taglines required to be specified by Competent Person based on size of load lifted. Hard hat required for all activities	
		11	Crush hazard to feet during load placement	Steel toe boot required, stay clear of loads be lowered into place, if close proximity required, be aware of hazard and ensure visibility of surface and feet are not obscured	
		12	Tipping of crane/boom truck form excessive load or boom angle	Competent person shall ensure all loads do not exceed load limits or the boom angle is not exceeded at any time during the lift.	
4	Maintenance	1	Awkward body positions and twisting	Plan inspection activity and do not hurry through task, stretch before crawling or squatting. Avoid overreaching.	
		2	Excessive force turning bolts or lifting heavy components, decontamination activities.	Use automated methods to loosen tigh bolts, do not use excessive force or torque when using hand tools. Do not use "cheater bars"	
		3	Contact with engine fluids or lubricants	Wear protective gloves, ensure MSDS is available for engine fluids and lubricants, promptly wash exposed skin, contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Flying debris during gross decontamination or cleaning activities	Wear adequate eye and face protectior when removing soils or solid media form tracks, buckets, or other component of equipment using pressure washer.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, ensure equipment is not operational (LOTO if necessary) when accessing engine compartment if intrusion required.	
		6	Exposure of hands and arms to hot engine components	Take the time to allow the engine to cool, wear protective gloves and forearm protection.	
		7	Struck by moving equipment or boom extensions	Keep at least 15 ft from any extendable area of the equipment, if entering within 15 ft, establish and maintain contact with equipment operator, ear high visibility clothing or work vest.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
5	Working in proximity to heavy equipment	1	Equipment damage from moving equipment	Keep other equipment not required for work outside of heavy equipment work area in all directions. Flag or mark with high visibility markings, cones, etc., any required equipment near the ground	
		2	Noise hazards from equipment operation	Wear hearing protection and increase distance if work activity permits.	

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)		Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs	as needed	Recommended
Miscellaneous PPE	personal flotation device	recommended when working next to water	Recommended
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Miscellaneous	fire extinguisher		Required
Miscellaneous	first aid kit		Required
Personal	eye wash (specify type)		Required

Job Loss Analysis

General

Client Name	KALAMAZOO RIVER STUDY GROUP
JSA ID	499
Job Name	Environmental-Soil sampling/well installation - drill rig
Task Description	Installation of borings and soil sampling
Project Number	B00645810000
Project Name	A-SITE
PIC Name	DESHIELDS, BRIDGETTE
Project Manager	COWIN, DOUGLAS
Status Name	(3) Completed
Cretaion Date	6/22/2009 02:05:34 PM

User Roles

Role	Employee	Due Date	Completed	Approve	Supervisor	Active Employee
Created By	Amber, Danielle	7/7/2009	7/7/2009		Erickson, Michael	True
Developer (Primary Contact)	Amber, Danielle	7/7/2009	7/7/2009		Erickson, Michael	True
Developer	Amber, Danielle	7/7/2009	7/7/2009		Erickson, Michael	True
HASP Reviewer	Webster, Charles	7/21/2009	7/17/2009	True	Lynch, Edward	True
Reviewer	Mcguire, Patrick	7/21/2009			Romagnoli, Robert	True

Reviewer Comments

Role	Employee	Approval Status	Completed Date	Comments
HASP Reviewer	Webster, Charles	Approve	07/17/2009	

Job Steps

Job Step	Job Step Description	Potential Hazard	Critical Action	HSP Reference
1	Mobilization/Demobilization	1 Vehicle accident	a. Use defensive driving skill and Smith System 5 keys to prevent MVAs. b. Park vehicle in a safe location, away from site traffic if possible.	
2	Conduct Site Safety (Daily Job Briefing)	1 N/A	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 the appropriate secions of the Field Safety & Health Handbook. Ensure that all employees are aware of all hazards and are wearing all necessary PPE. Ensure that all employees are aware of the locations of emergency equipment and contacts	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
3	General site condition assessment	1	Heat/Cold stress	a. Wear appropriate clothing for weather conditions to avoid heat stress, cold stress, sunburn, frostbite. b. Take rest breaks in conditioned space as needed to warm up/cool down.	
		2	Severe/Hazardous weather conditions	a. Check the weather forecast before going on site. b. Take shelter in the field vehicle or other sturdy structure if hazardous weather conditions materialize.	
		3	Slips/Trips/Falls	a. Evaluate site terrain and establish work and travel areas in clear areas. b. Wear appropriate boots with ankle support.	
4	Soil Boring/ Monitoring Well Installation	1	Struck by heavy equipment, hydraulic hoses or moving/rotating parts.	a. Communicate with driller and helper. b. Confirm rig has been inspected and is in working order. c. Know location of emergency shut off switches. d. Be aware of rig movements and hydraulic hoses. e. Do not stand within 15 feet of the drill rig.	
		2	Struck By Falling Objects	a. Check and eliminate overhead obstructions prior to work. b. Wear hard hat at all times.	
		3	Noise Exposure	Hearing protection (either ear plugs or ear muffs) are required when drill rig is operational.	
5	Conduct Site Safety (Daily Job Briefing)	1	Struck by heavy equipment, hydraulic hoses or moving/rotating parts.	a. Do not attempt to sample soil cutting while rig is operating and discharging cuttings. b. Ensure driller has secured hoses to prevent whipping while under pressure.	
		2	Exposure to Impacted Soil and Liquid or Chemical Preservatives.	Wear Kevlar liners under nitrile gloves when sampling and handling broken containers.	
		3	Cuts and Abrasions	Wear Kevlar liners under nitrile gloves when sampling and handling broken containers	
		4	Burns to skin, eyes and/or respiratory system	a. Avoid contact with preservatives. b. Nitrile gloves should be worn when retrieving sampling containers from cooler as preservative may have leaked from containers. Refer to laboratory packing slip for an inventory of preservatives as they can burn skin and eyes on contact. c. Open sampling containers away from face and allow fumes from preservatives to dissipate.	
		5	Back Strains	a. When lifting, keep loads close to body, avoid twisting torso, use legs (not back) to lift loads. b. Request assistance when lifting heavy objects (>50lbs). c. Use cart to transport equipment, coolers, buckets of cuttings. d. Avoid lifting heavy/awkward coolers by leaving cooler on tailgate.	

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
6	Decontamination of Downhole Equipment	1	Struck by heavy equipment.	Stand a minimum of 15 feet from decontamination activities.	
		2	Eye Irritation	Wear safety glasses at all times to prevent particles that may be dislodged during decontamination from getting into the eye.	
		3	Exposure to impacted soil and water	a. Decontamination waste will be temporarily containerized in drums. b. Wear nitrile gloves when handling and sampling decontamination waste.	
7	Pack Cooler for Shipping	1	Cuts and Abrasions	a. Wear Kevlar liners under nitrile gloves. b. Pack sample containers on ice in bubble wrap to prevent breakage during transport.	
		2	Exposure to chemicals	a. Do not ship leaking coolers. b. Labeling and packaging must be performed by a DOT trained individual.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	boots		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
Hand Protection	work gloves (specify type)		Required
Head Protection	hard hat		Recommended
Hearing Protection	ear plugs		Recommended
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Recommended
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	first aid kit		Recommended
Personal	insect repellant		Recommended
Personal	sunscreen		Recommended

ARCADIS

Appendix B

Material Data Sheet for Methane

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Methane
MSDS 440
MET1340

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Methane **CAS Number:** 74-82-8
Chemical Formula: CH_4
Structural Chemical Formula: CH_4
Synonyms: BIOGAS; FIRE DAMP; MARSH GAS; METHANE; METHANE,COMPRESSED; METHANE,REFRIGERATED LIQUID; METHYL HYDRIDE; R 50; R 50 (REFRIGERANT)
General Use: Constituent of illuminating and cooking gas.
Base raw material for many chemicals, in the manufacture of hydrogen, methanol, methyl chloride, methylene chloride, hydrogen cyanide, ammonia, acetylene, formaldehyde, in organic syntheses.
Operators should be trained in procedures for safe use of this material.

Section 2 - Composition / Information on Ingredients

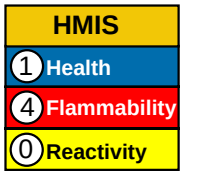
Name	CAS	%
methane	74-82-8	>98

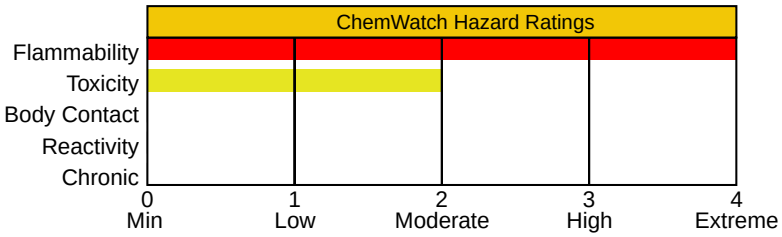
OSHA PEL
No data found.

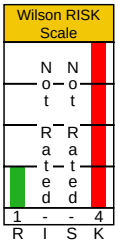
NIOSH REL
No data found.

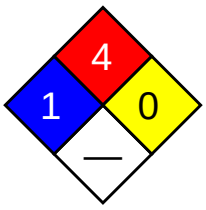
ACGIH TLV
No data found.

Section 3 - Hazards Identification









Fire Diamond

ANSI Signal Word
Danger!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; odorless. Stored as a compressed gas which can cause frostbite. A simple asphyxiant which can displace available oxygen needed for breathing. Extremely flammable.

Potential Health Effects

Primary Entry Routes: inhalation
Target Organs: None reported
Acute Effects
Inhalation: The gas acts as a simple asphyxiant by partially displacing, replacing the air required to support human life.
Symptoms of asphyxia (suffocation) may include headache, dizziness, shortness of breath, muscular weakness, drowsiness and ringing in the ears.

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If the asphyxia is allowed to progress, there may be nausea and vomiting, further physical weakness and unconsciousness and, finally, convulsions, coma and death. Significant concentrations of the non-toxic gas reduce the oxygen level in the air. As the amount of oxygen is reduced from 21 to 14 volume %, the pulse rate accelerates and the rate and volume of breathing increase. The ability to maintain attention and think clearly is diminished and muscular coordination is somewhat disturbed. As oxygen decreases from 14-10% judgement becomes faulty; severe injuries may cause no pain. Muscular exertion leads to rapid fatigue. Further reduction to 6% may produce nausea and vomiting and the ability to move may be lost.

Permanent brain damage may result even after resuscitation at exposures to this lower oxygen level. Below 6% breathing is in gasps and convulsions may occur. Inhalation of a mixture containing no oxygen may result in unconsciousness from the first breath and death will follow in a few minutes.

Eye: The gas is not harmful to the eyes. Contact with liquid may cause burns.

Skin: The gas is non harmful to the skin.

Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.

Ingestion: Not applicable.

Refer to inhalation.

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 long term effects.

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: Not applicable.

Skin Contact: In case of cold burns (frost-bite): Bathe the affected area immediately in cold water for 10 to 15 minutes, immersing if possible and without rubbing.

Do not apply hot water or radiant heat. Apply a clean, dry dressing.

Transport to hospital or doctor.

Ingestion: Refer to procedure for inhalation.

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

Note to Physicians: Treat symptomatically.

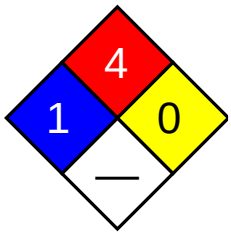
Section 5 - Fire-Fighting Measures

Flash Point: -218 °C

Autoignition Temperature: 537 °C

LEL: 5.0% v/v

UEL: 15% v/v



Fire Diamond

Extinguishing Media: Dry chemical powder; BCF (where regulations permit); carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Flammable gas. Severe vapor explosion hazard, when exposed to flame or spark.

Dangerous hazard when exposed to heat or flame.

Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, emits toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).

Fire Incompatibility: Explosion hazard may follow contact with incompatible materials.

Reacts violently with oxidizing agents such as chlorine.

Contact with chlorine dioxide causes spontaneous explosion.

Contact with liquid fluorine causes spontaneous explosion, even at very low temperatures (-19 °C).

A mixture of liquid methane and liquid oxygen is an explosive.

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.

If safe, switch off electrical equipment until vapor fire hazard removed.

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.

Do not extinguish burning gas. If safe to do so, stop flow of gas.

If flow of gas cannot be stopped, leave gas to burn.

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Section 6 - Accidental Release Measures

Small Spills:

1. Avoid breathing vapor and any contact with liquid or gas. Protective equipment including respirator should be used.
2. Do NOT enter confined spaces were gas may have accumulated.
3. Shut of all sources of possible ignition and increase ventilation.
4. Clear area of personnel.
5. Stop leak only if safe to so do.
6. Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve.
7. Keep area clear of personnel until gas has dispersed.

Large Spills: Contact fire department and tell them location and nature of hazard.
Clear area of personnel and move upwind.
Shut off all possible sources of ignition and increase ventilation.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. May be washed to drain with large quantities of water.
Consider evacuation.
Apply leak detection solution to suspected sites in lines and equipment.
Remove leaking cylinders to a safe place. Fit vent pipes. Release pressure under safe, controlled conditions by opening valve. Burn issuing gas at vent pipes.
Do not exert excessive pressure on valve; do not attempt to operate damaged valve.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Used in closed pressurized systems, fitted with safety relief valve.
Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, bare flames.
Atmospheres must be tested and O.K. before work resumes after leakage.
Obtain a work permit before attempting any repairs.
Do not attempt repair work on lines, vessels under pressure.
Handle and open container with care.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
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.
Avoid generation of static electricity. Ground all lines and equipment.
DO NOT transfer gas from one cylinder to another.
Natural gases contain a contaminant, radon-222, a naturally occurring radioactive gas. During subsequent processing, radon tends to concentrate in liquified petroleum streams and in product streams having similar boiling points.
Industry experience indicates that the commercial product may contain small amounts of radon-222 and its radioactive decay products (radon daughters). The actual concentration of radon-222 and radioactive daughters in process equipment (IE lines, filters, pumps and reactor units) may reach significant levels and produce potentially damaging levels of gamma radiation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon enriched stream or containing internal deposits of radioactive material. Field studies, however, have not shown that conditions exist that expose the worker to cumulative exposures in excess of general population limits. Equipment containing gamma-emitting decay products should be presumed to be internally contaminated with alpha- emitting decay products which may be hazardous if inhaled or ingested.
During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow gamma-radiation to drop to background levels. Protective equipment (including high efficiency particulate respirators (P3) suitable for radionucleotides or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination or inhalation of any residue containing alpha-radiation.

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Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state. [TEXACO].

Recommended Storage Methods: 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.
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: Areas where cylinders are stored require good ventilation and if enclosed need discrete/controlled exhaust ventilation.
Local exhaust ventilation (explosion proof) usually required.
Ventilation should ensure that work place atmospheres do not reach 25% of lower explosive limit.
Respiratory protection in form of air supplied or self contained breathing equipment must be worn if oxygen concentration in the air is suspected to be less than 19%. Cartridge respirators do NOT give protection and may result in rapid suffocation.

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: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:
Exposure Range unlimited: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: asphyxiant - no protection needed unless atmosphere is oxygen deficient

Other: Protective overalls, closely fitted at neck and wrist. Eye-wash unit.
IN CONFINED SPACES:
1. Non-sparking protective boots.
2. Static-free clothing.
3. Ensure availability of lifeline.

Staff should be trained in all aspects of rescue work.
Operators should be trained in correct use & maintenance of respirators.
Ensure that there is ready access to breathing apparatus.
Ensure ready access to a burns first aid kit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, odorless and tasteless gas. Gas has no odor detection level; unless mercaptan odorant is deliberately added. Gas is less dense than air. Burns with a pale, faintly luminous flame. Soluble in alcohol, ether, hydrocarbon and other organic solvents. Packed as a gas under pressure. Sudden release of pressure or leakage may result in generation of a large volume of highly flammable/ explosive gas.
Critical temperature: -82.1 °C. Critical pressure: 4640 kPa.

Physical State: Compressed gas
Vapor Pressure (kPa): Not applicable
Vapor Density (Air=1): 0.55
Formula Weight: 16.04
Specific Gravity (H_2O=1, at 4 °C): 0.422 as liquid
Water Solubility: 0.6 ml in 1 g ethyl alcohol at 20 °C
Evaporation Rate: Not applicable

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: -161.4 °C (-259 °F)
Freezing/Melting Point Range: -182.6 °C (-296.68 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Presence of heat source and ignition source. Presence of elevated temperatures.
Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from oxygen gas and oxidizing agents.

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Section 11 - Toxicological Information

No relevant toxicological data found at time of research.

See NIOSH, *RTECS* PA 1490000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Photolysis, hydrolysis and bioconcentration are not expected to be important environmental fate processes. A K_{oc} of 753 indicates low mobility with water in soil. However, its high vapor pressure would suggest that the gas may permeate through soil. Biodegradation and adsorption may occur in soil and water; however, volatilization is expected to be a far more important environmental fate process in water. Volatilization half lives from a model river and a model environmental pond have been estimated to be 1.17 and 13.89 hr, respectively. It is expected to exist entirely in the vapor phase in the ambient atmosphere. Reaction with hydroxyl radicals is the major sink (half life of 1,908 days).
Ecotoxicity: No data found.
Henry's Law Constant: estimated at 6.58×10^{-1}
BCF: no food chain concentration potential
Biochemical Oxygen Demand (BOD): none
Octanol/Water Partition Coefficient: log K_{ow} = 1.09
Soil Sorption Partition Coefficient: K_{oc} = estimated at 753

Section 13 - Disposal Considerations

Disposal: Discharge to burning flare.
Ensure damaged or non-returnable cylinders are gas-free before disposal.
Return empty or damaged cylinders to supplier.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: METHANE OR NATURAL GAS, COMPRESSED
Hazard Class: 2.1
ID No.: 1971
Packing Group: None
Label: Flammable Gas [2]

Additional Shipping Information: NATURAL GAS, COMPRESSED, with a high methane content

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date: .....1999-11 **Review Date:** 2000-07

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